Program at a Glance

Time	Aug. 10 (Fri.)	Aug. 11 (Sat.)	Aug. 12 (Sun.)	Aug. 13 (Mon.)	Aug. 14 (Tue.)	Aug. 15 (Wed.)	Aug. 16 (Thu.)	Aug. 17 (Fri.)
09:00-09:15	KAIST EEWS Workshop (ICCF-17 Tutorial)	Optional Tour			[TuM1] [TuM1-1] Mahadeva Srinivasan	[WeM1] [WeM1-1] Akito Takahashi	[ThM1] [ThM1-1] Liu Bin	[FrM1] [FrM1-1] Thomas W Grimshaw
09:15-09:30								
09:30-09:45				[Opening Ceremony] Sunwon Park [Martin Fleischmann Memorial] Michael McKubre	[TuM1-2] Pamela A. Mosier-Boss	[WeM1-2] Yeong E. Kim	[ThM1-2] Sakoh Hideyuki	[FrM1-2] Christian Elsner
09:45-10:00								
10:00-10:15				[Plenary Lecture] Frank Gordon	[TuM1-3] Melvin H. Miles	[WeM1-3] Peter L. Hagelstein	[ThM1-3] John Dash	[FrM1-3] Jed Rothwell
10:15-10:30								
10:30-10:45				Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break
10:45-11:00								
11:00-11:15				[MoM1] [MoM1-1] Francesco Piantelli /Peter Mobberley	[TuM2] [TuM2-1] Mitchell Swartz /Peter L. Hagelstein	[WeM2] [WeM2-1] Xing Zhong Li	[ThM2] [ThM2-1] Tatsumi Hioki	[FrM2] [FrM2-1] Tyler van Houwelingen
11:15-11:30								
11:30-11:45				[MoM1-2] Menelaos Koulouris (Defkalion)	[TuM2-2] Michael McKubre	[WeM2-2] Andrew Meulenburg	[ThM2-2] Yasuhiro Iwamura	[FrM2-2] Commercialization and Worldwide Impact Panel Discussion
11:45-12:00								
12:00-12:15	Lunch			[MoM1-3] Francis Louis Tanzella/Brillouin	[TuM2-3] Tadahiko Mizuno	[WeM2-3] Vladimir Vysotskii	[ThM2-3] Sanjai Sinha	
12:15-12:30								
12:30-13:00				Lunch	Lunch	Lunch	Lunch	Closing Comments Sunwon Park /Frank Gordon
13:00-13:30								
13:30-13:45	KAIST EEWS Workshop (ICCF-17 Tutorial)							
13:45-14:00								
14:00-14:15			Registration	[MoA1] [MoA1-1] George Miley /Kyu-Jung Kim	[TuA1] [TuA1-1] Lawrence P. G. Forsley	[WeA1] [WeA1-1] Michael McKubre Theory Panel Discussion	[ThA1] [ThA1-1] Olga Dmitriyeva	
14:15-14:30								
14:30-14:45				[MoA1-2] Mitchell Swartz /Peter L. Hagelstein	[TuA1-2] Jean Paul Biberian		[ThA1-2] Jean Paul Biberian	
14:45-15:00								
15:00-15:15				Break	[TuA1-3] Francesco Celani Demo	[WeA1-2] Dawn D. Dominguez	[ThA1-3] David J. Nagel	
15:15-15:30				Introduction of Poster Session				
15:30-15:45					Coffee Break	Coffee Break	Coffee Break	
15:45-16:00								
16:00-16:15					[TuA2] [TuA2-1] Akira Kitamura	[WeA2] [WeA2-1] Alexander Didyk	[ThA2] [ThA2-1] A. B. Karabut	
16:15-16:30								
16:30-16:45				Poster Session & Coffee Break	[TuA2-2] Naoko Takahashi	[WeA2-2] Eric Daniel Lukosi (Missouri University)	[ThA2-2] Francesco Celani Demo	
16:45-17:00								
17:00-17:15					[TuA2-3] David A Kidwell	[WeA2-3] Yury Bazhutov	Banquet Speech by Duncan Bockris Award Ceremony Entertainment	
17:15-17:30								
17:30-17:45								
17:45-18:00								
18:00-20:00			Welcome Reception	* Review Committee Meeting	* IAC Meeting			

* is closed program

Program & Abstract Book

The 17th International Conference on Cold Fusion

August 12~17, 2012

DCC Korea, Daejeon, South Korea

Co-sponsored by

The International Society for Condensed Matter Nuclear Science
Korean Institute of Chemical Engineers.
Korean Nuclear Society
Korean Institute of Metals and Materials
Korea Research Institute of Chemical Technology
KAIST EEWS Initiative
NEW ENERGY FOUNDATION, INC. (Infinite Energy)
Daejeon International Marketing Enterprise
Korea Tourism Organization

ICCF-17

The 17th International Conference on Cold Fusion

August 12~17, 2012
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CONTENTS

I. Welcome Message

Welcome to ICCF-17 from the Conference Chairmen

Welcome to the 17th International Conference on Cold Fusion (ICCF-17) to be held in Daejeon, Republic of Korea during August 12-17, 2012. This is the oldest conference dedicated to "Cold Fusion", also known by several names including Condensed Matter Nuclear Science (CMNS), Low Energy Nuclear Reactions (LENR) and Lattice Assisted Nuclear Reactions (LANR).

ICCF-17 promises to be the most interesting and timely conference. Recent claims that the Nickel-Hydrogen system can produce commercially viable amounts of excess energy have reinvigorated research. As with the initial announcement by Fleischmann and Pons involving Palladium-Deuterium, new groups of scientists are getting involved to conduct experiments using Nickel and Hydrogen, all looking for a safe, low-cost nuclear solution to the world's energy needs. ICCF-17 offers a unique opportunity for scientists from around the world to come together to report experimental results, present new theories, and share ideas in this most interesting and important scientific area. It also represents an opportunity for government agencies, industry, investors, and academia to meet face-to-face with scientists who have kept the dream alive.

Compelling experimental results supporting the Cold Fusion have been presented in the past 16 conferences but most main stream scientists and the general public are not aware of them. ICCF should not be the party only for people who believe in cold fusion. We especially invite skeptics and mainstream scientists from nuclear physics and nuclear engineering to attend and learn about the experimental results and engage in scientific discussions. ICCF-17 session topics will cover basic research, experimental results, applications of the technology, and theoretical developments.

The city of Daejeon, located approximately 100 miles south from Seoul is the ideal setting for the conference. Daejeon is home to many national research institutes in Korea and also the Korea Advanced Institute of Science and Technology, (KAIST) which was identified by Asiaweek in 1999-2000 as the number one university in science and technology in Asia. The city of Daejeon, the Republic of Korea, and the organizing committee are working to make ICCF-17 a special event.

"Cold Fusion" has sometimes been referred to as an example of bad science. We agree. It was bad science when Galileo agreed with Copernicus that the Earth orbited the sun and he was charged with heresy and placed under house arrest. It was bad science with Roemer announced that contrary to the prevailing belief, the speed of light was not infinite but was actually 186,000 miles per second. He was ridiculed by the scientific establishment and driven out of a scientific career. It was bad science when doctors continued to go from patient to patient without washing their hands, leading to childbirth mortality rates as high as 28% even after clinical studies had shown that washing between patients could significantly reduce mortality. It wasn't until many years later after Pasteur had identified bacteria that could be transmitted from patient to patient that hand-washing was widely adopted. These are just three examples of a long list of "bad science."

In each of these cases, it took in excess of 20 years after the initial announcement and compelling experimental evidence before the mainstream scientific establishment accepted the change. In this light, "cold fusion" is another example of bad science. And as with the examples listed above, after more than 20 years it is getting harder to deny the experimental evidence of "cold fusion." We believe "cold fusion" is well on its way to becoming an accepted scientific fact and that ICCF-17 will be a pivotal event in answering the question of whether "cold fusion" can become the safe, low-cost nuclear energy source to meet the world's growing energy demand.

Please make plans now to join us in Daejeon for ICCF-17, August 12-17, 2012.

Sunwon Park, Chairman

Professor of Chemical and
Biomolecular Engineering Department
KAIST
Daejeon
Republic of Korea

Frank Gordon, Co-chairman

Senior VP, Global Energy Corporation
Retired Head, Research and Applied Sciences Dept
US Navy SPAWAR Systems Center
San Diego, CA
USA

II. Committees

General Chair

- Sunwon Park (KAIST, Korea)

General Co-chair

- Frank Gordon (SPAWAR (retired), USA)

International Advisory Committee

- Yury Bazutov (IZMIRAN RAS, Russia)
- Jean Paul Biberian (Aix-Marseille University, France)
- Francesco Celani (Frascati National Laboratory, Italy)
- William Collis (ISCMNS, UK)
- Martin Fleischmann (Southampton University (retired), UK)
- Frank Gordon (SPAWAR (retired), USA)
- Igor Goriachev (Kurchatov Institute, Russia)
- Peter L. Hagelstein (MIT, USA)
- Yasuhiro Iwamura (Mitsubishi Heavy Industries, Japan)
- Yeong E. Kim (Purdue University, USA)
- Xing Zhong Li (Tsinghua University, China)
- Michael McKubre (SRI International, USA)
- Michel E. Melich (Naval Postgraduate School, USA)
- George Miley (University of Illinois, USA)
- David J. Nagel (George Washington University, USA)
- Sunwon Park (KAIST, Korea)
- Seung Bin Park (KAIST, Korea)
- Vittorio Violante RdA (ENEA, Frascati, Italy)
- Francesco Scaramuzzi (LNF/INFN, Italy)
- Mahadeva Srinivasan (BARC (retired), India)
- Akito Takahashi (Technova, Inc., Japan)

National Steering Committee

- Soon Heung Chang (KAIST, Korea)
- Kew-Ho Lee (Korea Research Institute of Chemical Technology/UST, Korea)
- Sung-Chul Shin (DGIST, Korea)
- Seung Bin Park (KAIST, Korea)
- Seung Jong Lee (Seoul National University, Korea)
- Sunwon Park (KAIST, Korea)

Technical Program Committee

- Gun-Woong Bahng (Korea Research Institute of Standards and Science, Korea)
- Pamela A. Mosier-Boss (MIT, USA)
- Francesco Celani (Frascati National Laboratory, Italy)
- William Collis (ISCMNS, UK)
- Lawrence P. G. Forsley (Global Energy Corporation, USA)
- Frank Gordon (SPAWAR (retired), USA)
- Peter L. Hagelstein (MIT, USA)
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- Yeong E. Kim (Purdue University, USA)
- Do Hyun Kim (KAIST, Korea)
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- Xing Zhong Li (Tsinghua University, China)
- Michael McKubre (SRI International, USA)
- Michel E. Melich (Naval Postgraduate School, USA)
- David J. Nagel (George Washington University, USA)
- Sunwon Park (KAIST, Korea)
- Mahadeva Srinivasan (BARC (retired), India)
- Edmund Storms (LANL (retired), USA)
- Akito Takahashi (Technova, Inc., Japan)
- Jin-Hee Yoon (Inha University, Korea)

Publications Committee

- Chair, Doh Chang Lee (KAIST, Korea)

Publicity Committee

- Co-chair, Yoon-Bong Hahn (Chonbuk National University, Korea)
- Co-chair, Do Hyun Kim (KAIST, Korea)
- Co-chair, MoonYong Lee (Yeungnam Univeristy, Korea)
- Co-chair, Kwan Young Lee (Korea University, Korea)

Secretariat Committee

- Chair, Woohyun Kim (KAIST, Korea)
- Genicom Co., Ltd. (Korea)

III. Technical Program

1. Information on Technical Program

Oral Presentation Guideline

- The time for oral presentation is 30 minutes and this includes the presentation and Q&A time.
- A LCD projector and a computer with Windows OS, MS PowerPoint and Adobe Acrobat Reader installed will be available in session room for regular presentations. For presenters, please kindly bring your presentation saved on a USB memory stick and load your presentation on the computer prior to the session.
- MAC users, please bring your own cable to connect it to the LCD projector. MAC cables may NOT be available on site, so please be sure to bring the necessary adaptors.
- Please provide your presentation file to info@iccf17.org at least one day before your session begins.
- If the presentation contains video or audio, please let us know when you register so that we can check to be sure that the presentation will work with the systems available at the conference.
- Video recordings will be made of all presentations during the conference for possible distribution including posting on the internet or other uses.

Poster Presentation Guideline

<u>Poster-teaser-session</u>

- On Monday afternoon, you will have an opportunity to promote your poster via 2 slides for 1 minute poster teaser presentation.
- Please indicate the Paper No. on the upper center of the presentation slide. Please do not include videos, as we cannot guarantee that they will work.

<u>Poster Presentation Guideline</u>

- Poster will be placed during the whole conference day.
- The poster size shall be limited to 0.9m in width and 1.5m in height.
- Poster number will be placed on the top of each poster board to help presenters easily find the designated spot.
- Adhesive tapes will be available within the poster presentation area but push-pins and double-sided tapes are prohibited.

Guide to Understanding Session Numbering

Each session in the technical program is assigned a unique number which clearly indicates when the session is presented.

Day				Time		Session Order	
Mo	Monday	Th	Thursday	M	Morning	1	First Session
Tu	Tuesday	Fr	Friday	A	Afternoon	2	Second Session
We	Wednesday						

Example) [MoM1]: the 1st session on Monday morning

2. Technical Sessions

August 13, 2012 [Monday]

Opening Ceremony	Date & Time	August 13, 2012 (Monday) / 09:30 - 09:40
M. Fleis-chmann Memorial	Date & Time	August 13, 2012 (Monday) / 09:40 – 09:50
Plenary Lecture	Date & Time	August 13, 2012 (Monday) / 09:50 - 10:30

Opening Ceremony	09:30 - 09:40	**Opening Ceremony** Sunwon Park (KAIST, Korea)
M. Fleis-chmann Memorial	09:40 – 09:50	**Martin Fleischmann Memorial** Michael McKubre (SRI International, USA)
Plenary Lecture	09:50 - 10:30	**Cold Fusion-From the Laboratory to the World: Setting the Stage for ICCF-17** Sunwon Park (KAIST, Korea) and Frank Gordon(SPAWAR (retired), USA)

MoM1	Date & Time	August 13, 2012 (Monday) / 11:00 - 12:30
Session Chair		Prof. Seungbin Park (KAIST, Korea)

MoM1-1	11:00 - 11:30	**Anomalous phenomenon in Ni-H Systems** F. Piantelli (Italy) *Speaker: Peter Mobberley (Advanced Energy Technologies, UK)
MoM1-2	11:30 - 12:00	**Technical Characteristics and Performance Issues of Defkalion's Hyperion Pre-Industrial Product and Further Developments** John Hadjichristos (Praxen Defkalion Green Technologies (Global) Ltd., Greece) *Speaker: Menelaos Koulouris (Praxen Defkalion Green Technologies (Global) Ltd., Greece)
MoM1-3	12:00 - 12:30	**Controlled Electron Capture and the Path toward Commercialization** Robert Godes, Robert George (Brillouin Energy Corporation, USA), Francis Tanzella, and Michael Mckubre (SRI International, USA)

August 13, 2012 [Monday]

MoA1	Date & Time	August 13, 2012 (Monday) / 14:00 - 15:00
Session Chair		Dr. Gun Woong Bahng (Korea Research Institute of Standards and Science, Korea)

MoA1-1	14:00 - 14:30	**Use of D/H Clusters in LENR and Recent Results from Gas Loaded Nanoparticle-Type Clusters** George H. Miley, Xiaoling Yang, Kyujung Kim (University of Illinois, USA), and Heinrich Hora (University of New South Wales, USA)
MoA1-2	14:30 - 15:00	**Demonstration of Energy Gain from a Preloaded ZrO_2-PdD Nanostructured CF/LANR Quantum Electronic Device at MIT** Mitchell R. Swartz (JET Energy, Inc., USA) and Peter L. Hagelstein (MIT, USA)

Poster Teaser Session	Date & Time	August 13, 2012 (Monday) / 15:15 - 16:30
Session Chair		Prof. Byung Yoon Park (Chungnam National University, Korea)

Poster Session	Date & Time	August 13, 2012 (Monday) / 16:30 - 18:00

August 14, 2012 [Tuesday]

TuM1	Date & Time	August 14, 2012 (Tuesday) / 09:00 - 10:30
Session Chair		Prof. Kew-Ho Lee (Korea Research Institute of Chemical Technology, Korea)

TuM1-1 09:00 - 09:30 **Transmutations and Isotopic Shifts in LENR Experiments: An Overview**
Mahadeva Srinivasan (Bhabha Atomic Research Centre (BARC), India)

TuM1-2 09:30 - 10:00 **It's not Low Energy – But it is Nuclear**
Pamela A. Mosier-Boss (MIT, USA)

TuM1-3 10:00 - 10:30 **Co-Deposition of Palladium and Other Transition Metals in H_2O and D_2O Solutions**
Melvin H. Miles (Dixie State College, USA)

TuM2	Date & Time	August 14, 2012 (Tuesday) / 11:00 - 12:30
Session Chair		Prof. Hongjoo Kim (Kyungpook National University, Korea)

TuM2-1 11:00 - 11:30 **Energy Gain from Preloaded ZrO_2-PdNi-D Nanostructured CF/LANR Quantum Electronic Components**
Mitchell Swartz, Gayle Verner, and Jeffrey Tolleson (JET Energy, Inc., USA)
*Speaker: Peter L. Hagelstein (MIT, USA)

TuM2-2 11:30 - 12:00 **Calorimetric Studies of the Destructive Stimulation of Palladium and Nickel Fine Wires**
Michael Mckubre, Jianer Bao, Francis Tanzella (SRI International, USA), and Peter Hagelstein (MIT, USA)

TuM2-3 12:00 - 12:30 **Theoretical Analysis of Chemically Assisted Nuclear Reactions (CANR) in Nanoparticles**
Tadahiko Mizuno
(Hydrogen Engineering Application & Development Company, Japan)

August 14, 2012 [Tuesday]

TuA1	Date & Time	August 14, 2012 (Tuesday) / 14:00 - 15:30
Session Chair		Prof. Do Hyun Kim (KAIST, Korea)

TuA1-1 14:00 - 14:30 **Tickling the Dragon's Tail: Harnessing LENR**
Lawrence P. G. Forsley (Global Energy Corporation, USA)

TuA1-2 14:30 - 15:00 **Possible Role of Oxides in the Fleischmann-Pons Effect**
Jean-Paul Biberian (Aix-Marseille University, France), Iraj Parchamazad, and Melvin H. Miles (University of La Verne, USA)

TuA1-3 15:00 - 15:30 **Cu-Ni-Mn Alloy Wires, with Improved Sub-Micrometric Surfaces, used as LENR Device by New Transparent, Dissipation-Type, Calorimeter**
Francesco Celani, E. F. Marano, A. Spallone, A. Nuvoli (Frascati National Laboratories, Italy), E. Purchi, M. Nakamura (ISCMNS, Italy), B. Ortenzi, S. Pella, E. Righi, G. Trenta, S. Bartalucci (Frascati National Laboratories, Italy), G. L. Zangari (ISCMNS, Italy), F. Micciulla, and S. Bellucci (Frascati National Laboratories, Italy)

TuA2	Date & Time	August 14, 2012 (Tuesday) / 16:00 - 17:30
Session Chair		Prof. Jin-Hee Yoon (Inha University, Korea)

TuA2-1 16:00 - 16:30 **Recent Progress in Gas-Phase Hydrogen Isotope Absorption/Adsorption Experiments**
A. Kitamura, Y. Miyoshi, H. Sakoh, A Taniike, Y. Furuyama (Kobe University, Japan), A. Takahashi, R. Seto, Y. Fujita (Technova Inc., Japan), T. Murota, and T. Tahara (Santoku Corp., Japan)

TuA2-2 16:30 - 17:00 **Detection of Pr in Cs Ion-Implanted Pd/CaO Multilayer Complexes with and without D_2 Gas Permeation**
Naoko Takahashi, Satoru Kosaka, Tatsumi Hioki, and Tomoyoshi Motohiro (Toyota Central R&D Labs., Inc., Japan)

TuA2-3 17:00 - 17:30 **Gas Loading of Nanopalladium**
D. A. Kidwell (Naval Research Laboratory, USA)

August 15, 2012 [Wednesday]

WeM1	Date & Time	August 15, 2012 (Wednesday) / 09:00 - 10:30
Session Chair		Prof. Byung-taik Kim (SungKyunKwan University, Korea)

WeM1-1 09:00 - 09:30 **Physics of Cold Fusion by TSC Theory**
Akito Takahashi (Technova Inc., Japan)

WeM1-2 09:30 - 10:00 **Conventional Nuclear Theory of Low-Energy Nuclear Reactions in Metals: Alternative Approach to Clean Fusion Energy Generation**
Yeong E. Kim (Purdue University, USA)

WeM1-3 10:00 - 10:30 **A Model for Collimated X-Ray Emission in the Karabut Experiment**
Peter Hagelstein (Massachusetts Institute of Technology, USA) and Irfan Chaudhary (University of Engineering and Tehcnology, Pakistan)

WeM2	Date & Time	August 15, 2012 (Wednesday) / 11:00 - 12:30
Session Chair		Prof. Hasuck Kim (Daegu Gyeongbuk Institute of Science & Technology, Korea)

WeM2-1 11:00 - 11:30 **"Excess Heat" in Ni-H Systems and Selective Resonant Tunnelling**
Xing Z. Li, Zhan M. Dong, and Chang L. Liang (Tsinghua University, China)

WeM2-2 11:30 - 12:00 **New Visions of Physics through the Microscope of Cold Fusion**
A. Meulenberg (Universiti Sains Malaysia, Malaysia) and K. P. Sinha (Indian Institute of Science, India

WeM2-3 12:00 - 12:30 **Application of Correlated States of Interacting Particles in Nonstationary and Periodical Modulated LENR Systems**
Vladimir Vysotskii, Mykhaylo Vysotskyy (Kiev National Shevchenko University, Ukraine), and Stanislav Adamenko (Electrodynamics Laboratory "Proton-21", Ukraine)

August 15, 2012 [Wednesday]

WeA1	Date & Time	August 15, 2012 (Wednesday) / 14:00 - 15:30
Session Chair		Dr. Michael McKubre (SRI International, USA)

WeA1-1 14:00 - 15:00 **Theory Panel Discussion**

WeA1-2 15:00 - 15:30 **Anomalous Results in Fleischmann-Pons Type Electrochemical Experiments**
D. D. Dominguez (Naval Research Laboratory, USA), L. DeChiaro (Naval Surface Warfare Center, USA), D. A. Kidwell (Naval Research Laboratory, USA), A. E. Moser (Nova Research, Inc., USA), V. Violante (ENEA, Frascati, Italy), G. K. Hubler (Naval Research Laboratory, USA), S-F. Cheng (Naval Research Laboratory, USA), J-H. He (Nova Research, Inc., USA), and D. L. Knies (Naval Research Laboratory, USA)

WeA2	Date & Time	August 15, 2012 (Wednesday) / 16:00 - 17:30
Session Chair		Dr. Suk Jae Yoo (National Fusion Research Institute, Korea)

WeA2-1 16:00 - 16:30 **Nuclear Reactions in Gaseous Deuterium under High Pressure and in Saturated with Deuterium Palladium, Induced by γ-Quanta**
Alexander Yurievich Didyk (Joint Institute for Nuclear Research, Russia) and Roland Stanislaw Wiśniewski (National Center of Nuclear Research, Poland)

WeA2-2 16:30 - 17:00 **Diamond-Based Charged Particle and Neutron Sensor for LENR Experiments**
Eric Lukosi, Mark Prelas, Joongmoo Shim, Haruetai Kasiwattanawut, Charles Weaver, Cherian Joseph Mathai, Shubhra Gangopadhyay (University of Missouri, USA)

Neutron Emission from Cryogenically Cooled Metals under Thermal Shock
Mark A. Prelas and Eric Lukosi (University of Missouri, USA)

WeA2-3 17:00 - 17:30 **Investigation of Radiation Effects at Loading Ni, Be and $LaNi_5$ by Hydrogen**
Yu. N. Bazhutov (Terrestrial Magnetism, Ionosphere and Radiowave Propagation Institute RAS (IZMIRAN), Russia), E. O. Belousova (Lomonosov Moscow State University, Russia), V. P. Koretsky (retired, Russia), A. G. Parkhomov (Lomonosov Moscow State University, Russia), A. D. Sablin-Yavorsky (retired, Russia), and Yu. A. Sapozhnikov (Lomonosov Moscow State University, Russia)

August 16, 2012 [Thursday]

ThM1	Date & Time	August 16, 2012 (Thursday) / 09:00 - 10:30
Session Chair		Dr. Myung Won Seo (Korea Institute of Energy Research, Korea)

ThM1-1	09:00 - 09:30	**Nuclear Transmutation on a Thin Pd Film in a Gas-Loading D/Pd System** Bin Liu (Shenhua Group Corporation Limited, China), Zhan M. Dong, Chang L. Liang, and Xing Z. Li (Tsinghua University, China)
ThM1-2	09:30 - 10:00	**Hydrogen Isotope Absorption and Heat Release Characteristics of a Ni-Based Sample** H. Sakoh, Y. Miyoshi, A. Taniike, Y. Furuyama, A. Kitamura (Kobe University, Japan), A. Takahashi, R. Seto, Y. Fujita (Technova Inc., Japan), T. Murota, and T. Tahara (Santoku Corp., Japan)
ThM1-3	10:00 - 10:30	**Effect of Recrystallization on Heat Output and Surface Composition of Ti and Pd Cathodes** J. Dash and J. Solomon (Portland State University, USA)

ThM2	Date & Time	August 16, 2012 (Thursday) / 11:00 - 12:30
Session Chair		Prof. Hyunduk Kim (KAIST, Korea)

ThM2-1	11:00 - 11:30	**Isotope Effect for Heat Generated upon Pressurizing Nano-Pd/Silica with Hydrogen Isotope Gases** Tatsumi Hioki, Noriaki Sugimoto, Teppei Nishi, Akio Itoh, and Tomoyoshi Motohiro (Toyota Cenyral R & D Labs., Inc., Japan)
ThM2-2	11:30 - 12:00	**Increase of Reaction Products in Deuterium Permeation Induced Transmutation** Y. Iwamura, T. Itoh, M. Tsuruga, (Mitsubishi Heavy Industries, ltd., Japan), K. Fukutani (University of Tokyo, Japan), and D. Sekiba (University of Tsukuba, Japan)
ThM2-3	12:00 - 12:30	**Extraction of Useful Energy from Metal/H (D) Cathodes via Modulation of the Internal Energy of the Hydride System** Sanjai Sinha (ChrononixUSA, USA)

August 16, 2012 [Thursday]

ThA1	Date & Time	August 16, 2012 (Thursday) / 14:00 - 15:30
Session Chair		Dr. Woohyun Kim (KAIST, Korea)

ThA1-1	14:00 - 14:30	**Using Bakeout to Eliminate Heat from H/D Exchange during Hydrogen Isotope Loading of Pd-Impregnated Alumina Powder** Olga Dmitriyeva, Richard Cantwell, Matt McConnell (Coolescence LLC, USA), and Garret Moddel (University of Colorado, USA)
ThA1-2	14:30 - 15:00	**Cold Fusion** Jean-paul Biberian (Aix-Marseille University, France)
ThA1-3	15:00 - 15:30	**Statistical Analysis of Transmutation Data from LENR Experiments and Comparison with a Prediction Based on a Widom-Larsen Theory** Felix Scholkmann (-, Switzerland) and David J. Nagel (The George Washington University, USA)

ThA2	Date & Time	August 16, 2012 (Thursday) / 16:00 - 17:00
Session Chair		Dr. Young Kim (Korea Institute of Machinery & Material, Kore)

ThA2-1	16:00 - 16:30	**Excess Heat Power Registration in Experiments with High Voltige Electrolisis Cell** A. B. Karabut (Samar+ COMPANY, Russia)
ThA2-2	16:30 - 17:00	**Demonstration** Francesco Celani (Frascati National Laboratories, Italy)

August 17, 2012 [Friday]

FrM1	Date & Time	August 17, 2012 (Friday) / 09:00 - 10:30
Session Chair		Prof. Seong Ihl Woo (KAIST, Korea)

FrM1-1	09:00 - 09:30	**Public Policy Planning for Broad Deployment of Cold Fusion (LENR) for Energy Production** Thomas W. Grimshaw (The University of Texas, USA)
FrM1-2	09:30 - 10:00	**Potential Economic Impact of LENR Technology in Energy Markets** Alexander Kleehaus (Ecorium GmbH, Germany) and Christian Elsner (CHM, Germany)
FrM1-3	10:00 – 10:30	**The Future May Be Better than You Think** Jed Rothwell (LENR-CANR.org, USA)

FrM2	Date & Time	August 17, 2012 (Friday) / 11:00 – 12:30

FrM2-1	11:00 – 11:30	**Is Commercial Low Energy Nuclear Reaction (LENR) the Real Deal?** Tyler van Houwelingen (AzulStar, Inc., USA)
FrM2-2	11:30 – 12:30	**Commercialization and Worldwide Impact Panel Discussion**

August 13 - 17, 2012 [Monday - Friday]

P_1005	**Anomalous Metals in Electrified Vacuum** Edward Esko (Quantum Rabbit LLC, USA)
P_1006	**Geological Aspects of Cold Fusion** Tarasenko G. (KGUTI name Sh. Esenov., Kazakhstan)
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Peter Mobberley (Advanced Energy Technologies, UK)

Abstracts

The 17th International Conference on Cold Fusion

Plenary Lecture

Cold Fusion—From the Laboratory to the World
Setting the Stage for ICCF-17

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The objective of ICCF-17 is to allow international groups of scientists to present their data to further the collective understanding of scientists working in the field and so that skeptical members of the mainstream scientific community, the media, and the public will see the evidence that "cold fusion" is real. Indeed, several groups are currently developing commercial products that produce energy using the "cold fusion" phenomena. Ultimately, the reality of cold fusion will be determined by the public acceptance of commercial devices. People and companies who continue to deny the existence of cold fusion will become irrelevant as the applications are placed into service.

III. Technical Program

MoM1-1

Anomalous phenomenon in Ni-H Systems

F. Piantelli, Italy

In August 1989 a biophysics experiment in which Hydrogen gas at 1 atm was in contact with an electrically heated Nickel foil yielded anomalous heat which was not commensurate with the electrical power supplied.

Many subsequent verification experiments have shown not only excess heat radiation but also nuclear radiation. Professor Piantelli's recent results are presented.

MoM1-2

Technical characteristics and performance issues of Defkalion's Hyperion pre-industrial product and further developments

John Hadjichristos

Defkalion Green Technologies Global, Head of Development

Summary

Hyperion is a line of multi-reactor products by Defkalion Green Technologies-Global, designed and tested to produce heat energy based on a chemically assisted low-energy Ni-H reaction. Meeting all EU safety standards, such design triggers a multi-phase reaction of excited Hydrogen atoms on a specially prepared Nickel micro-powder lattice, whilst all its subsystems are consistent with the engineering demands for a safe and easy to control and integrate this new energy source with different third-party applications. It's reactor "dry cell" configuration enables the control of the reaction between the nuclei of Hydrogen and Nickel in a dynamic environment. Working Hyperions and their subsystems are presented.

Having been tested with the co-operation of first line international labs, Hyperion lab reactors perform a COP of more than 20. Methods of testing, the protocols and their results are presented.

Hyperion will be the first industrial product based on the so called LENR-CANR technology. Defkalion is building the first series of new lab instrumentation specially designed for these new type of reactions that will provide to the scientific community robust data on the observed transmutations as well as data to check or rebuild theories on the measured phenomena. Defkalion will support the setup and the development of an independent international scientific body in order to help the global exploitation and standardization of this new energy industry.

MoM1-3

Controlled Electron Capture and the Path Toward Commercialization

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Brillouin Energy Corp. has run over 150 experiments using two different cell/calorimeter designs. Excess heat was always seen[1] in experiments where Q pulses, which have been tuned to the resonance of the hydride conductors ("core"), are present. Using our open cell design it is now possible to get excess heat on demand using light water and hydrided nickel and palladium.

Pulsed power in the cathode is the preferred method used to raise the energy of the virtual particles surrounding and confining hydrogen nuclei in the metal lattice[2]. We postulate that conversion of this energy to mass, results in the production of cold to ultra-cold neutrons. The removal of charge from the system by absorption of an electron by a proton makes a current pulse the preferred source of pulsed power because it provides an explicit source of electrons for capture.

In all cases, the application of a suitable Quantum Compression waveform enables active hydrided materials to produce excess power on demand. While it is common for "gross loading" systems to work with some pieces of material and not others from the same batch, Quantum Reactor technology caused every centimeter in all 15 meters of Pd wire to immediately produce excess heat while exposed to properly pulsed currents in light water. Quantum Reactor technology also allows for significant modulation of the power out of the cell.

Leveraging the results of the open cell experiments, the proprietary circuitry was attached to hydrided conductors in high-pressure, high-temperature systems for the sealed cell experiments[3]. The data taken from nickel-hydrogen system that was stimulated by Brillouin's proprietary electronic inputs show that the thermal output is statistically significantly greater than the electrical input. Measurable and repeatable surplus thermal output is found in the nickel-hydrogen system when all other inputs to the cells remain constant. We have shown 100% excess energy and hope to achieve 200%, which would make the technology industrially useful. In addition to Pd and Ni, the Q-pulse reactor system should work with other transition metals that confine hydrogen nuclei enough in a lattice to effect electron capture events.

We have started to perform experiments in a third cell/calorimeter design in collaboration with SRI international that we believe will lead to more useful heat by operating at higher temperatures. We will describe our latest results from both the second and third design of sealed cells.

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MoA1-1

Use of D/H Clusters in LENR and Recent Results from Gas Loaded Nanoparticle-Type Clusters

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Our recent gas loaded nanoparticle experiments are an outgrowth of "lessons learned" from earlier light water electrolysis experiments. Studies of LENR reactions, occurring with light water electrolysis of Ni/Pd electroplated on millimetre size plastic beads in a packed bed flow calorimeter (Patterson cell), demonstrated both excess heat and various nuclear reaction products such as Fe, Ag, Cu, Mg, and Cr [1]. The Q-value for nuclear reactions creating these products accounted for most of the excess heat observed [2]. Later work utilized the multilayer Ni/Pd thin film electrodes formed on a quartz substrate. A unique parallel-cathode-anode geometry created an electric field along the thin films in order to enhance loading by electromigration. Unlike the flowing packed bed geometry, periodic voltage pulses were applied to initiate and maintain the excess heat. This was attributed to the need for a flow of protons through the thin films in addition to the H/metal loading. A number of observations such as local melting spots in the electrodes, spotty charged particle emission observed on CR-39 film measurements, and localization of reaction products suggested that the reactions were taking place in small local areas (nuclear active regions). These observations led to several years' study of ultra-high density regions of Deuterium found in voids or dislocation loops in the films. Hydrogen "clusters" in these regions were estimated to have roughly 100–1000 atoms with superconducting properties below 70 °K as shown by SQUID measurements [3]. Subsequently, ways to increase the clusters per cc were studied, typically using multiple loading-deloading techniques to build up voids and dislocation loops near film interfaces. Recently, we have extended these techniques to the creation of clusters in pores in nanoparticles employed in our gas loading experiments [4]. The nanoparticles are formed from various alloys ranging from Pd-rich to Ni-rich. D_2 or H_2 gas at pressures up to 100 psi is used, with the Pd-rich or Ni-rich nanoparticles, respectively. The LENRs are initiated by an initial temperature rise associated with gas absorption in the nanoparticles. Depending upon conditions, LENR heating then rises to 300–400 °K, followed by a slow drop off over about 4 hours under constant pressure conditions. This drop off is attributed to a decrease in H/D flux with static pressure, cf. the need for voltage pulses in the earlier thin film electrolysis work. Periodic pressure variations are employed to obtain controlled runs over much longer periods. Simultaneously other methods for initiation and run time control of the reactions are under evaluation. No detectable radiation has been observed outside of the pressure vessel containing the nanoparticles, but low energy beta particle emission from nanoparticle is under study immediately after a run. These results are explained in terms of flow-momentum exchange between diffusing gas ions and the clusters.

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MoA1-2

Demonstration of Energy Gain From A ZrO_2-PdD Nanostructured CF/LANR Quantum Electronic Device At MIT

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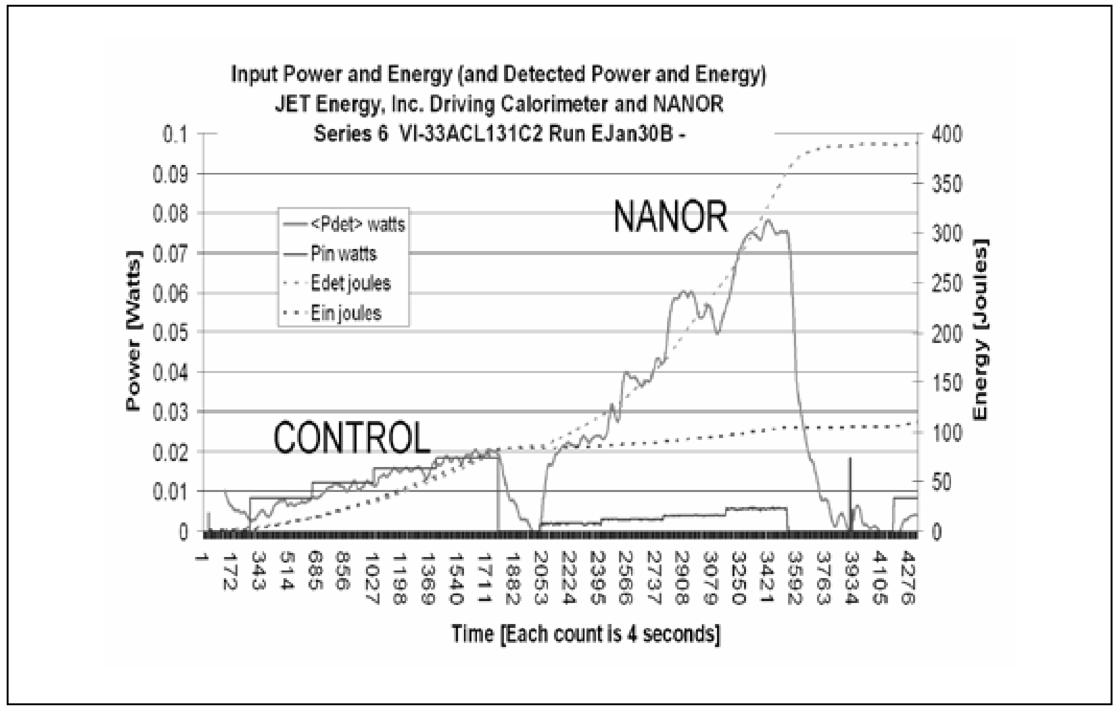
A CF/LANR quantum electronic component (NANOR), containing active ZrO_2-PdD nanostructured material at its core, has shown energy gain during, and after, the January, 2012 IAP MIT Course on CF/LANR. This two terminal, self-contained, Series VI NANOR features a new composition, internal structure, simpler connectivity, and superior handling properties. Most importantly, these NANORs are pre-loaded so that LANR activation is separated from loading. For verification, the calorimeter had parallel diagnostics including heat flow measurement, and repeated ohmic (thermal) control calibration. The CF/LANR quantum device demonstrated reproducible, controllable, energy gain which ranged generally from 5 to 16 [energy gain of ~14.1 during the course demonstration]. During February and March, a range of experiments examined the impact of H-field intensity and various driving sequences on the NANOR performance, which has continued to produce excess energy, as corroborated by daily calibration. This open demonstration of an active ZrO_2-PdD nanostructured quantum electronic device has confirmed the existence, reproducibility, and better control, of CF/LANR, and has shown that it may be superior CF/LANR nanostructured material, configuration, and means to activate these important systems.



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TuM1-1

Transmutations and Isotopic shifts in LENR Experiments: An Overview

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Abstract

The term Low Energy Nuclear Reactions (LENR) has come to refer to the phenomenon wherein Nuclear Reactions are found to take place when selected metals such as Pd, Ti, Ni etc or alloys/mixtures thereof are "loaded" with either deuterium or hydrogen. As the title of the present conference (ICCF 17) implies, the LENR phenomenon continues also to be referred to by its historic name of "Cold Fusion", a term coined soon after the Fleischman-Pons announcement of 1989. As for the specific type or types of nuclear reactions which occur in LENR devices, right from the inception it was assumed & presumed that the main reaction(s) involved were some type of fusion reaction between the deuterons loaded in the Pd cathode, with the "host metal lattice" serving merely as a catalyst or a non participating witness to these reactions. But right from day one, there were speculations as to whether the "host lattice" Pd may also be a participant in the LENR phenomenon. Even as early as October 1989 at the NSF/EPRI workshop on "Anomalous Effects in Deuterated Materials" atleast one group presented preliminary mass spectroscopic results which suggested that the isotopic composition of the Pd in selected locations on the cathode surface may have been altered. Since then there have been persistent reports presented at almost every ICCF conference indicative of the possible occurrence of nuclear reactions between host lattice nuclei and the loaded light element nuclei.

From the viewpoint of those who find it difficult to believe/accept/explain even the initial "claim" of cold fusion reactions taking place between the hydrogenous nuclei, the occurrence of these heavy element-light element cross-species reactions are even more difficult to digest. It is such reactions which are referred to as "Transmutations and isotopic shifts". Russian groups were amongst the earliest to report the presence of "new elements" and isotopic anomalies in glow discharge experiments. George Miley's observation of a variety of transmutation products in Patterson type thin film Ni-Light water cells in 1995-96 was a turning point, while Iwamura's systematic deuterium gas permeation experiments have placed LENR Transmutations on a firm footing even though the theoretical mechanism underlying Transmutations continues to baffle. The interest and importance of the topic has acquired new urgency with the latest reports of industrial level heat being observed in Rossi type Ni-H reactors wherein the inventors claim that the nuclear heat arises from a transmutation reaction involving proton capture in Ni isotopes to generate Cu isotopes. But these claims have not yet been supported by sound experimental evidence. Assuming that Transmutations do occur in LENR devices, the big question is whether it is only side reaction of academic interest or is it or can it be the main reaction mode and primary source of heat generation in robust LENR products.

The present paper gives an overview of Transmutation experimental results "mined" from the past two decades of LENR/CF publications. It is an update on an earlier review authored jointly with George Miley and Edmund Storms and published last year in the Wiley Encyclopedia on Nuclear Energy [1].

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[1] Mahadeva Srinivasan, George Miley and Edmund Storms, "Low Energy Nuclear Reactions: Transmutations", Chapter 43 in "Nuclear Energy Encyclopedia", John Wiley & Sons, (2011)

TuM1-2

It's not Low Energy – But it is Nuclear

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Originally 'low energy nuclear reactions' (LENR) encompassed all anomalous effects reported for the metal deuteride systems. These effects included heat, helium-4, energetic charged particles, tritium, neutrons, gamma/X-ray emissions, and transmutation. It was later shown that the heat did not correlate with either neutrons or tritium.[1] Instead it was found that the heat correlated with helium-4.[2] These results indicated that there were at least two channels - an aneutronic channel that produced heat (the so-called true Fleischmann-Pons effect) and another channel that favored formation of energetic charged particles, neutrons, and tritium. It was Swartz[3] who suggested that, by adjusting the experimental parameters, one could switch from one channel to the other. Currently, there are those in the field who are asserting that the reported tritium, energetic particles, and neutrons that have been observed in the Pd/D and Ti/D experiments are not the result of LENR. Given that the energies of these species are in the MeV range, they are clearly not low energy. However, given these MeV energies, the origins of these species have to be nuclear in nature.

In the Pd/D co-deposition process that was pioneered by Szpak, both the heat[4,5] and energetic particle[6,7] producing channels have been observed. The focus of this communication is on the experimental observations of energetic particles as detected using CR-39 solid state nuclear track detectors. In particular, three criticisms of these results will be addressed: (1) chemical damage vs. nuclear origins of the tracks; (2) why the Pd/D co-deposition tracks are predominantly circular is shape; and (3) the absence Pd K-shell X-ray emissions that should simultaneously occur with the energetic charged particles. The implications of these results on the nuclear processes occurring inside the Pd lattice will also be discussed.

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TuM1-3

Co-Deposition Of Palladium And Other Transition Metals In H_2O and D_2O Solutions

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Anomalous effects for Pd/D co-deposition were first reported by Szpak and Mosier-Boss using the $PdCl_2$+LiCl/D_2O system [1]. However, commercial electroplating baths for palladium are often based on aqueous ammonia solutions (NH_4Cl/NH_3) at pH 7 to 10 [2]. The related $PdCl_2+ND_4Cl+ND_3/D_2O$ deuterated ammonia system previously produced large reproducible excess power in three out of three experiments [3]. This co-deposition excess power was similar to the anomalous effects observed in other Pd-D systems [3]. Recent experiments have shown that these anomalous excess power effects were absent in Pd/H_2O controls as well as for the co-deposition of ruthenium (Ru) in both H_2O and D_2O ammonia solutions [4,5]. This study reports results for the co-deposition of rhenium (Re), nickel (Ni), iridium (Ir) and other transition metals in both H_2O and D_2O ammonia systems.

The experimental conditions for palladium co-deposition often did not work well for the deposition of other transition metals. Furthermore, each transition metal has its own unique electrochemical catalytic properties for the electrolysis of water [6]. Also, the problems of chlorine (Cl_2) evolution and the formation of nitrogen trichloride [4] vary greatly from one transition metal to another. A common feature for all metals was that the initial solution pH was basic (pH=9 to 10) due to the ammonia added but became acidic (pH=1 to 2) with the complete electrochemical deposition of the positive metal ions and their equivalent replacement by H^+ or D^+ ions. Large currents where the electrolysis gases drive off the ammonia facilitate these large changes in the solution pH. The co-deposition of rhenium using a dark red solution of rhenium chloride ($ReCl_3$) yielded a completely clear solution with a black rhenium metal deposit with a very high surface area (10^5 cm^2) on the copper cathode. The calorimetric study of this Re/H_2O system over 10 days yielded a near zero mean value for excess power of -1.1 ±4.2 mW. Similar stable calorimetric results with no excess power were obtained with Ni/H_2O and Ni/H_2O+D_2O co-deposition systems. Metal vacancies may be important for excess power in the Pd/D_2O system, and the co-deposition of palladium at higher currents is expected to create an increased number of such vacancies [7]. Preliminary studies of the co-deposition of palladium at 300 mA in deuterated ammonia systems have produced excess power exceeding 300 mW and a total of 150 kJ of excess energy. However, the poor adherence of the palladium deposited at high currents creates recombination problems that may account for part of the excess energy. In more than 20 experiments involving the co-deposition of various transition metals in the ammonia electrolyte, only the Pd/D_2O system has produced anomalous excess power.

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TuM2-1

Energy Gain from ZrO_2-PdNiD Nanostructured CF/LANR Quantum Electronic Components

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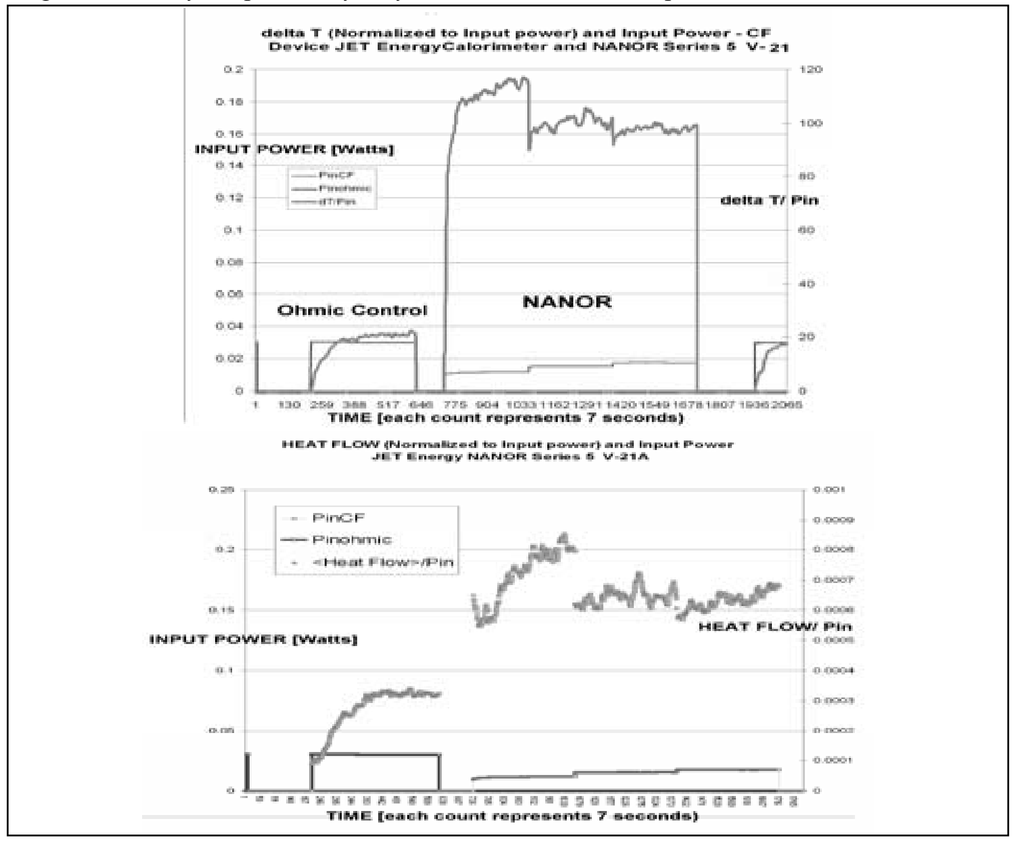
ZrO_2-PdNiD nanostructured materials can generate LANR/CF energy gain with acoustic and electric fields; with additional palliative effects from orthogonal applied DC magnetic field intensities (1). They have been fashioned into LANR/CF transistors (1) which exhibit energy gain and simultaneous non-thermal near infrared emission at their pair optimal operating points. However, there are complicated polarization/transconduction phenomena which include an "avalanche (transconduction electrical breakdown) effect". This has a critical role in excess heat observed and energy gain (2). Control of the breakdown states and quenching tendencies has been critical. Surmounting this, we report a new generation of CF/LANR quantum electronic devices which have at their core nanostructured ZrO_2-PdNiD, and exhibit considerable energy gain (a NANOR™-type CF/LANR device). The core is ZrO_2-PdNiD [Zr (~66%), Ni (0-30%), and Pd (5-25%) by weight] with additional D_2 and H_2. These devices feature two terminals and self-contained superior handling properties enabling portability and transportability. Most importantly, the activation of the cold fusion/lattice assisted nuclear reaction is, for the first time, separated from loading. These NANORs are functionally "dry", glued into an electrically conductive, sealed, configuration. They are potentially very useful and have more reproducible CF/LANR behaviour.



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TuM2-2

Calorimetric Studies of the Destructive Stimulation of Palladium and Nickel Fine Wires Loaded with Hydrogen and Deuterium

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An experimental program was designed and performed to test three aspects of CMNS studies. In the light of reports from Rossi regarding large scale heat release from the nickel – natural hydrogen system, prompting re-evaluation of earlier work on this system performed by Piantelli, and later claims by Defkalion, a fourth objective was added:

1. The conditions causing the Fleischmann Pons Heat Effect (FPHE) in Condensed matter Nuclear Science (CMNS) experiments have been well established by empirical study. In a suitable lattice one needs to achieve (and maintain) a large D/Pd loading ratio and then stimulate a rapid disequilibrium condition causing a deuteron flux. In the experiments of Fleischmann and Pons (and others) the electrochemical process achieves both conditions. Of interest is whether the loading and stimulation conditions can be decoupled.
2. CMNS experiments have been demonstrated to produce over 20 keV of thermal energy per host Pd atom or interstitial D [1]. This is approximately 10,000 times larger than the largest possible chemical energy release. In experiments previously performed the rate of energy release has been limited by mechanisms unknown, to a few 10's or 100's of Watts per cm^3 of Pd. We were interested in evaluating potential limits on the rate of thermal energy release by optimizing then freezing lattice conditions and then applying large and abrupt stimuli.
3. One reason for the slow development of the CMNS field is the unavailability of a robust experiment that can be performed rapidly and repeatedly to evaluate the influence of potentially relevant experimental parameters; the physical scientists equivalent of the biologists "lab rat" or Drosophila. The experiment described here was designed with the potential to play this role, allowing more rapid empirical exploration and rationalization of experiment with theory.
4. Initial and repeatable success with the Pd/D system and outside claims of success with Ni/H (or natural H/D) systems, possibly involving structures having nano-dimensions, prompted an expansion of our study to include prefabricated, superficial, dendritic nano-structures, and the rapid stimulation of pre-loaded NiH and PdH wires with and without such nano-structures.

Results of these studies will be reported. These indicate, perhaps providentially, that very high rates of energy release signalling high explosive powers do not normally or necessarily result from extreme electrical stimulation of metal wires highly loaded with hydrogen and/or deuterium. Experimental support is given for the claims of nuclear level excess heat from both Pd wires loaded with isotopically enriched D, and Ni wires loaded with H at natural isotope levels. The excess heat effect was larger for PdD, and largest for PdD with dendritic PdD surface structure, but was nevertheless clear and present for Ni wires loaded in "normal" H_2O providing further experimental support for the work and claims of Piantelli, Rossi and Defkalion. Some comments will be directed to possible mechanistic implications.

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III. Technical Program

TuM2-3

Theoretical Analysis of Chemically Assisted Nuclear Reaction

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Many problems still existed in the current CANR reports. First of all, the phenomenon was difficult to reproduce; second, some data were difficult to comment as possible measurement errors existed; third, some of the data recorded can be explained by other chemical and/or physical reaction; and last, the mechanism still unknown.

After electrolyzing and discharging electricity, the nuclear reaction product was induced at the metals surface such as Pd and Ni in the medium of the hydrogen isotope. The experiment is conducted for a long time such as several day and week. The reaction metal and the alloy have been treated as the mechanical processing before the experiment. These materials were electrolyzed for long time by the current density of several ten mA/cm^2. After that, we can see many metal particle (100nm or less) on the electrode surface. At that time, we frequently confirm many products that can be considered as the reaction products after the nuclear reaction. These were the generation of radiation, neutron, tritium, helium and some nuclear transmutation materials.

Theories on this mechanism that seemed to have generated nuclear reaction in special metallic structure were suggested. This is a nuclear fusion reaction by the hydrogen isotope, and the reaction to stay up experimentally. We considered the interaction of the localization electron and charged particles in the Nano particle.

Hydrogen isotopes is changed slightly with these electron near the nuclei. And then the calculation of the tunnel probability is very increased. This change is strongly depended on the potential between two of the hydrogen nuclei. As for a reactive probability by the tunnel effect, if the barrier potential decreases as 50%, then the reaction probability increases as ten digit.

TuA1-1

Tickling the Dragon's Tail: Harnessing LENR

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Arguably, the Nuclear Age was ushered in with the 1939 Naturwissenschaften paper on nuclear fission by Hahn and Strassmann, and subsequent replications by scientists around the world. Similarly, we published a Naturwissenschaften paper 70 years later demonstrating DT fusion in a Pd lattice. Yet, although only 18 years went between the '39 paper and the Shippingport, PA commercial nuclear reactor, 23 years have elapsed since Fleischmann's and Pons' discovery with as yet no commercial device sold. This talk examines LENR's nuclear conundrum and the Catch-22 of licensing impediments to commercialization.

TuA1-2

Possible Role Of Oxides In The Fleischmann-Pons Effect

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Typical Fleischmann-Pons (F-P) electrolysis experiments using solid palladium cathodes generally do not produce excess power effects for the first several days or even for the first week or two of electrolysis. This may be due to the slow leaching of silicon oxides and other oxides from the glass cells and the deposition of these oxides onto the palladium surface. The Naval Research Laboratory (NRL) recently reported that no excess power effects are observed with Teflon cells unless oxide impurities are added [1]. Several China Lake experiments using polymer coated glass cells failed to produce excess power from previously active palladium cathodes [2]. The successful replication of the F-P effect by Lonchampt and others [3] in France also involved formation of a silicate layer at the cathode that came from the walls of the glass cell. Arata has shown that the oxide-metal interface is important by his deuterium gas loading work with palladium and ZrO_2 [4]. It has been proposed that oxide interfaces are necessary in F-P type experiments because of the strong electric fields produced [1,5]. The work of Parchamazad [5] with zeolites also suggest an important role for oxides in conjunction with palladium in the zeolite cavaties. Zeolites are micro-porous crystalline aluminosilicate materials having a highly regular structure of pores and chambers. Strong electric fields are present in the zeolite cages that may act as nanoreactors in studying the possibility of deuterium fusion at room temperatures [5]. A significant heating effect was observed for zeolite palladium exposed to deuterium gas in contrast to the use of hydrogen gas [5].

Two types of experiments have produced excess power effects without the long incubation times, and both may involve oxides that are already present. The first type is co-deposition studies where nanoparticle palladium is formed that may form surface oxides by reaction with the oxygen generated at the anode. In fact, co-deposition studies in ammonia based alkaline systems initially form insoluble palladium oxides or hydroxyl oxides. The second type is palladium-boron (Pd-B) alloy cathodes that may contain boron oxides formed in their preparation. Detailed analysis of a Pd-B experiment showed excess enthalpy generation during the first few days of electrolysis [6].

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TuA1-3

ICCF17 (August 2012, Korea)

Studies on a surface nano-structured low cost material (Cu-Ni-Mn) used as possible source of anomalous heat by H_2 interaction at high temperatures.

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In the framework of studies devoted to induce thermal and/or nuclear anomalies due to the close interaction of H_2 isotopes in some specific materials (e.g. Pd, Ni, Ti, Th, U, and/or their alloys), from several years we adopted the procedure to cover Pd or Ni thin (Φ=50-100 μm) and long (50-100 cm) wires with several nano-layers of elements that can promote the absorption of H_2 isotopes, even at high temperatures (200-900°C). Wires were pressurised (up to 10 Atm.) inside a glass tube.
The heating was provided by Joule effect along the wires. In the reaction chamber 3 wires were put, each electrically insulated (by HT sheaths): a) *active wire* (i.e. Pd or Ni with surfaces covered by the proper nano-layers); b) *reference*, i.e. same as a) but without the nano-layers; c) *calibration*, a nominally inert wire made of pure Pt with smooth surface.
Calibrations were made using inert gases (He, Ar, Xe), air and vacuum at different electric input powers (from 10 up to 150W).
The reactor chamber is equipped with several SS screened thermocouples (K type) to monitor all the temperatures inside and outside the hottest area. The temperature drops give useful information to cross-check the results. The acquisition system is based on NI Lab-View standard and Agilent instrumentations. The minimum acquisition time is 2s. The thermal anomalies, if any, were detected by flow calorimetry.
Since March 2011 we studied a new low cost material usually used in the electronics as very stable resistor (+-1%) against large temperature changes (up to 600°C in free air). The general brand name is “constantan” and we used the type that was in our hands (composition Cu_{55}-Ni_{44}-Mn_1, commercial name ISOTAN 44, Company Isabellenhutte-Germany).
We selected such material because has the largest value (over 3eV) of catalytic power in respect to H_2 decomposition (in comparison, pure Pd has a value of only 0.4eV).
We decided to increase the intrinsic catalytic power by modification of the surface, from smooth to sub-micrometric. In addition we built on the surface of the wire (diameter 200μm) a specific structure, called skeleton, that has a total thickness of about 20-30 μm in respect to the original diameter. In other words, the original bulk constantan has a diameter of about 170μm, the apparent dimension after thermal treatments increased to 220-230μm.
The modification of constantan surface was obtained by selective oxidation of Cu at temperatures of 650-1000°C. We experienced that the rising and falling of temperatures have strong effect on material dimensionality.
Some of this material showed anomalous heat at wire temperatures > 250-300°C.
On January 2012 we went to know that a similar material (Ni-Cu-ZrO_2), at nanosized dimensions, was successfully used also by A. Takashi and A. Kitamura group (Osaka and Kobe University, Japan). Some of the results obtained by them have similar behaviours to ours.
We will show also new results that we will obtain using a material obtained by a very recent enhanced procedure of preparation: there were “produced” lower dimensionalities (before the amount of material at <<100nm was 2-3%, now reached values of over 20%).

TuA2-1

Recent progress in gas-phase hydrogen isotope absorption/adsorption experiments

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Gas-phase hydrogen isotope absorption/adsorption experiments performed since 2008 at Kobe University are sammarized. The samples include 0.1-μm-diam. Pd particles (PP, Nilaco Corp.), Pd-black (PB, Nilaco Corp.), oxide nano-composites of Pd·ZrO_2 (PZ, Santoku Corp.), porous-silica-included Pd nano-particles (PS, Admatechs Co. Ltd.), ternary oxide compound of Pd·Ni·ZrO_2 (PNZ, Santoku Corp.), binary oxide compound of Ni·ZrO_2 (NZ, Santoku Corp.), Pd·Ni nanoparticles dispersed in ZrO_2 powders provided by B. Ahern (PNZ2B), and ternary oxide compound of Cu·Ni·ZrO_2 (CNZ, Santoku Corp.).

A twin absorption system consisting of two equivalent sets of reaction chambers and the reservoir tank filled with D_2 and H_2 gas, respectively, has been employed. The flow rates of D_2 and H_2 gas into the reaction chambers after an absorption run starts are regulated with "Super Needle" valves. For calorimetry a chiller is provided to keep the coolant water temperature constant within an error of ±0.1 °C.

Time-dependent measurements of the temperature and the pressure enable measurements of time-dependent specific heat release $W(t)$, dynamic loading ratio $L_D(t)$ ($L_H(t)$) of hydrogen isotopes, dynamic sorption energy $\eta_D(t)$ ($\eta_H(t)$), as well as time-integrated parameters such as hydrogen isotope loading ratio D/Pd (H/Pd) and hydridation energy Q_D (Q_H). Radiation detectors, such as a neutron doserate meter, NaI scintillation probe, an ion-implanted Si detector and a Si-PIN diode are also provided for time-dependent measurements of neutrons, γ rays, charged particles and X-rays.

Based on the results of the extended measurements, the effects of the sample structure on the absorption/adsorption characteristics are discussed; particle size, oxide formation on the Pd samples, the silica-inclusion of Pd nanoparticles, and Ni-substitution for Pd. Anomalously large values of the evolved heat, the total D/Pd (H/Pd) loading ratios and the η-values have been repeatedly observed in the absorption runs at room temperature using the samples of PZ, PS and PNZ2B.

The CNZ sample has required elevated temperature to absorb hydrogen isotopes. Preliminary results show slight and long-term increase in temperature in some runs operated at above 500 K. Detailed description of the experiments using this sample is given in another presentation by H. Sakoh.

TuA2-2

Detection of Pr in Cs ion-implanted Pd/CaO multilayer complexes with and without D_2 gas permeation

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Nuclear transmutation with deuterium gas permeation through Pd/CaO)/Pd multilayer complexes has been claimed by Iwamura et al [1]. They have reported transmutation reactions of Cs into Pr, Sr into Mo and Ba into Sm [2]. A serious question for these results has been whether the observed elements are generated by nuclear reaction or are caused by chemical contamination. A difficulty in clarifying the origin of the observed element is the fact that the amount of the element is so small that it is not easy to detect it and distinguish from contamination.

In this study, we have examined the performance of trace Pr detection for several kinds of analysis methods, and carried out an experiment to reproduce the Cs to Pr transmutation using the selected analysis tool. We compared the detection sensitivity among GD-MS (Glow Discharge Mass Spectrometry), LA-ICP-MS (Laser Ablation Inductively Coupled Plasma Mass Spectrometry), and ICP-MS (Inductively Coupled Plasma Mass Spectrometry), using reference samples that were doped with given concentrations of Pr by ion implantation. We concluded that ICP-MS was most adequate because it had the highest performance of sensitivity and quantitative determination.

Substrates of Pd (purity: 99.95%) 100μm in thickness were commercially obtained. The as-purchased substrates were heat-treated in vacuum (5×10^{-5}Pa) at 1173K for 15h and subsequently in the air at 873K for 10min to remove impurity atoms. Next, Pd/CaO multi layers were formed on the Pd substrates by pulsed laser deposition (PLD). Then Cs atoms were implanted in the multilayer at 65keV and to a dose of 1×10^{14} ions/cm^2. Subsequently, the Pd substrates were heat-treated in the air at 573K for 10min in order to remove carbonaceous materials deposited during the ion implantation. The samples were then subjected to D_2 gas permeation treatments at 423K and 9atm for about 250h. The D_2 permeation system was the same with our previous report [3]. The up-stream side was filled with D_2 of 900kPa. The purity of the D_2 gas was 99.995%. The down-stream side was evacuated with a dry pump and a turbo molecular pump. After the D_2 permeation, we dissolved the Pd substrates by nitric acid or aqua regia and analyzed them by ICP-MS (Agilent: 7700X).

We detected approximately 0.5ng/cm^2 of Pr by ICP-MS in the D_2 permeated Pd/CaO multilayer samples with ion-implanted Cs atoms. Similar results were frequently obtained for samples with the D_2 permeation treatments. For comparison, we measured the amount of Pr in the samples without D_2 permeation treatments, e.g., the amount of Pr was 0.005ng/cm^2 in the Pd substrate covered with the Pd/CaO multilayer formed by PLD, 0.006ng/cm^2 in the Pd substrate implanted with Cs ions.

We concluded that the amount of Pr in the D_2 permeated samples was larger than those in the non-D_2 permeated comparison samples.

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TuA2-3

Gas Loading of Nanopalladium

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To obtain high loading of palladium through gas pressurization we have postulated that the palladium nanoparticles must be <2 nm in diameter. Particles of this size are difficult to produce in bulk. We have used Zeolites to confine particle growth inside the Zeolite cages.[1] Although an abnormal amount of heat is evolved when pressurizing these materials with deuterium vs. hydrogen, much of the heat can be attributed to D-H exchange with the -OHs on the zeolite surface and adventitious water. Similar results were obtained on alumina if the loading was <2% palladium.[2] Cycling the alumina system showed the abnormal excess heat persisted for 8-10 cycles and then decreased linearly. We postulated that the particles grew during cycling and growth above a critical size stopped heat production. However, palladium particles in the 2 nm and below regime are difficult to characterize so this hypothesis could not be fully tested. We developed a process to start with atomic palladium and during the pressurization process grow palladium through some critical size. With this scheme, long-term (days) heat was produced in the presence of a constant pressure of deuterium. This long-term heat can be put to useful work. The amount of heat is much greater than can be accounted for by D-H exchange. However, there may be a chemical explanation due to other chemicals being present. The selection of materials that allow this controlled growth, the thermodynamics of possible chemical reactions, and results from heat measurements will be presented.

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WeM1-1

Physics of Cold Fusion by TSC Theory

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Model principle of cold fusion processes in nano-metal mesoscopic catalysts (Pd, Ni, alloys) are proposed and discussed pertaining to the transitory Bose-Einstein type condensation of hydrogen isotope (D and H) clusters.

Brief show on modeling transient/dynamic D(H)-cluster formation on/in a nano-metal particle with surface sub-nano-holes (SNH) is first given. Formation of 4D(H)/TSC will be enhanced on surface SNHs and by non-linear phonon-coupled excitation of D(H)-oscillation-motions in global mesoscopic potential well (GMPW) of nano-particle catalyst. The elevation of sample temperature will cause the enhancement of 4D(H)/TSC-cluster formation rates.

Based on the TSC (tetrahedral symmetric condensate) theory, comparison is made between 4D/TSC and 4H/TSC condensation motions and resultant strong and weak nuclear interactions. Mean reaction kinetic energies for cold fusions of D_2 molecule, muonic dd molecule and 4D/TSC are comparatively discussed; 2.7 eV, 180 eV and about 10 keV, respectively for D_2, ddμ and 4D/TSC-minimum-state. The elevation of kinetic energy of confined particles is resulted in reflecting the Heisenberg Uncertainty Principle (HUP) or the relation between de Broglie wavelength and the depth-and-spread of trapping potential.

The probability of 4H/TSC fusion by the simultaneous weak and strong interaction (WS-fusion) is quantitatively analyzed to be on the order of 10^{-7} f/4H-cluster, while the 4D fusion (major products are two ^{4}He particles) probability for deuterons 1.0 f/4D-cluster is very large. However, 4H/TSC cluster (products are ^{3}He and proton) may have much longer life time than 4D/TSC cluster, in their final-stage time-intervals of condensation motion, so that significant enhancement of 4H/TSC WS-fusion reaction rate (as well as 4H/TSC induced clean fission of host metal nuclei, due to relatively easier barrier penetration of several fm-size neutral entity 4H/TSC-minimum-state through multi-layered electron shell clouds of metal nucleus) may be expected, especially for lighter catalyst nano-metal as nickel/nickel-alloy.

The cold deuterium-base fusion can be attained by confining a high kinetic energy (as 10 keV) deuteron-cluster in a very microscopic domain (as small as 20 fm diameter) in condensed matter as nano-metal-particle, for a very short time interval as 2×10^{-20} s, while the hot fusion is realized by confining high kinetic energy (as 10 keV) D-T plasma in a very large space (ca. 10 meter diam. torus) of magnetic (or inertial) confinement bin. Interestingly, the relative reaction kinetic energy is on the resembling order to each other, in microscopic nuclear physics view-point, so far.

WeM1-2

Conventional Nuclear Theory of Low Energy Nuclear Reactions in Metals: Alternative Approach to Clean Nuclear Fusion Energy Generation

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Over the last two decades, there have been many publications reporting experimental observations of excess heat generation and anomalous nuclear reactions occurring in metals at ultra-low energies, now known as 'low-energy nuclear reactions' (LENR). After a review of key experimental observations, theoretical explanations of the LENR phenomena will be described by conventional nuclear theory based on the optical theorem formulation of LENRs (OTF-LENRs) [1] and on Bose-Einstein condensation of deuterons in micro/nano-scale metal particles [2-11]. Proposed experimental tests of the basic assumption and theoretical predictions as well as potential applications will be described [11, 12].

Cryogenic ignition of deuteron fusion in metal particles [11, 12] will be described as an alternative approach to clean fusion energy generation based on theory of Bose-Einstein condensation nuclear reactions (BECNR) in micro/nano-scale metal particles [1-11].

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http://www.physics.purdue.edu/people/faculty/yekim.shtml.

WeM1-3

A model for collimated x-ray emission in the Karabut experiment

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Karabut first reported the observation of collimated x-ray emission near 1.5 keV in his glow discharge experiments about a decade ago. The effect is reproducible, and is seen with many different cathode metals, and also with a variety of different discharge gasses (deuterium, hydrogen, helium, argon and krypton). The strongest effect comes about over the course of about a millisecond after the discharge is turned off. One can see in the time history of the current that a very strong and short current spike occurs in association with the current turn off. The collimated emission is very bright, sufficient to cause "solarization" (damage) of the film.

We have been of the opinion for years that this effect was important, and was telling us something important about how nuclei interact with a lattice. For example, it seemed reasonably clear that the collimation must come about as a result of a phased array effect in the emitters. We surmised that the radiation must be of nuclear origin since it seems to be very difficult to arrange for in-phase electronic excitation in the keV regime. Coherent excitation of the nuclei would require a source of phase coherence, and the only possible source of such coherence would seem to be low frequency acoustic phonons. The physics issues requiring clarification in such a scenario concerns the coupling between lattice vibrations and nuclear excitation, and how the low-energy vibrational quanta are up-converted to keV quanta.

Last year we recognized that this effect is consistent with the donor-receiver lossy spin-boson models that we have been studying in connection with excess heat in the Fleischmann-Pons experiment. For excess heat, the model starts with nuclear excitation, and then the large energy quantum is fractionated and coherently exchanged with a vibrational mode in the lattice. For collimated x-ray emission, the energy starts as strong excitation of a vibrational mode, and then is up-converted and coherently transferred to nuclear transitions.

However, we faced two major issues in the specification of an associated model for the collimated emission. One is the identification of a strongly-coupled transition capable of up-converting many low-energy oscillator quanta into a large two-level system quanta. The other is the identification of the nuclear transition involved in the emission.

Potential solutions to both problems have become apparent recently. We have identified a new mechanism that is capable of coupling lattice vibrations to nuclear excitation which resulted from a new relativistic model for nuclei embedded in a lattice. This mechanism appears to apply generally to all composite nuclei, which seems consistent with Karabut's observation of collimated x-rays with different cathode metals. We have also identified a candidate nuclear transition near 1.5 keV in ^{201}Hg, which is the lowest energy excitation from the ground state of any stable nucleus. Coupling to this state could occur through electron-nuclear interactions, which will be sensitive to lattice vibrations if an outer electronic orbital is involved.

The emission line shape is very broad within the model. Karabut has recently published spectra from incoherent emission which seems to show a similar line shape. The collimated emission is observed at different wavelengths. Collimated emission at different specific wavelengths within the broad line shape is predicted in models with a random emitter distribution assuming atomic displacement in an ordered lattice.

WeM2-1

"Excess Heat" in Ni-H Systems and Selective Resonant Tunnelling

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Piantelli, Focardi, and Miley et al. have paved the road from fundamental research towards industrial application of "Excess Heat" in Ni-H systems; however, the Coulomb barrier with high charge number (Z=28) is still a serious subject to be studied. Selective resonant tunnelling model is able to explain the 3 puzzles (i.e. tunnelling the Coulomb barrier, "excess heat" with no strong neutron and "excess heat" with no strong gamma radiations) in terms of ***weak interaction*** . This model has been confirmed by hot fusion data in calculating 7 major fusion cross-sections of light nuclei (d+d, d+t, d+^{3}He, t+t, t+^{3}He, p+d, p+^{6}Li). It explains also the anomalous yield of 3 deuteron nuclear reactions, and the "Heat after Death" phenomena in terms of a long life-time resonance governed by the ***weak interactions***. Nevertheless, the high charge number (Z=28) for nickel nucleus needs additional effort to develop the theoretical model. The recent calculation of p+^{6}Li fusion cross-section revealed the importance of the electron screening effect, the information implied in the large n+^{6}Li cross-section at low energy, and the condition for low energy resonance governed by the ***weak interaction*** in p+^{6}Li fusion reaction. These 3 issues play their important roles in Ni-H systems as well. They are particularly important when we propose the following mechanism for interaction between low energy proton and nickel nucleus.

It is prevailing to assume a mechanism to turn proton into neutron in order to overcome Coulomb barrier with high charge number. However, the mass defect (782keV) prevents from transforming (p+e$^-$) into a free neutron. In this presentation we are going to propose a mechanism which would transform (p+e$^-$) into a confined neutron in order to avoid the difficulty of mass defect.

Weak interaction is a short range force; hence, we are supposed to calculate the overlapping of the wave functions when we calculate the transition probability from (p+e$^-$) to a confined neutron. Usually the wave function of a confined neutron is constrained inside the nucleus; however, in some specific cases the neutron wave function might extend outside the nuclear radius such that the overlapping between the wave function of (p+e$^-$) and the wave function of a confined neutron would be enhanced even if the Coulomb barrier is high and thick. We call it a new kind of resonant tunnelling for the case of ***weak interactions***.

This new mechanism would predict the nuclear products accompanied with the "excess heat" in Ni-H systems. It might answer the questions: "why does some additive increase the power of Ni-H systems? (the additive or catalyser)" and "why is there some 'frequencies generator' to control and stabilize the Ni-H system?". The possible mechanism to transfer the energy to crystal would be discussed. A new experiment would be proposed to test this new mechanism governing ***weak interaction*** as well.

WeM2-2

New Visions of Physics through the Microscope of Cold Fusion

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Cold-Fusion (CF) Research is not hindered as much by what we do not know as it is by what we know too well. The well-known nuclear physics of tunnelling through a Coulomb barrier, which had said deuterium-deuterium fusion at room temperatures was more than 100 decades away from the observable CF effects, was based on extrapolation from experimental results of high-energy (E > 1 MeV range) d-d collisions. These predictions, while good for E > 25 keV, have been over-turned by lower-energy experiments during the last two decades. Extrapolation from the new results is much closer to the measured Cold-Fusion results than to that of the early 'Gospel'.

Nuclear physics declared that d-d fusion, in creating excited states of helium, $^4He^*$, must result in energetic protons, neutrons, tritons, and ^3He, rather than in ^4He. Since not enough neutrons have ever been observed in CF to account for the measured heat, "CF cannot be a d-d fusion effect." Nuclear physicists neglected to consider well-known excited states of helium below the neutron fragmentation level because they 'knew' that d-d collisions cannot populate these states.

Quantum mechanics declares that the ground state of hydrogen is its lowest energy level. However, mathematically, it is a 'minimal', not a minimum, level. The relativistic Schrodinger equations (the Klein-Gordon and Dirac equations) are solved for a charged body in a Coulomb (1/r) potential. The solutions that are singular at r = 0 have been repeatedly rejected and ignored. Nuclear physics, many decades ago, decided that the Coulomb potential must be different when r => 0. There is no singularity! These rejected solutions predict a deep atomic level (~ 500 keV) for relativistic electrons.

These examples, and others, of "too much knowledge and not enough thinking" will be discussed in the context of some models for cold fusion.

WeM2-3

Application of Correlated States of Interacting Particles in Nonstationary and Periodical Modulated LENR Systems

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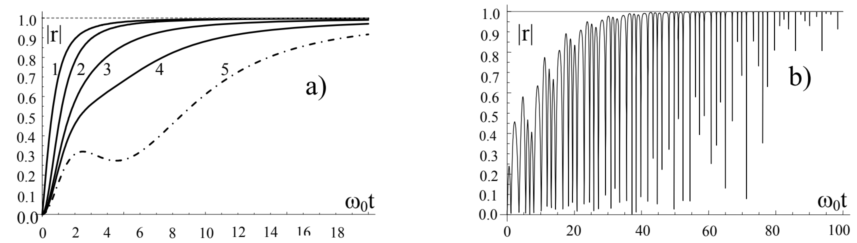
It is well known that the probability of nuclear reactions to run with the participation of charged particles at a low or middle energy (for $E << Ze^2/R$) is defined, in the first turn, by the action of a Coulomb barrier Ze^2/R and is bounded by a very small probability $D << 1$ of the tunnel effect (e.g. $D_{r=0} \approx e^{-2440} \approx 5.10^{-1059}$ for $Ni^A + p \to Cu^{A+1} + \nu$ reaction).

In the report the universal mechanism of optimization of low energy nuclear reactions on the basis of correlated states of interacting particles is considered. This mechanism provides the giant increase of barrier penetrability under critical conditions (very low energy, high barrier), where the effectiveness of "ordinary" tunneling effects is negligibly small.

We consider prerequisites and investigate some optimal methods for the formation of a correlated coherent state of interacting particles in systems like nonstationary harmonic oscillator. This method is shown to lead to rapid formation of a strongly correlated particle state that provides an almost complete clearing of the potential barrier for both the monotonous [1] (Fig.a) and oscillating [2] (Fig.b) increase of correlation coefficient $|r(t)| \to 1$ at different types of modulation of oscillator frequency: $a)\ \omega(t) = \omega_o \exp(-t/T),\ T_1 < T_2 < ... < T_5$; $b)\ \omega(t) = \omega_o(1 + g\cos\Omega t)$ at $|g| << 1$.



The optimal regimes of formation of completely correlated states of a particle with the giant increase of coordinate variance under the potential barrier and similar giant increase of both tunnel effect probability and nuclear reactions probability are investigated in details. It was shown that in real nuclear-physical systems very sharp grows (up to $10^{100} - 10^{1000}$ and more times!) of initial low Coulomb barrier transparency at very low energy up to value $D_{r(t)\to 1}(E) \to 1$ with the monotonous [1] or high-frequency periodic [2] increase of correlation coefficient is possible.

We have studied also influence of stochastic fluctuation and damping on the processes of formation of correlated state. It was shown for the first time that at special conditions in real LENR systems the presence of stochastic force and essential damping don't influence on formation of correlated states!

Several successful low-energy fusion experiments (e.g.[3]) based on usage of correlated states of interacting particles are discussed. Such effects take place in different nonstationary experiments with release of energy (including isotope transmutation in growing biological systems, action of ultrasound, the method of "SuperWave", experiments of Rossi on $(Ni^A + p)$ LENR and "Terahertz" laser experiments of Hagelstein, Letts and Cravens).

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WeA1-2

Anomalous Results in Fleischmann-Pons Type Electrochemical Experiments

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We have conducted over 300 Fleischmann-Pons type electrochemical experiments varying several parameters. Less than 5% of these experiments showed substantial excess heat with bursts of many kJ. These bursts are sometimes accompanied by radio-frequency emissions and abnormal voltage transients. We have been unable to explain these bursts as an experimental artifact, and they are too large to be chemical in origin. However, given the sporadic nature of the bursts, their origin is difficult to pinpoint. Great care was taken in design of our instrumentation to avoid a number of artifacts, which will be described. This large volume of experimental results will be described in detail.

WeA2-1

Nuclear reactions in saturated with deuterium palladium surrounded by dense deuterium gas, induced by γ-quanta

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A high pressure chamber filled with 3 kbar (possible up to 6 kbar) D_2 gas (99.8%) and containing a Pd (99.996%) specimen and Cu/Zn substrate aimed to collect the synthesized products (see Fig.1), was irradiated during 2.2×10^4 sec by 8.8 MeV g–quanta. As a consequence, a synthesized novel object (SNO, see Fig. 1), strongly deformed Pd-specimen (see Photos 2 and 3), destructed brass surface and strongly deformed central area of the γ-quanta window plug were observed. A detailed chemical analysis of the initial and irradiated components as well as SNO was made. Large concentrations of light elements as Ti were found. A model of fusion-fission reactions leading to the observed chemical compositions is proposed. The established effects may be applied for the study of nuclear reactions in deuterated metals surrounded by dense D_2 gas and construction of a novel deuterium fusion-fission reactor. Presented work is continuation of the studies first announced in [1].

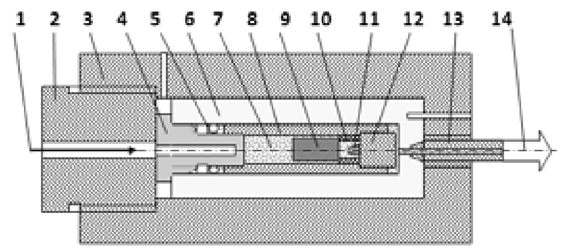

Fig. 1: The schematic drawing of high pressure apparatus [1]. 1 – γ- quanta, 2 – closing screw with hole, 3 – reinforcing high pressure chamber body, 4 - $Cu_{0.98}Be_{0.02}$ "window" plug, 5 – high pressure seals, 6 – $Cu_{0.98}Be_{0.02}$ high pressure chamber, 7 – (hydrogen) deuterium under high pressure, 8 – brass sleeve, 9 – investigated Pd-rod, 10 – distance manganin sleeve, 11 – expected reaction product, 12 – brass screw, 13 – high pressure connecting capillary, 14 – high pressure valve, strain gauge pressure sensor and gas filling inlet.

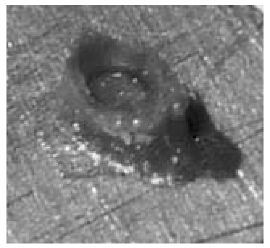

Photo 1, [1]

Photo 2

Photo 3

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WeA2-2

Diamond-based charged particle and neutron sensor for LENR experiments

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***Abstract--* There have been many reports on charged particle neutron production in LENR experiments but as of yet they have not been correlated in time with excess heat generation. Diamond sensors with palladium electrodes can be utilized to address this need. First results using a diamond sensor is presented.**

WeA2-2

Neutron Emission from Cryogenically Cooled Metals Under Thermal Shock

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In 1991 intense neutron bursts were observed after temperature shocking titanium from LN_2 to 100 C that were saturated with deuterium. Counts were time stamped [1] and 2 million neutrons were counted in a five minute period. Rapid heating is suspected to produce a large pressure inside the crystalline lattice.

WeA2-3

Intermetallic Powder LaNiCuCeAl Loading by Hydrogen

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The results received in the loading of intermetallic powder LaNiCuCeAl by protium and deuterium mixture in various equality at rising & decreasing temperature from 30 C to 700 C and pressure from 0 to 70 bars are presented. Measurements of X-rays, gamma and neutron radiations were carried out during experiments by very different devices (2 NaI (Tl) scintillation detectors Ø40x40mm & Ø100x100mm, plastic scintillation detector Ø150x20mm, 4 Geiger counters). Chemical composition & its pictures were obtained more exactly by a scanning electron microscope Jeol JSM - 6480OLV. Received results are analyzed.

III. Technical Program

ThM1-1

Nuclear Transmutation on a Thin Pd Film in a Gas-Loading D/Pd System

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When deuterium gas permeates through a thin palladium film, it was thought as a diffusion process only. However, after ~80 times absorption and desorption processes accompanied with permeations, nuclear transmutation was discovered on the surface of palladium film using SEM (scanning electron microscopy).

At first glance, it was noticed that the macroscopic deformation of palladium was so large that the palladium film might increase its thickness while decrease its diameter of a rounded palladium film. The stress at the rounded sealing line might be so strong that it even cuts the palladium film into two pieces: the central rounded piece and the ring-shape edge piece. SEM analysis revealed that new elements (Cu, Zn, Si, etc.) were detected in the permeation area, but there were no such elements in the original palladium film or in the ring-shape area where no deuterium permeation happened. The temperature of palladium film was much higher than that of Iwamura experiments in Advanced Technology Research Center, Mitsubishi Heavy Industries. Besides, there was no super lattice on the surface of our palladium films. Metallography analysis will be shown as well.

ThM1-2

Hydrogen isotope absorption and heat release characteristics of a Ni-based sample

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Recently, several researchers claim excess heat from Ni-based alloy samples under application to gas-phase protium absorption experiments instead of expensive Pd-based nano-compounds. In the present study, we use a ternary compound of Cu-Ni-ZrO_2 (“CNZ”) sample supplied by Santoku Corporation. Preliminary results are shown below.

The twin absorption system [1] has been employed here again. It consists of two equivalent sets of reaction chambers and the reservoir tank filled with D_2 (or H_2) gas beforehand. The D_2 (or H_2) gas is supplied into the reaction chamber through a liquid nitrogen trap for purification. Since the sample absorbed negligible amount of deuterium (protium) at room temperature, most of the hydrogen isotope absorption runs have been performed at an elevated temperature up to 573 K.

Since mass flow calorimetry employing water is not applicable at such temperatures, heat evolution caused by absorption of hydrogen isotopes is measured by comparison of the sample temperatures with those in blank runs using He gases. This corrects roughly for the cooling effect due to introduction of the cool gas into the reaction chamber kept at high temperature. Correction is also made for possible fluctuation of the electrical input power into the heaters.

Up to now, we have performed about twenty absorption runs using four aliquots of the CNZ powder (2g net Ni content in 10g sample), or ten deuterium runs each accompanied by a simultaneous protium run, at temperatures of 273 K, 373 K, 473 K, 523 K and 573 K. We observed endothermic temperature change in runs below 523 K both for deuterium and protium. However, exothermic tendency with excess temperatures of 1.4 – 3.2 K appeared in some runs at 523 K and at 573 K. The tendency continued for more than one week, after which the loading ratio showed a saturation behavior at $L_{D(H)}$ = 1.8 (1.5) with an integrated power corresponding to astonishingly large output energy of several hundred eV/atom-Ni, unexpectedly larger for H-runs.

Since the excess temperature corresponding to 1.4 – 3.2 W is rather small compared to the input power of up to 105 W, we need further study to confirm the phenomenon. If it turns out that this is a real heat release phenomenon, a very serious proposition is brought up. Since such a large excess energy cannot be caused only by chemical reactions, it is strongly inferred that a nuclear process participates in the phenomena.

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ThM1-3

Effect of Recrystallization on Heat Output and Surface Composition of Ti and Pd Cathodes

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***Abstract* — The microstructure of Pd and Ti foils was altered by cold rolling followed by heating at temperatures up to ~700˚C. The surface topography and microchemical composition of these foils was studied before and after electrolysis with heavy water electrolyte. Temperature measurements during electrolysis showed that Ti and Pd cathodes which had been heated to ~700˚C gave about 1W excess power relative to a control.**

ThM2-1

Isotope Effect for Heat Generated upon Pressurizing Nano-Pd/Silica with Hydrogen Isotope Gases

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It has been reported by Arata and Zhang that the heat arising from nuclear fusion reaction in solid is observed simply by pressurizing nano-Pd/ZrO_2 system with deuterium gas [1]. The system was reported to absorb a large amount of hydrogen per Pd atom [2]. It seems that nano-scale Pd particles absorb hydrogen more than Pd bulk does and are advantageous to induce low energy nuclear phenomena in solids.

Since nano-Pd particles are easy to agglomerate and grow once they are exposed to hydrogen isotope gases, it is not easy to pressurize nano-Pd system with these gases keeping the initial size of the nano-Pd particles [3].

If Pd particles are inside the pores of porous matrix materials, the growth of the Pd particles may be considerably suppressed. Actually, a large and reproducible isotope effect for the heat generated during pressurization has been reported by Kidwell et al using Pd-dispersed zeolite systems [4].

Here we have used two silica's as the porous matrices: zeolite and FSM (Folded Sheets mesoporous Material [5]) with pore sizes of 0.74nm and 1.5-2nm, respectively. The heat generated during pressurization with deuterium or hydrogen gas up to 1MPa was measured by a flow calorimeter. The heat measurements were cycled several times or more. Prior to each measurement the samples were evacuated at 350℃ for 3 hours.

A large isotope effect for the heat was observed in a reproducible manner for both Pd/zeolite and Pd/FSM. The isotope effect decreased as increasing cycle of measurement for Pd/zeolite, while it was maintained up to several cycles or more for Pd/FSM.

The origin of the observed isotope effect will be discussed based on possible chemical reactions.

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ThM2-2

Increase of Reaction Products in Deuterium Permeation Induced Transmutation

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We have been investigating about permeation induced transmutation, which we originally noticed in the nano-structured Pd multilayer film composed of Pd and CaO thin film and Pd substrate[1]. Transmutation reactions of Cs into Pr, Ba into Sm, W into Pt and Sr into Mo were observed[1]-[3]. Especially, transmutation of Cs into Pr has been confirmed by "in-situ" measurements using x-ray fluorescence spectrometry (XRF) at SPring-8 in Japan[3]. Similar experiments have been performed by some researchers and positive results have been obtained in some cases. However, it is necessary to increase the amount of the transmutation products if we think about commercialization of this new phenomenon..

We now postulate the following two factors are important to increase the transmutation products up.

1) Local Deuteron Density
2) Electronic Structure

Based on this assumption, we applied an electrochemical method to increase the local deuteron density near the surface of the nano-structured Pd multilayer film. Transmutation products were increased by this approach.

We also tried to increase the transmutation products by changing surface electronic state. One approach is to change intermediate element instead of CaO, and the other is to make surface plasmons on the Pd multilayer by laser irradiation. Work functions on the Pd multilayer film were changed depending the intermediate elements. Transmutation products and deuterium permeation rates were changed by laser irradiation. These experimental results and discussions will be presented.

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ThM2-3

Extraction of useful energy from Metal/H (D) cathodes via modulation of the internal energy of the hydride system.

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Abstract:

Chrononix is developing methods to generate controllable amounts of useful energy from Metal/H (D) cathodes in electrolysis cells. These methods involve modulating the internal energy of metal-hydrogen cathodes and produce macroscopic and microscopic deformations, motions, stresses, electro-magnetic fields in the cathode. These modulations are of electric, magnetic, electromagnetic, and acoustic origin.

A consequence of these applied, transient perturbations is the possibility of enhanced hydrogen-hydrogen interactions inside the host metal lattice and release of useful energy from the cathode.

Our experiments with Pd - H,D utilizing pulsed electric currents have generated small and unambiguous amounts of excess heat (up-to 30% excess) and have been repeatable.

ThA1-1

Heat generation processes and measurement artifacts in hydrogen isotope gas loading experiments

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Multiple studies on gas loading of nanomaterials demonstrated consistent and repeatable anomalous heat production [1-3]. Excess heat observed in these systems is interpreted as evidence for nuclear reactions. We have replicated and carefully analyzed the results of gas loading reactions. In the experiments reported here, we examined whether conventional heat generation processes and measurement artifacts could account for at least some of these observations.

We carried out an experimental study of excess heat production during hydrogen and deuterium loading of Pd, Pt and Ni enriched material. Earlier studies with Pd-impregnated oxide powders [4, 5] have shown that a conventional hydrogen/deuterium (H/D) chemical exchange reaction in water can account for at least some of excess heat observed during gas-loading experiments. We generalized the study to see if the same hypothesis could be applied to a wider range of materials. We have found that different metals in their nanoparticle form catalyze H/D exchange reactions in the material and produce heat that might be misinterpreted as anomalous. That excess heat can be eliminated by removing the residual water from the material by prebaking it in vacuum at 390ºC.

We also studied the influence of temperature gradients on heat measurements. The ruling assumption of gas loading experiments is that heat produced under the gas pressure is an indication of the reaction (chemical or nuclear). However, the presence of gas significantly changes the heat conduction inside the system. Therefore, when under pressure, the heat transfer efficiency changes. This change in heat transfer in the presence of temperature gradients artificially shifts the temperature measurement baseline, which could be mistaken for excess heating. We suggest it is crucial to test the measurement system with inert gas to eliminate potential measurement errors induced by temperature gradients.

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ThA1-2

Cold Fusion

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My interest in Cold Fusion started day one. However, not being an electrochemist, I did not begin working in this field until 1993 when I met Francis Forrat an engineer at the French Atomic Energy Commission in Cadarache. Following his encounter, I started working with solid-state electrolytes. Later I continued with many different techniques including electrolysis and gas diffusion. In this paper, I report my almost 20 years of work in this field.

ThA1-3

Statistical Analysis of Transmutation Data from LENR Experiments and Comparison with a Prediction Based on a Widom-Larsen Theory

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There are four classes of evidence for low-energy nuclear reactions (LENR): excess heat, transmutation products, energetic particles and other low-energy phenomena. Excess heat data has received the most attention, but there are also many studies of transmutation products. For example, Miley [1], Mizuno [2], Little [3] and Yamada [4] have published independent experimental transmutation data for elements across the periodic table. Their plots of production rates as a function of atomic mass number (A) appear to be qualitatively similar. However, these important data sets have never been compared with each other quantitatively. We performed such an analysis using 20 transmutation data sets from diverse LENR studies. In particular, we analyzed (i) whether these data sets show a consistent pattern, and (ii) whether this pattern correlates with the neutron scattering strength f as a function of A according to a Widom-Larsen (WL) theory [5]. Our analysis revealed that the data sets (i) exhibit a similar pattern, as shown in Fig. 1(a), and (ii) correlate with the predicted f(A) function. See Fig. 1(b). The last three peaks of the f(A) function (intervals: 64–79, 116–129, 191–208 A) were significantly ($p < 0.05$) correlated with the averaged data.

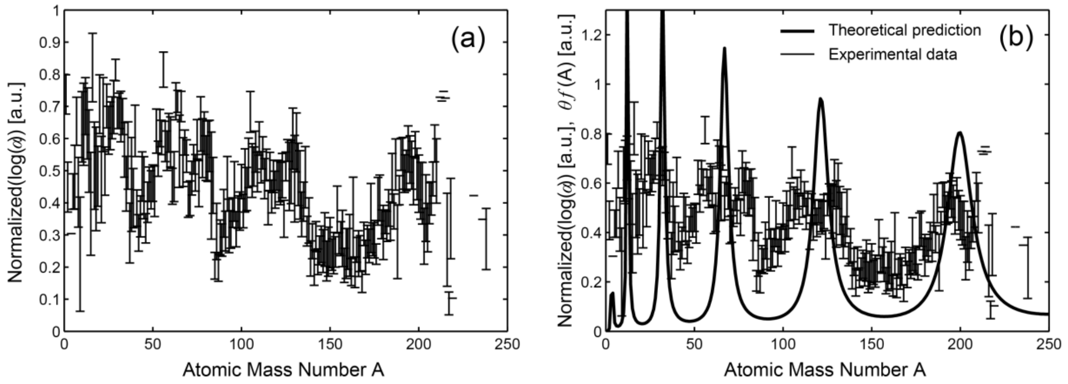

Fig. 1: (a): Average of 20 LENR transmutation data sets. The data are given in normalized units. α refers to the originally reported data units (i.e. production rate, counts/s, isotopic ratio, intensity/counts, normalized intensity, difference in atomic %, secondary ion counts, amount appearing in micrograms/microsphere). (b) Comparison between the averaged data and the predicted f(A) function based on the WL theory. $\theta = 0.8$.

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ThA2-1

EXCESS HEAT POWER REGISTRATION IN EXPERIMENTS WITH HIGT VOLTIGE ELECTROLISIS CELL

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The paper presents data resulting from investigation of Excess Heat power production in experiments with high voltage electrolysis cell (HVEC). D_2 loaded Pd cathode samples in Glow Discharge and light water were used in experiments. The cathodes used in the experiments were made of Pd foil, Pd coated Re and solid – state nanostructured Pd. The Glow Discharge was fed by the pulse-periodic power supply with the voltage 500 –4300 V and current meaning ranging 30 – 300 mA. The high voltage electrolysis cell was fed by the pulse-periodic power supply with the voltage 500 –2500 V and current meaning ranging 0.3 – 2.0 A. The heat capacity calorimeter and the flow calorimeter methods were used. The registered meanings of Excess Heat power obtained in the experiments amounted to 120 – 280 W with Heat Efficiency (the ratio between output heat power and the input electrical power) 200 – 340 % in HVEC experiments. Production of impurity nuclides with atomic masses less than and more than that of the cathode material was registered. The registration of X-ray emission with 0.6 – 10 keV was performed using Al_2O_3-based TLD (Thermo-Luminescent Detectors), the obscure chamber, PM scintillating detectors and curved mica crystal X-ray spectrometer. These total experimental results allow us to propose a Low Energy Nuclear Reactions phenomenological model based on interaction of electric discharge with the condensed matter.

FrM1-1

Public Policy Planning for Broad Deployment of Cold Fusion (LENR) for Energy Production

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CF/LENR[1] has the potential for immense benefit as a virtually unlimited and very low cost source of energy. At the same time, it is widely recognized that CF/LENR would be a disruptive technology[2] and would likely have a number of direct and secondary impacts, at least in the short term. Public policies must be adopted both to support CF/LENR development and to deal with adverse side effects associated with its broad deployment – and displacement of current energy infrastructure – for the public welfare benefit.

Proven methods exist for proactive planning for disruptive new technologies having broad social impacts. A strong candidate for understanding adverse impacts and developing mitigative measures for CF/LENR is technology assessment (TA). TA has been utilized effectively for a number of energy technology deployment situations, including large-scale energy development in the western U.S.[3] and nationwide deployment of coal slurry pipelines[4]. The basic TA method consists of six steps: 1) statement of the problem; 2) description of the technology; 3) determination of parties-at-interest (focus on impacted parties); 4) identification and evaluation of potential impacts; 5) delineation of mitigative measures and policy options; and 6) recommendations and implementation.

Because of the uncertainty of the degree of success and rate of deployment of CF/LENR, a phased TA would be advisable. Phase 1 would begin with characterization of CF/LENR as a revolutionary – and disruptive – energy technology and finalization of the specific TA methodology for the CF/LENR case. An interdisciplinary project team would then be assembled, and a high-level Advisory Group would be formed. This Advisory Group would consist of experts both in energy impact analysis broadly and in the CF/LENR field specifically. The project team would then perform the primary work of the TA – define the entities of direct and secondary impacts (e.g., workforce unemployment, population losses in energy-devoted communities), develop mitigative strategies, and prepare a plan for implementing mitigative measures. Phase 2 would then consist of implementation of the mitigative measures plan. Mitigative strategies are anticipated to maximize involvement of existing entities and infrastructure (e.g., employment agencies, workforce training at community colleges, community impact grants) to deal with adverse short-term CF/LENR impacts.

As CF/LENR gains recognition, achieves success as an energy source, and becomes more widely deployed, a window of opportunity is opening to plan proactively to identify and mitigate direct and secondary consequences. TA represents an effective and proven means of dealing with adverse side effects likely to occur with of broad CF/LENR deployment.

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[1] Cold fusion refers to nuclear fusion achieved at low (earth-surface) temperatures with large releases of energy. The term low energy nuclear reactions (LENR) is now preferred by most researchers in the field, but cold fusion continues to be much more widely known. The combined acronym CF/LENR is therefore used in this paper.

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FrM1-2

Potential Economic Impact of LENR Technology in Energy Markets

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There has been a huge discussion about the technology of Low Energy Nuclear Reaction (LENR) devices. Some of the common assumptions about this technology discuss the projected major transformation of our present society in points of infrastructure, cost of power and power storage, but a clear economic impact simulation in a business plan systematic review manner with different parameters and scenarios is still missing.

The question is how will the lives of people be affected by LENR and how will power industry adapt the potential huge changes in infrastructure and cost of power. There is no doubt that access to LENR will change the lives of average citizens for that matter. It is estimated that an average American family spends at least $1,842 (here example of an American home) on power bills just/only to provide heat for their homes in the winter time. Families that use propane fuel, on the other hand, spend an average of $3,409 (here example of an American home) a year just to heat their homes.

Assuming that the LENR technology could reduce this cost in half, it will be a savings of around $921 for every family. This amount may not be a lot of money to rich families but it is already worth something for any average income families. According to Italian inventor Andrea Rossi, the LENR powered heating device will cost between $500 and $900. After installation, it is estimated that heating the home will now cost about $1 a month. Indeed, it will be a big help to any family that is struggling to make both ends meet. And for families relying on the Low Income Energy Assistance Program of the federal government, this amount will go a long way in improving their lifestyles.

The adopted simulation was programmed in common tools using Microsoft Office and .NET Technology and is able to project effects of LENR on different countries. The simulation was done with the the example country of Germany but can also be projected over common parameters to any other country. The Input Parameters of the simulation are:

- Present Value of the Countries Power Infrastructure with fixed rate for yearly maintenance
- Lost Power due to non-storage losses in percentage of produced power
- Cost of Energy for the average family and number of families in the country for heating and other purposes
- Cost of the LENR Device with consumption and maintenance

The simulation is then able to compute different scenarios with different assumptions on the possibility of the break down of power infrastructure and different scenarios of LENR use just for heating and/or for all other purposes. The saved money is then distributed into the available income of the population and generates local spill-over effects on the economics of the given country. The economics effect is then computed as a increase in QALYs of the average family. The model further assumes, that the work force freed in the power industry is completely absorbed in other or the new LENR market and will be neutral for the economy.

FrM1-3

The Future May Be Better Than You Think

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Cold fusion researchers are prone to be unduly pessimistic about the potential for cold fusion. They know too much; they are too close to the problem. They may also have unexamined assumptions. Researchers feel put upon because of political opposition. The LENR-CANR log file proves there is a great deal of interest in this field. There is broad, untapped, latent support for it. The log shows that every week scientists and engineers download thousands of papers on cold fusion.

FrM2-1

IS COMMERCIAL LOW ENERGY NUCLEAR REACTION (LENR) THE REAL DEAL?

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This presentation attempts to analyze whether or not commercial LENR is real and when/if products are coming to market. This analysis is targeted at executive level decision and policy makers as well as persons new to the field or those seeking an update on the latest progress. I have made every attempt explain this subject in laymen's terms and keep my personal opinion to a minimum, instead focusing on conveying the facts as they are and letting the reader reach their own conclusions.

I have performed this analysis using a fact-based approach based on verifiable data and credible sources and highlighting any circumstantial or yet unsubstantiated evidence that is shown. At the conclusion of the presentation; I briefly discuss some of the possible outcomes related to a commercial LENR device coming to market in the near term and its potentially unprecedented affect on our world.

My background is that of an Electrical Engineer/MBA and founder/CEO of a successful technology startup. I previously served as an Engineer with Intel Corp. and as Management Consultant (High Tech) with McKinsey & Co. I do not have a deep history with cold fusion/LENR and this presentation offers a fresh look at the subject that began some 15 months ago, after I was informed about Andrea Rossi's initial public LENR demonstrations.

P_1005

Anomalous Metals in Electrified Vacuum

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In a study funded by the New Energy Foundation and conducted at Quantum Rabbit (QR) lab in Owls Head, Maine, on September 27, 2011, independent analysis by inductively coupled plasma spectroscopy (ICP) of test samples revealed the anomalous appearance of potassium (K) at 181 ppm (parts per million) and gold (Au) at 252 ppm. The vacuum discharge test employed a copper cathode, pure lithium and sulfur test material, and a pure copper anode at the center of which a pure lead insert had been pressed. Scientific grade neon was added to the vacuum tube to strike plasma, followed by a catalyst of pure oxygen.

Comparison of 2011 and 2009 Experiments

Element	**Starting Concentration ppm***	**Final Concentration ppm****
2011		
Au	<0.51	252
K	<1.615	181
2009		
Au	<0.5	174
K	36.610	750

*Certificate of Analysis provided by Alfa Aesar; value for K in quartz tube provided by M & M Glassblowing.
**ICP Analysis by New Hampshire Materials Laboratory.

The 2011 test followed a test conducted at the QR lab in Owls Head on July 30, 2009, and described in my paper "Anomalous Metals in Electrified Vacuum." [1] In the 2009 test, a lead insert was pressed into a copper anode. A copper cathode was inserted into one end of the vacuum tube, followed by pure lithium and sulfur test material. The lead-tipped anode was then inserted, the tube pumped down to vacuum, and pure oxygen admitted to approximately 3.5 torr. An electric arc was struck and a glow discharge with the characteristic color of lithium was produced. ICP analysis of test samples revealed the anomalous presence of germanium (Ge) at 3596 ppm; potassium (K) at 750 ppm; and gold (Au) at 174 ppm. Aside from possible minute traces listed in the Certificates of Analysis of several test components, none of the anomalous metals was introduced into the experiment. The appearance of anomalous metals in these experiments confirms earlier findings [2] and raises the possibility of low energy transmutations or LENR.

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P_1006

Geological aspects of cold fusion.

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Geological substantiation of cold fusion processes in the Earth crust related to the concretion model of Planet Earth. The Earth is generator and the core is the rotor consisting of rotating gas and dust cloud (fireball) starting the moment of building up (Big Bang) of the Earth. Rotation of geospheres from the core (20-40 m/sec) up to the surface crust (2-16 cm./year) brings to friction and generator of static electricity accumulates within lithosphere and electrical condensation. Electrical charges' over satiation lead to the electrical discharges in the crust. Because of electrical discharges the plasma in a view of ball or line lighting is generated and ball and cylinder concretions in the crust are generated from them. The plasma is charged (maintained) in the mantle and core because of subduction of continental crust which consisted from rocks and organic sediments. The formation of mineral resources in the crust related to the electrical discharges which brought to the cold fusion processes within the earth crust (CF). This can be visually seen by extracting the oil from the soda ash dissolution. Because of electrical charge in this solution the oil, coal and diamond parts were generated in this solution. The study of electrical charges in the solutions may provide us with a lot of useful information on transformation of one chemical element into the others. But Cold fusion processes as it is understandable by physicists cannot exist without gravitation and magnetic fields as it is in the earth conditions. Cold fusion cannot make energy as thermonuclear fusion. Formation of volcano and earthquakes related to these electrical charges in the crust. Cold fusion processes are noticed in them.

In order to create natural cold fusion process the model of Planet Earth shall be made. These kind of models were made by some surveyors http://www.nature.com/news/dynamo-maker-ready-to-roll-1.9582, but they created the rotation of geospheres by mechanical drive. Our model will be created at the basis of fireball rotating. This fireball will be created in the special reactor which is placed into the stator of electric motor instead of rotor. High-voltage spark-gaps and solution similar to the mineral composition of formational conditions and fireball concretion are placed in the reactor. Tension is appears in the stator in time of electric discharges. At present time the constant rotation in the reactor is not reached because there are not all conditions in place for making this experiment, but all geological features are available.

Figure 1. Spherical concretions and ball lightning, the main participants of the new energy.

P_1012

Magnetic Moment Predictions in the Nuclear Lattice Model

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It is well established that many ***nuclear*** properties are, in first approximation, due to the summation of ***nucleon*** properties (the independent-particle model, IPM). What has remained uncertain for many decades, however, is the phase-state of the "independent" nucleons in stable nuclei. In fact, mutually-contradictory gaseous, liquid, solid and cluster models have been developed, and their continued use is typically explained in textbooks as an inevitable consequence of the complexity of quantum reality. To the contrary, having found that the symmetries of the Schrödinger wave equation are uniquely reproduced in an antiferromagnetic face-centered-cubic (fcc) lattice of nucleons [1-3], we have advocated the unification of nuclear theory within the lattice model. The model not only accounts for the diverse liquid, gaseous and cluster properties of nuclei, but it leaves the systematics of the IPM totally unchanged. The lattice model also explains the asymmetrical fission fragments of Uranium, the transmutation results in the LENR experiments reported by Mizuno [4] and more recently the geophysical transmutation effects reported by Carpinteri et al. [5].

Because significant magnetic effects have been reported in several LENR experiments, we have studied the magnetic properties of the nucleus within the framework of the fcc lattice model. Here, we report good agreement between the lattice model predictions of the magnetic moments (μ) and experimental data. It is noteworthy that, beyond the assumptions underlying the lattice model itself, ***no*** adjustable parameters are required in order to make μ predictions. That is, building from a central tetrahedron (^4He), individual protons and neutrons occupy lattice sites located at distances from the nuclear spin-axis that reproduce the experimental nuclear spins/parities [1-3]. The dipole orientations of the nucleons are then determined using a "molecular dynamics" technique, where randomized angles for the dipoles located at fcc lattices sites are assumed for 10^{10} iterations, and μ is calculated for the set of nucleon orientations that gives maximal dipole-dipole (q_1-q_2) attraction among the nucleons, following classical electromagnetic theory, Eq. [1]:

$$E(q_1, q_2) = 1/4\pi\varepsilon_0 \{ \mu_1\mu_2/r^3 (2 \cos\theta_1 \cos\theta_2 + \sin\theta_1 \sin\theta_2 \cos\phi_1) \} \qquad \text{Eq. [1]}$$

where θ, ϕ and r are the angles and distances among the nucleon dipoles (μ_1 and μ_2), as given by the fcc geometry. Note that the dipole-dipole effect is ***not*** used to calculate nuclear binding energies (a more difficult task due to the complexities of the nuclear force), but rather is used solely to calculate the relative orientations of all nucleon dipoles, from which the total magnetic moment can be obtained by simple summation of known μ-values for the proton and neutron.

The big ***unanswered*** question in LENR, in general, remains: How can H^+/D^+ charges be shielded from the charge of a target nucleus to induce nuclear effects? Most hypotheses have focused on the electronic structure of hydrogen [6] and/or the nanostructure of the host lattice [7], but experimental demonstration of an on/off switching effect due to a 90^o rotation of an externally applied magnetic field [8] indicates that the magnetic environment at active sites (NAE) is also important.

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P_1018

Examples Of Isoperibolic Calorimetry In The Cold Fusion Controversy

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The initial cold fusion controversy centered around claims by Fleischmann and Pons for anomalous excess enthalpy and excess power produced in Dewar type isoperibolic calorimetric cells during the electrolysis of D_2O + LiOD using palladium cathodes [1]. This was soon followed by counter claims of no excess enthalpy produced in the calorimetric cells used by MIT, Caltech, and Harwell. These and other examples will be examined in terms of the complete equation for isoperibolic calorimetry expressed by Equation 1 [1-3].

$$P_{calor} = P_X + P_{EI} + P_R + P_C + P_H + P_{gas} + P_w \qquad (1)$$

The net power that flows into and out of the calorimetric system (P_{calor}) is determined by the excess power (P_X), the electrochemical power (P_{EI}), the heat radiation power (P_R), the heat conduction power (P_C), the internal heater power (P_H), the power carried away by the gases generated (P_{gas}), and the power due to pressure-volume work. Each power term is a function of time (t) such as P_{calor} = C_pMdT/dt, thus Eq. 1 is a differential equation that can be used directly or numerically integrated. Equation 1, originally developed by Fleischmann and Pons, has not been challenged, yet many groups have not considered or have ignored important terms by making various approximations.

The Caltech isoperibolic calorimetry publications shows only fragments of Eq. l, thus only P_{EI} and a term for the total power similar to P_C could be identified. The Caltech cell required electrical stirring due to its large diameter, and this introduced a poorly defined heat source. The most disturbing aspect of the Caltech experiments was that the cell constant was allowed to increase with time. This alone will serve to zero out any possible excess power [3]. The MIT isoperibolic calorimetry used terms corresponding to P_{EI}, P_H, P_X, and P_C in Eq. 1 and P_{calor} would be small or zero in their constant temperature system. However, a large error in the MIT calorimetry was that the major heat transfer pathway was out of the cell top due to the thick glass wool insulation that was used for the cell walls [4]. The Harwell isoperibolic calorimetry shows only the use of the P_{EI} term and approximations for P_{gas}, P_R, and P_C. Other error sources include their method of cell calibration and the unfavorable geometry of various cathodes used [3]. In contrast to Caltech, MIT, and Harwell, the Grenoble work in France succeeded in obtaining excess power using Dewar cells [5]. The only power terms of Eq. 1 neglected were the small P_C and P_W terms. Five out of eighteen experiments by the Grenoble group produced excess enthalpy. The measured excess power ranged from 50 to 300 mW and the percent of excess reached 150% during the boiling phase [5]. The data analysis methods used for isoperibolic calorimetric results may also lead to different conclusions. This is generally due to errors in determining the key calorimetric parameters involving the conductive heat transfer coefficient, k_C, the radiative heat transfer coefficient, k_R, and the heat capacity of the calorimetric system, C_pM [2].

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P_1020

Neutron burst emissions from uranium deuteride and deuterium-loaded titanium samples

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The question of whether neutrons are actually produced in the deuterated metals in low energy nuclear reactions is still open. We have measured the neutron random and burst emissions from the uranium deuteride and deuterium-loaded titanium samples at room temperature. The control experiments were also carried out by using uranium oxide, hydrogen-loaded titanium and deuterium-unloaded titanium samples. The neutron detector consists of 88 ^{3}He-tubes (6×10^5 Pa) embedded in polyethylene moderator, and detection efficiency is calibrated by ^{252}Cf neutron source (average neutron energy = 2.3 MeV) to be (55±1.3)%. The neutron multiplicity measurement was carried out by multiplicity shift register.

The result clearly shows that anomalous neutron bursts occur intermittently in the uranium deuteride and deuterium-loaded titanium samples. The intensities of the time-correlated neutron bursts were measured up to 2800 neutrons in 64-μs gate during 30-second counting time.

Finding of nuclear reactions in metal hydrides may be helpful to explanation of occurrences of tritium and ^{3}He in Earth mantle [1], as well as existence of energy sources in stars [2]. In the previous works, we also reported the results of finding of energetic proton emission, anomalous ^{3}He and tritium in the deuterium-loaded titanium samples [3, 4]. The nuclear reactions in metal hydrides may also be a potential nuclear source.

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P_1021

Evidence-Based Public Policy for Support of Cold Fusion (LENR) Development

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CF/LENR[1] has the potential for immense benefit as a virtually unlimited and very low cost source of energy. However, the claimed phenomenon was rejected by mainstream science within a year of its announcement by Martin Fleischmann and Stanley Pons in 1989. Despite continued successful experimental results and public demonstrations, CF/LENR is not yet widely accepted. The combination of the very high potential public welfare benefit and continued rejection of CF/LENR represent a major challenge for rational public policy for support of its development. A promising way of meeting this policy challenge is to rely on evidence-based policymaking (EBP).

The first step in applying EBP to the CF/LENR case is to establish levels of evidence for the reality of the phenomenon. Borrowing from the legal field, four categories may be established based on relative probabilities of CF/LENR reality. For each level of evidence category, an appropriate policy response (given the potential public welfare benefit) may also be delineated as shown below.

Level of Evidence	Probability	Policy Response
Insufficient Evidence, ISE	<50%	No change from current status; continue no (or very low level of) public funding support
Preponderance of Evidence, PoE	50-70%	Restore CF/LENR legitimacy and provide normal support for emerging technologies
Clear and Convincing Evidence, CCE	70-90%	Increase support to level of hot fusion development in past decades
Beyond a Reasonable Doubt, BRD	>90%	Institute a crash program to realize the public welfare benefit

A rational argument may be made that experimental successes in the initial years after announcement demonstrate a PoE level of evidence. Beaudette[2], for example, cites no fewer than seven instances of successful replication by different experimenters, methods, and laboratories from 1989 to 1991. Continued successes in the years since rejection indicate a CCE level of evidence. Storms[3] conducted a review of experimental reports for the period 1989 to 2004 and found more than 300 reports of excess heat (a primary signature of CF/LENR), elemental transmutation, and anomalous radiation. Finally, successful recent demonstrations by Andrea Rossi indicate that CF/LENR is a real phenomenon at the BRD level of evidence. He conducted at least six single-unit demonstrations of CF/LENR-based steam generating units from January to October 2011 leading up to a multiple-reactor (over 50 units) test on October 28. The single-unit tests appeared to be successful, and the multiple-reactor configuration apparently produced steam with an energy content equivalent to more than 70 gallons of gasoline in a 5½-hour test. If these arguments for the levels of evidence for CF/LENR reality are persuasive, the policy implications are profound.

The EBP approach to the CF/LENR case provides a clear path for making public policy decisions regarding support for its development. EBP analysis shows that a reversal of current negative policies for CF/LENR support is essential for the public welfare benefit.

[1] Cold fusion (CF) refers to nuclear fusion at low (earth-surface) temperatures with large releases of energy. The term low energy nuclear reactions (LENR) is now preferred by most researchers in the field, but CF continues to be much more widely known.
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P_1023

Quasi-stability theory: revealing various atomic breakups and cold fusion

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Abstract- The inevitability of various particle masses for hadrons, quarks, leptons, atoms, biological molecules, liquid droplets of fossil fuel and water, living cells including microorganisms, and stars was synthetically revealed by statistical and continuum mechanics and the spherical Lie group theory. [1-4] The present report also clarifies the particle masses generated by the cold fusion [5]. This is possible because each flexible particle is commonly generated by a mode in which a larger particle mainly breaks up into smaller ones. These masses, sizes, frequencies, and diversity dominated by the super-magic numbers including about 1:1, about 1.44:1 (between the silver and golden ratios), about 1.8:1, about 2.1:1, and about 3.6:1 can be derived by the quasi-stability principle defined between absolute instability and neutral stability, because the weak quasi-stability corresponds to meta-stable cold fusion. The proposed theory based on the quasi-stability principle posits a new hyper-interdisciplinary physics that explains a very wide range of scales.

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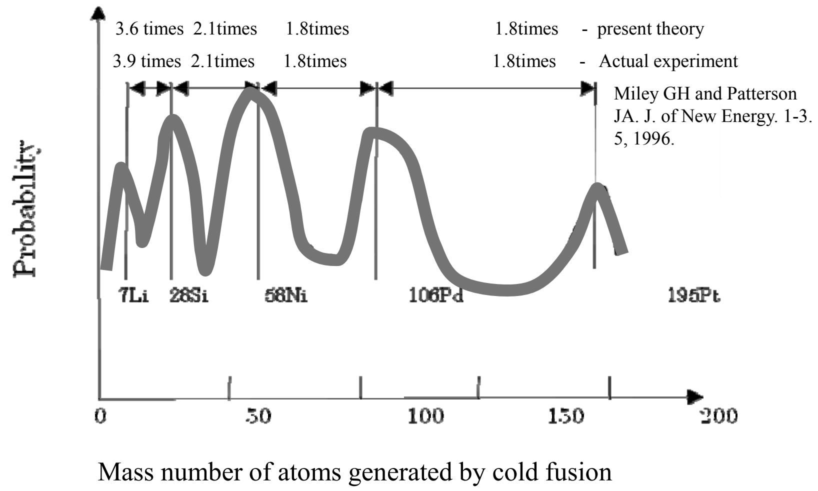

Fig. 1 Atoms generated by cold fusion.

P_1026

Advanced Simulation Model of Cascade of Vortices under Beneath the Sub-surface Layer

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During long-term electrolysis for well annealed thick Pd rod (9.0 mm Φ) in 0.1M LiOD, vortex pattern was observed [1-2]. The morphology of the postelectrolysis electrodes revealed the two long faults without any cracks on the surface. N-cycle model was proposed [3], where the vortex threads move under beneath the electrode surface (sub-surface layer) to understand the Cold fusion (CF) phenomenon. Further the vortex threads were realized as the continuous flow of the hypothetical particles mass from a vessel to a neighboring one in the Scavenger process. So far, we have succeeded in obtaining, though not precise a vortex pattern and their cascade using PC simulation methods [4-5]. Noting that the magnetic configuration under beneath the sub-surface layer plays an important role in the simulation, we are motivated to improve the physical rules, which define the motion of the hypothetical particles mass in the sub-surface layer.

From a different viewpoint, we should focus the physical rules which were found in natural phenomena and apply these ideas to advance our model in PC computer simulation works. Of particular interest is 'cyclonic vorticiy' [6], namely vortices obtained by PC simulation in Fig.1. This view is the rather schematic diagram of the fluid stream line appeared in the solar convection zone. The solar convection zone locates more inside in the solar spherical shell system. It seems certainly helpful to understand the differences between the characteristics of the sun, and our experiment conducted. The difference of the scale is insignificant, and the vortex observed might be corresponded to the sun' axisymmetric rotation. As shown in Fig.1, the strong downflow consists of two kinds of vortices (positive and negative helicity) where the hydrodynamics of the solar convection zone determined by the solar seismology. Following the sun's dynamics considering the differences of both, we further build the appropriate model incorporating the dynamics coupled with the magnetic fields evolved. This study helps us in shedding a new light on the numerical simulation of the motion of the hypothetical particles mass.

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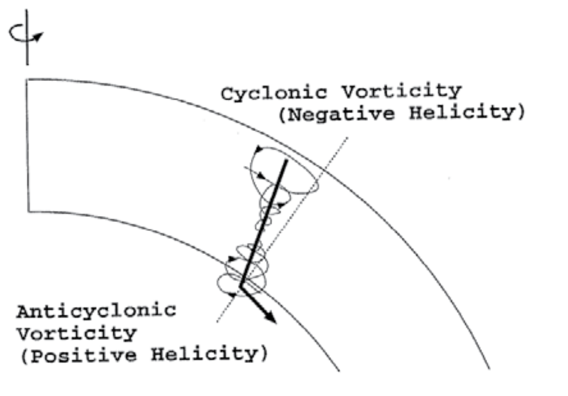

FIG. 21.—Rough schematic diagram of a characteristic, coherent, strong, midlatitude downflow in simulation TUR. Solid lines and arrows illustrate the sense of the flow and the dotted line indicates the radial (vertical) direction for comparison.

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P_1027

Numerical Simulation of Vortex and Cascade of Vortices Appeared under Beneath the Sub-surface Layer

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Long-term electrolysis for well annealed thick Pd rod (9.0 mm Φ) in 0.1M LiOD was performed. Microscopic observation of the post electrolysis Pd showed that long-term electrolysis did not result in any cracking but surface voids, two long faults, voids arranged in a straight line and peculiar surface traces: vortex (on this vortex our research target is placed, Fig.1) [1-2]. In-situ measurement of the hydrogen/deuterium loading behaviour of the Pd-H (D) system [3] and the measurement of solid-state properties of the post electrolysis Pd [4] revealed the micro structural model inside the solid (N-cycle reaction model, also see Ref.3), which improves reproducibility of cold fusion related phenomena. In N-reaction cycle model, four sequential processes including cold fusion (CF) reaction consist of intaking and compression-triggering-reaction-scavenging. As the last scavenger an outflow of the hypothetical particles mass (HPM) occurs 360° radial direction of the outside at a surface. Such a high energy motion of HPM might be originated from the explosive energy evolution due to CF reaction. As a result, there appeared the vortex pattern on the post electrolysis electrode (Fig.1). So far, numerical simulation methods: lattice Gas Cellular Automata (LGCA) [4-5] and discretization method for 3-D electromagnetic fluid has been applied to reproduce the vortex pattern; however, there remained ambiguity in the vortex and CF reaction relation. Here, a preliminary result of LGCA is shown in Fig.2 where two vortices behind plates evolve in the 2D rectangular domain. In this study, more advanced calculation results accompanied with a precise sub-surface layer structure will be presented for discussion.

References

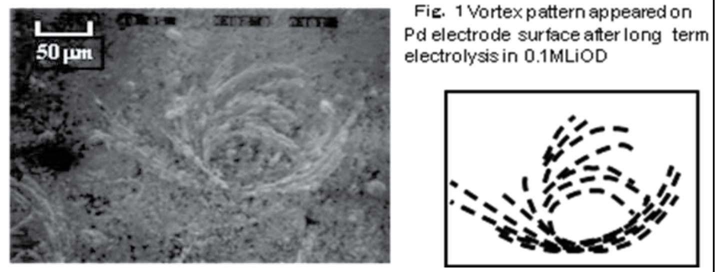

Fig. 1 Vortex pattern appeared on Pd electrode surface after long term electrolysis in 0.1MLiOD

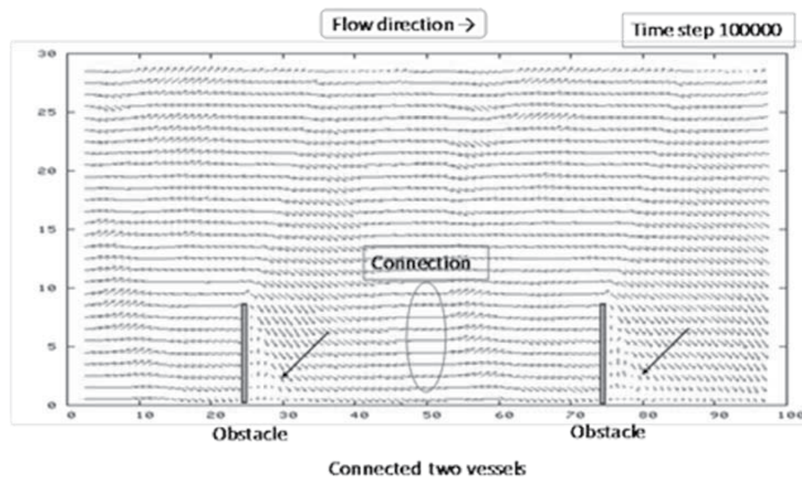

Fig.2 LGCA simulation result of vortices evolved behind plates on 4640x1152 grids at Time step=100000. This work is directed toward the advanced LGCA simulation model: the cascade of vortices (vortex-thread).

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P_1029

A Self-Consistent Iterative Calculation for the Two Species of Charged Bosons Related to the Nuclear Reactions in Solids.

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Many theoretical studies on cold fusion have been done by many workers using Bose-Einstein condensation (BEC) in order to find a possible mechanism of this phenomenon. In our previous work on BEC approach to the theoretical interpretation of cold fusion, we estimated the transition temperature of BEC in palladium deuteride [1]. It was based on the Kim's work by using equivalent linear two-body (ELTB) method to the many-body problems of charged bosons trapped in an ion trap [2]. Recently, Kim et al. tried to explain the results of Rossi's experiment [3] by using the ELTB method for a mixture of different two species of positive charged bosons trapped to the harmonic potential [4]. In this study, we verified Kim's theory and considered how to perform the numerical calculation. A self-consistent iterative calculation was introduced and the coupled two equations corresponding to the two species of positive charged bosons were solved.

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P_1030

Features and Giant Acceleration of "Warm" Nuclear Fusion at Interaction of Moving Molecular Ions $(D\text{-}...\text{-}D)^+$ with the Surface of a Target

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Nuclear interaction mechanism and optimization methods of (dd) synthesis under bombardment of solid targets by linear oriented molecular ions consisted with a few deuterium atoms will be discussed.
About two decades ago the abnormally high yield of synthesis products (p, t и He^3) was observed experimentally under collisions of single charged cluster ions of heavy water $(D_2O)_N$ with energy 0,12 ÷6 keV/nucleus with TiD target. It was found that the synthesis efficiency depended on a number of nuclei N in the clusters: 25<N<1300. In the absence of D in cluster ions (i.e. at light water use $(D_2O)_N \rightarrow (H_2O)_N$) or at use of the targets formed on the basis of hydrogen (D→H), the reaction products were not observed.

Any mechanism leading to the enhanced yield was not revealed in [1]. However the assumption has been suggested in [2] that the anomalies can arise due to collisions between cluster components. Moreover environment surrounding moving cluster ions in a solid influences on these collisions.
Since detailed dynamic calculation for system with N>>1 is impossible the main objective of the present work is to study mechanisms of this phenomenon.

In the report the new experiments and theoretical models are discussed.

Experiments with beams of the accelerated molecular ions (D_2^+ and D_3^+ with energy 3,3 keV/nucleon), bombarding a target from stainless steel were made, and also the analysis and calculation of processes in such system was carried out. The target was mounted in UHV chamber and bombarded with the mass separated ion beam along the surface normal. Duoplasmatron ion source was used. A background pressure in the target chamber was 2×10^{-6} Pa, while a density of ion beam current was 0,2÷0,3 mA/cm^2. Large aperture neutron detector was placed behind glass window of the vacuum chamber. In preliminary experiments it was found that the neutron yield (neutron/nucleon) increased more than one order (typically by 20-25 times) under transition from bombardment by D_2^+ (and $D_1^+ \equiv d$) ions to D_3^+ ions.

It is shown that the yield increasing of nanocluster (dd) synthesis can be connected with cumulative effects at cluster component collisions in a target or with formation of the correlated conditions [3,4] in nanocluster volume. Such optimization method of accelerating ("heat") synthesis at rather small nanocluster energy can be used to optimize a work of neutron generators.

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P_1031

On the possibility of application of Widom-Larsen Theory for Analysis and Explanation of Rossi Experiments

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The effectiveness and possibility of application of Widom-Larsen theory [1,2] for explanation of Rossi experiments [2] on stimulation of (p, Ni^A) LENR is analyzed. The general scenario of such theory includes three consecutive steps:

- Process of increase of electron mass with $\Delta m_e > 0$ by "dressed up" effect and formation of slow heavy electrons by ponderomotive nonlinear action of variable electric field of surface plasmon;
- Transformations of protons, which are situated in the form of monoatomic hydrogen layer on Ni surface, into slow neutrons in inverse reaction of beta-decay
  $\tilde{e}^- + p \to n + \nu,\ \tilde{m}_e \equiv m_e + \Delta E / c^2,\ \Delta E = \Delta m_e c^2 > |Q_{e^- p}|,\ Q_{e^- p} \approx -0.78\, MeV$
  with the help of "dressed up" heavy electrons. For realization of such reaction the variable electric field with magnitude $|E(\vec{r},t)|_{\max} \geq |E(\vec{r},t)|_{thresh} \approx 3*10^{10}\, V/cm$ is needed [1,2];
- Immediate absorption of these slow neutrons in a matrix and stimulations of non-barrier nuclear reactions $n +_z Ni^A \to_z Ni^{*A+1} \to_{z_1} Y^{A_1} +_{z-z_1} K^{A-A_1} + N\gamma + \Delta Q \to ....$

The main questions is the following: are the process of stimulated inverse beta-decay reaction in metal hydrides like N_i+H possible (a) and efficient enough (b)?

In the report this question is investigated by analysis of several important partial problems.

1) *Calculation of real (and maximum) magnitude of variable electric field in the volume of surface plasmon of metal hydride.*

It was shown that the real magnitude of variable electric field of metal hydride surface plasmon is $|E(\vec{r},t)|_{\max} \leq 10^7\, V/cm$, that is by 3000 times less than threshold value $3*10^{10}\, V/cm$.

2) *Analysis of the action of variable non-uniform electric field of surface plasmon on electrons.*

It was shown that the main result of action of ponderomotive force of *variable non-uniform electric field* is the formation of relativistic "normal" electron with the energy $\varepsilon_e = \gamma m_e c^2$ instead of the formation of slow "dressed up" electron with the energy $\varepsilon_e = \tilde{m}_e c^2$ [2,3], where γ is Lorentz factor.

3) *Effectiveness of neutron production by inverse reaction of beta-decay at ponderomotive action of variable electric field of surface plasmon.*

It was shown that in idealized (declared in [1,2]) case with $|E(\vec{r},t)|_{\max} \geq 3.10^{10}\, V/cm$ the real possible rate of neutron production on a metal hydride surface is much lower value [2] ($\tilde{w}(\tilde{e}^- p \to n\nu) \approx 10^{13} cm^{-2} s^{-1}$) and equals very low value $\tilde{w}(\tilde{e}^- p \to n\nu) \approx 0.03\ cm^{-2} s^{-1}$.

4*) The problem of additional localized energy for the generation of heavy electrons.*

The proposed [3] rate of neutron production on a metal hydride surface $\tilde{w}(\tilde{e}^- p \to n\nu) \approx 10^{13} cm^{-2} s^{-1}$ is connected with declared surface density of heavy electron-proton pairs $N/S = 10^{16} cm^{-2}$ [2]. It was shown that the real possible total number of heavy electron-proton pairs with additional energy $\Delta E \geq \Delta E_{thesh} \equiv (\tilde{m} - m)c^2 \geq 0.8\, MeV$ at averaged (thermal) energy $kT \approx 0.05 - 0.07\, eV$ of each proton in considered system (monoatomic hydrogen layer) is very small and equals $N/S << 1 cm^{-2}$.

The carried out analysis has shown that Widom-Larsen theory, which is connected with the inverse reaction of beta-decay in variable electric field of surface plasmon in metal hydride, is unsuitable for the description and explanation of Rossi experiments in metal hydrides.

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P_1033

Stimulated ($B^{11}p$) LENR and Emission of Nuclear Particles in Hydroborates in the Region of Phase Transfer Point

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It is well known that one of the most attractive nuclear reactions $B^{11} + p = He^4 + \Delta E$ is characterized by a large release of energy $\Delta E = 8.7\, MeV$ and by the practically full absence of induced radioactivity. In ordinary conditions of a paired collision of free nuclei, this reaction has a maximal cross-section under relative energy of colliding particles $T_{pB^{11}} = 675\, KeV$. This is large energy and usually, to obtain it, highly-precise ionic accelerators are needed.

However, in case the interacting particles are located in nonstationary microcavities and in the volume of non-standard crystals (crystals which are in the stage of transition processes like phase transfer) the fusion process may occur even at low energy of relative motion. Such processes were observed in, for example, deuterixed crystals like KDP during phase transfer, when the local deformation of crystalline grating led to a stable and recurrent generation of a small number of neutrons by the formula $d + d = He^3 + n$

In the hydroborate crystals under consideration there are all the prerequisites for realizing the reaction for the synthesis of He^4 (quasi-free hydrogen in a state with large mobility; the boron ions, representing local targets and variable local conditions (the presence of phase transfers and local high pressure)). The most interesting processes are expected in phase transfer. Practically all types of natural hydroborates show phase transfer and spasmodic change of conductivity, which is connected with the remoulding of the structure of crystals.

The mechanism of suppression of Coulomb barrier of the reaction is connected with the process of formation of correlated states in monotonous changing potentials holes during phase transfer [1,2].

The temperature of these phase transfer lies at a very low interval. For example, in *colemanite* the phase transfer corresponds to the temperature of 0^0 C; in *interboride* at 40^0 C and 100^0 C; in *ulexite* at 40^0 C and 80^0 C. These anomalies are observed only at very low frequencies. It is the result of proton conductivity in hydroborate crystals!

The presence of phase transfers at different temperatures is a very important circumstance and may be used for self-controlled secure LENR with negative feedback on a temperature.

Experiments on controlled ($B^{11}p$) LENR were conducted at variation of temperature of different hydroborate crystals. For analysis of LENR processes we have used modified small size alpha-detector that was situated near crystal surface.

For each sample, several trials were conducted. For each separate measurement a fresh copy of the crystal was taken.

During numerous experiments different regimes of He^4 generation were observed. In the report the detail analysis of these regimes and analysis of He^4 nuclei energy distribution will be presented.

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P_1038

Femto-molecules and transmutation

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The present Lochon and Extended-Lochon Models predict both the fusion of monatomic hydrogen and the formation of femto ions, H^{-}**^** or D^{-}**^**, and of femto-hydrogen molecules, H_2**^** or D_2**^**. The femto ions would be highly mobile in the lattice because of their multi-femtometer size. However, the negatively charged ion would not penetrate an atom as quickly as they would penetrate a positive ion (they must penetrate the atom's electron cloud), but would interact with atoms as would an antiproton and eventually fuse (but without the annihilation) or form a femto-molecule. The low-energy nuclear reaction, LENR, fusion process for a femto-hydrogen ion, H^{-}, with an atomic nucleus of mass A and charge Z could yield: (A, Z-1), (A, Z-2), (A+1, Z), (A+1, Z-1), (A+1, Z-2) or femto-hydrides. Because of the multi-body interaction, strong near-field radiation from tightly bound electrons, and low input energies, energetic particle emission is much less common than for normal fusion or neutron-activation processes. The number of corresponding fusion products for a femto-deuterium ion or molecule, would be even larger.

Neutral femto-hydrogen molecules are slowed from fusing by the centrifugal force countering the dipole-dipole Coulomb attraction. They have a finite lifetime that, in matter, would be primarily limited by chance interactions with lattice nuclei. This interaction of H_2**^** or D_2**^**, with atomic nuclei would greatly increase the possible LENR products. There will be new selection rules because of this process that will be guidelines rather than rigid rules. The formation and stability of alpha particles, and even neutron-proton pairs, in the product nucleus will be important. This paper will detail many transmutations and their energy release.

P_1039

Deep-orbit-electron radiation emission in the decay from 4H*^ to 4He

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One of the major problems in the acceptance of Cold Fusion, CF, by the Nuclear Physics community was the lack of energetic particulate radiation known to occur in all deuterium reactions, D-D. This has been shown by the present authors to be a 'sign-post' for a model proposed to show how CF can occur. The Lochon Model provided the pathway for deuterons in a palladium (Pd) lattice to overcome the Coulomb barrier that prevented all prior low-energy fusion reactions from occurring. The natural extension of this model was able to identify the means of tunnelling beneath the fragmentation level of 4He* to avoid producing the expected energetic particles. The Extended-Lochon Model also provided a qualitative description of how the nuclear energy (~ 20 MeV) could be transferred from the excited states of 4He (4He* and 4He***^**, the excited state with lochon present) to the lattice without destroying it.

The process of energy transfer involves the near-field electromagnetic coupling of energy of energetic charged nuclear dipoles to tightly co-confined electron dipoles (possibly in nought orbits). From there, the energetic electrons can near-field-couple energy into the adjacent Pd-bound electrons causing intense local ionization, but no energetic radiation beyond the keV level. The steady loss of nucleon energy to the nought-orbit electron(s) and their disturbing presence in the nuclear region prevent the semi-stable nuclear orbits required for the formation of gamma rays. This paper seeks to quantify the decay process and identify the conditions and limits required to permit stable and efficient conversion processes from nuclear energy to thermal energy in the lattice. In particular, it will describe the near-field EM coupling that will take place within the nuclear region. While nuclear-dipole coupling has been studied, the coupling of nucleons to tightly bound electrons and thence to nearby bound electrons may be new.

As an example of the desired quantitative results, 20 MeV distributed into an average 5 eV Pd d-orbital ionization implies 4E6 ionizations. Assuming that the vacant d-orbital is refilled from the conduction band and adjacent d-orbitals within a picosecond and that there are, on average, four d-orbital electrons close enough for rapid energy transfer, then the decay time of 4He***^** to 4He of more than a microsecond would not even cause damage to the lattice. However, to attain the 'magic' number of 1E12 fusions per second, this would result in a steady level of 1E6 actively decaying 4He***^** nuclei. If there were 1E15/cm^2 surface Pd atoms of material and only one in a million were part of a nuclear active environment (NAE) region consisting of 100 Pd atoms, then the NAEs could be continuously productive at the magic number rate and still be at 1/10 the lattice damage level. A range of various parameters will be tested for various input conditions and results. Rationale will be provided for the ranges chosen. This will be a test of various models, but of the extended-lochon model in particular.

P_1040

Excess Heat Triggered by Current in a D/Pd Gas-loading System

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Abstracts: In order to study the relationship between the triggering current, deuterium pressure and the excess heat, a series of experiments were made in a deuterium/palladium gas-loading system. By comparing the system constants ($k=\triangle T/\triangle P$) in both nitrogen and deuterium environment we found an optimum current (8A) and a deuterium pressure (9×10^4 Pa) in which the system could release a maximum excess power (more than 80W). The reproducibility was 16/16 and the total excess energy was about 300MJ within two weeks, which was corresponding to 10^4eV for each palladium atom. Analysis of the palladium surface with a scanning electron microscopy (SEM) and an energy dispersive spectrometer (EDS) revealed that some new surface topographical feature with concentrations of unexpected elements (such as Ag and Ca) appeared after the current triggering. The results implied that the excess heat might come from a nuclear transmutation.
Keywords: D/Pd gas-loading system; pressure; current triggering; excess heat

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P_1044

Nuclear reactions in liquid metal: an approach to dense plasma fusion

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Liquid metal, which consists of metal ions and conduction electrons, can be regarded as plasmas, since ions (positive charges) can move almost freely in a sea of electrons (negative charges). The density of the liquid metal is much higher than gas plasmas. This is a definite advantage to nuclear fusion, because in plasmas a fusion reaction rate is proportional to the square of the density.

We have studied nuclear reactions in liquid metal by using low-energy deuteron beams, in order to investigate any effects on nuclear reactions provided by such high-density plasmas. In these several years, screening potentials of the d+d and Li+d reactions in liquid Li were studied.[1,2] We have found that the reactions in liquid Li are really enhanced, due to the large screening potential originated from the positive ions in addition to the screening from the conduction electrons. Recently, we have developed another technique to enhance the reaction rates by operating an ultrasonic wave to liquid Li.[3,4] It is found that dense-and-hot d^+ plasmas can be formed in micron-sized cavitations in liquid Li induced by the ultrasonic wave.

In this work, I summarize the measurements and results of our investigations, show the phenomenological understanding of the screening potential in liquid metal, and discuss the possibility of fusion reaction in liquid metal, i.e., fusion in high-density low-temperature plasmas. In addition, I discuss, also, the possibility of fusion in high-density and medium-hot plasmas, which can be realized in liquid metal with ultrasonic cavitations.

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P_1045

Models for excess heat in PdD and NiH

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We begin by splitting the modelling problem into "conventional" and "unconventional" parts, in which the "unconventional" piece involves new physical mechanisms. Many aspects of the Fleischmann-Pons PdD experiment can be understood in terms of purely conventional electrochemistry, physical chemistry, hydrogen in metals physics, and sigma-bonded dideuterium quantum chemistry. Less studies have appeared so far on the NiH system, but a case can be made that similar issues arise in the NiH experiments described by the Piantelli group.

The need for new "unconventional" physics in our view is driven by the relative absence of energetic nuclear products in amounts commensurate with the energy produced in the PdD system. Energy production in conventional nuclear reactions is accompanied by commensurate energetic reaction products as a consequence of local energy and momentum conservation. To account for the absence of commensurate energetic nuclear products in the Fleischmann-Pons experiment we have explored models in which a large nuclear quantum is fractionated into a very large number of low-energy condensed matter quanta.

We find that such fractionation is predicted in lossy spin-boson type models. An analysis of the strong coupling limit has yielded "gentle" scaling laws for coherent energy exchange when large two-level system quanta are fractionated into many oscillator quanta. We can describe coherent energy production that seems similar to the excess heat effect using a model in which two-level systems that are weakly coupled to the oscillator (representing the $D_2/^4He$ transition) are assisted by a second set of two-level systems that are strongly coupled.

Historically there has been a problem in the identification of the strongly-coupled transition as a physical transition, since all conventional electron-nuclear and electron-electron transitions are too weak to do the job. Recently we have identified a new coupling mechanism that arises from a relativistic formulation of the fundamental Hamiltonian describing nuclei embedded in a lattice. In the relativistic problem there appears an interaction (which is analogous to spin-orbit coupling) that couples the center of mass momentum to the internal degrees of freedom, which leads to a coupling between vibrations and nuclear excitation.

We have recently evaluated this coupling in the case of deuterons in a lattice, with the result that the coupling matrix element is orders of magnitude larger than for electron-nuclear and electron-electron coupling. We are able to make a connection between the model and the physical system in the optical phonon mode case with the energy supplied by $D_2/^4He$ transitions, converted (or spread) by triplet to singlet deuteron "dynamical polarization", and coherently exchanged with an optical phonon mode oscillator. Numerical values obtained for the coupling matrix elements are of the right magnitude to account for experiment (such as the two-laser experiment where an optical phonon mode is implicated).

Fewer experimental studies are available for the NiH system, so that we have much less guidance from experiment relevant to model development. We are considering an analog model with the $HD/^3He$ transition supplying the reaction energy, energy conversion (spreading) via "dynamical polarization" in the host Ni nuclei, with coherent energy exchange with a THz acoustic phonon oscillator. Since the host Ni nuclei participate in the fractionation, occupation of long-lived fission unstable states seems likely, resulting in the significant production of energetic daughters and associated loss of useable thermal energy.

III. Technical Program

P_1047

Molecular D_2 near vacancies in PdD and related problems

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If one takes as an ansatz that two deuterons must exist reasonably close together in order for ^4He to be created, independent of the specific mechanism involved, then it seems possible to make sense out of a number of experimental observations concerning loading and codeposition in the Fleischmann-Pons experiment.

From the simplest perspective, one can conclude that molecular D_2 does not form in bulk PdD because the background electron density is too high. This can be quantified by comparing the background electron density in diatomic PdD and triatomic PdD_2 with the background electron density in PdD. One finds that the background Pd electron density at the D position in PdD is about 0.069 e/A^3, which is less than the background Pd electron density at the O-sites in PdD, which we estimate to be near 0.081 e/A^3. The background electron density in triatomic PdD_2 at the position of the D_2 molecule is about 0.033 e/A^3, which is much lower. When the background electron density is higher, antibonding orbitals are occupied, which pushes the deuterium atoms apart. This is why molecular D_2 cannot form in bulk PdD.

The background electron density can be lower in the vicinity of a Pd monovacancy, and reach values sufficiently low for molecular D_2 formation to occur. We have proposed that this is a key issue in the Fleischmann-Pons experiment.

The monovacancy concentration in Pd or PdD under normal conditions from our perspective is low relative to what is needed for enough D_2 to form in the lattice to support excess heat production. Vacancy stability improves as the loading increases, up to the point where vacancies become thermodynamically favoured above a D/Pd ratio of 0.95 near room temperature. One might expect that under these conditions massive vacancy formation should occur, but it can't because the atomic self-diffusion coefficient is much too small. We have proposed that inadvertent Pd codeposition at a D/Pd loading at or above 0.95 creates superabundant vacancies in the Fleischmann-Pons experiment. This is supported by the recent experiments of Letts where reproducible excess heat is observed when a modified Szpak protocol is adopted in which the codeposition occurs at high current density (with a reduced concentration of Pd in the electrolyte).

It seems likely that the situation is qualitatively similar in the case of HD formation in NiH. Molecular HD cannot form in bulk because the electron density is too high, but the electron density is lower near a monovacancy. Hydrogen loading in Ni is hindered relative to Pd due to the lower solubililty, but when H goes into Ni in the miscibility gap it clumps. In the Piantelli experiments the temperature is sufficiently high that Ni self-diffusion can occur, which provides a mechanism to make vacancies. Hydrogen cycling in the Piantelli protocol results in observable uptake of hydrogen, which can probably be interpreted as due to a macroscopic vacancy concentration in the accessible metal.

We will provide an update of progress on the modelling. These models have the potential to provide guidance to the design and development of new materials that may be useful for excess heat experiments.

P_1048

Basic physics model for PdH and PdD thermodynamics

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Palladium hydride is one of the most studied and best understood metal hydrides. Given the progress made in recent years in density functional codes, we decided to make use of Quantum Espresso to carry out density functional theory (DFT) calculations for PdH_x and PdD_x[1]. We find that the DFT results are pretty good, but that minor corrections are required in order to obtain agreement with experimental results for the chemical potential. However, a straightforward DFT type model cannot account for the excess entropy derived from experiment.

If we think about excess entropy as telling us something about the incremental number of accessible microstates, then we conclude that additional states must be present beyond those accounted for in the basic formulation of interstitial hydrogen. An analysis of the electronic contribution to the entropy (based on the DFT electronic structure) reveals that it is too small to account for experiment, and also has a different dependence on the loading.

We have explored a new model that posits a weak binding between hydrogen atoms at neighbouring sites. We have developed a formulation and fitted the results to experimental data. We find that a least squares fitting of the model to the entropy and enthalpy results in model parameters which seem physically reasonable. The resulting model appears to provide a natural physical explanation for the dependence of the excess entropy on loading.

Experiments will be needed to verify the predictions of this new model.

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P_1049

Empirical models for excess power in two-laser experiments

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A variety of approaches have been used over the years to understand the excess heat effect in the Fleischmann-Pons experiment, ranging from the purely empirical fitting of experimental data to the development of purely theoretical models. Empirical models that correspond well to experimental data would be very useful in the design and assessment of new experiments, independent of theory. Data analysis in connection with hypothesis-driven models is a powerful tool that can clarify the importance of experimental parameters, such as temperature and magnetic fields. Ideally we would like to make progress on theory-based models as a way to understand and interpret experimental data.

We have available many data sets based on a series of electrochemical experiments with two-laser stimulation that have been reported previously [1]. The cathodes were stimulated with dual lasers over a wide range of beat frequencies, and resonances were observed near 8, 15 and 20 THz, as discussed in [2]. In our previous analysis of the data we developed an empirical model for the maximum excess power as a function of beat frequency [3] and proposed a connection with specific optical phonon frequencies. However, in this analysis we did not take into account other important experimental parameters. For example, different experiments were run at different temperatures, and different magnetic field strengths were used.

We have recently expanded our analysis of the data sets to take into account additional experimental parameters. Taking into account temperature, field strength, and cathode geometry allows us to obtain improved agreement between model and data. Results will be presented for the most interesting models, and the implications for theory. We found that it is possible to achieve close agreement with many experimental data sets using this approach.

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P_1050

Detecting Energetic Charged Particle in D_2O and H_2O Electrolysis Using a Simple Arrangement of Cathode and CR-39

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We have been studied low energy nuclear reaction (LENR) during electrolysis using CR-39 [1, 2]. In this present study, we performed the electrolysis of Li_2SO_4/H_2O, Na_2SO_4/H_2O, Li_2SO_4/D_2O and $LiOH/D_2O$ solutions under DC current range 3-160 mA for time range 20min-168 h using cathodes of a 5μm thick Ni film and a 2.5μm thick Au film. A simple arrangement of cathode and CR-39 for detecting energetic charged particles was used for the study; a CR-39 detector of 30×30mm in size is set in close contact with the rear surface of the metal film cathode. This construction can avoid contamination from the electrolyte and keep the ideal distance between the cathode and the CR-39 chip.

Anomalous increasing in number density of etch pit is sometimes observed on the chip for the electrolysis experiment. Fig.1 shows a typical relation between number and the diameter of the etch pit for light water electrolysis using 0.1-M Li_2SO_4 solution. The result suggests that a LENR occurs and an energetic charged particle is generated at the Ni film during the electrolysis. The common factors to increase number of the anomalous etch pit in the CR-39 chip might be Ni film cathode, Li in the electrolyte solution and the long electrolysis time. All the results might show a characteristic of LENR in the electrolysis that the reaction dose not always takes place in every experiment but does occasionally under the same experimental condition.

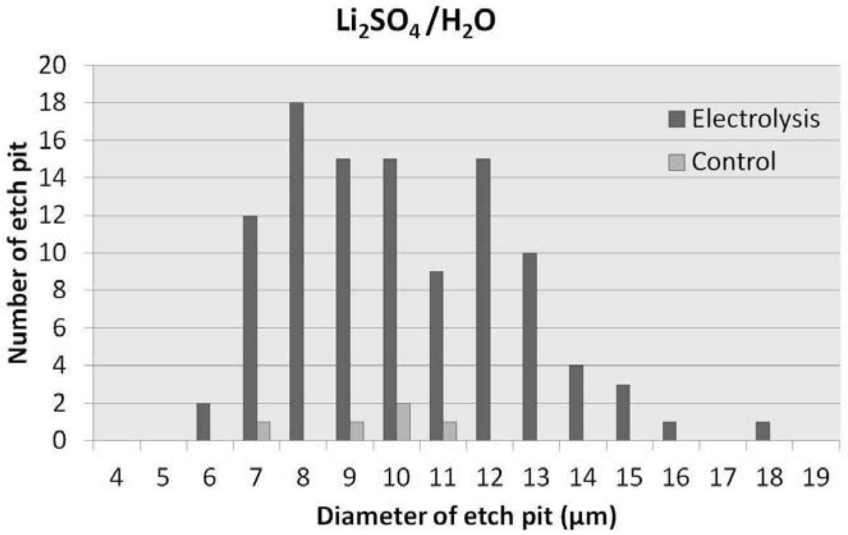

Fig.1 Distribution of diameter of etch pit for an electrolysis experiment and the corresponding control experiment.

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P_1054

Experimental Evidence for Bursts of Heat, Particles and Sound in LENR Experiments

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The energy released in LENR experiments and generators is unavoidably pulsatile on the scale of atoms. This is because some amount of energy is released during each LENR event at a point in time and space. If there are many LENRs occurring simultaneously, the power production on mesoscopic and macroscopic levels can occur in bursts. Or, if there are numerous LENRs occurring sequentially, the power production can have an apparently continuous and smooth time history. So, there are four basic modes of uncontrolled energy release: (a) a constant rate (ignoring shot noise), (b) a slowly-varying (pseudo-steady) rate, (c) bursts of various durations and magnitudes, and (d) a mix of the more-or-less steady output plus the occurrence of some bursts.

There are different classes of evidence for the occurrence and characteristics of LENR. The first is production of heat that cannot be explained by chemistry. Because of the long time constants of calorimeters, most thermal evidence cannot resolve LENR energy releases that occur in bursts However, there are some other thermal phenomena, such as crater production and infrared emission, which require nuclear events for their explanation. The second kind of evidence is the residue of nuclear reactions, that is, the nuclear ash left from transmutation reactions. Here again, data from transmutations usually cannot provide evidence of bursts of energy production because the sensitive chemical analysis methods needed to quantify nuclear ash can only be used after an experiment. That is, localization in time cannot be detected, but localization in space can be discerned by post-run scanning spectroscopy. Measurements of energetic particles that cannot be due to chemistry is the third foundation for LENR. In this case, it is possible to see bursts of energetic particles, so that something can be learned about the time history of the occurrence of LENR. Similarly, bursts of sound from LENR experiments have been measured.

In this paper, we examine the available evidence that illuminates the short-time history of the energy production by LENR and, for some cases, the spatial distribution. Fast thermal events, including characteristics of craters left in cathode surfaces [1] and the emission of infrared emission from cathodes during electrolysis [2], are surveyed. The durations and amplitudes of bursts of neutron [3] and charged particle [4] emission are also summarized. Finally, the characteristics of pulsed sound emission from LENR experiments are analyzed [5]. The goal of this review is to compare the temporal extent and the total energy in bursts from LENR experiments that are measured in these various ways. The motivation is to learn more about the mechanism(s) that lead to the occurrence of LENR.

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P_1056

Cold Fusion Plasmoids

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For 20 years, this author has been trying to tell people about the existence of microscopic plasmoids in Cold Fusion-LENR type devices[1]. The evidence for these objects has been increasing since in the last decade some Russian groups investigated the objects[2]. Several of the Russian experimental researchers suppose it is a kind of monopole. The objects behave like the micro ball lightning objects described by T. Matsumoto in the 1990s, and they behave like the "EVs" described by Ken Shoulders. These microscopic objects evidently exist and are known to play a key role in transmutation reactions.

These objects are important to know about and study. Savvatimova, Shoulders, and Matsumoto describe their relationship to transmutation species. They say that the objects relate to the presence of elemental species. Adamenko, Savvatimova and Shoulders each showed evidence that the intricate plasmoid tracks are marked by the presence of **transmuted elements**.

In 1992, I advised to look for evidence of these objects in the form of tracks associated with elemental changes saying that pits and tunnels would be caused by their movement through materials along with elemental changes. I suggested microscopic and elemental analysis of experimental components. First, Matsumoto found this evidence. Then Shoulders, Urutskoev et.al., and Savvatimova published evidence of the objects and transmutation products. Then Adamenko found a "mouse hole" with material sloshing lip as explained by Ken Shoulders along with anomalous tracks and transmutations[3].

The existence of these objects in transmutation devices is significant. They point to a new physics and a new physical paradigm[4]. These objects are unknown to most physicists. Technologically useful behaviors **include transmutation, energy production,** and **energy transmission**.

For example, these objects have **electrical superconductivity** characteristics, and understanding this will help understand both superconductivity and transmutation phenomena in materials [5]. This author supposes that the formation of these objects in material is associated with the generation of gravity and time change that can be detected with instrumentation as described in 1992[1].

Researching these objects directly will benefit understanding of both energetic material behaviour and atmospheric phenomena, and on a larger scale help us understand atomic, stellar and galactic plasmoid phenomena. The author hypothesizes that **atoms themselves are structured like ball lightning-like plasmoids:** parcels of bound electricity.

In summary, microscopic plasmoids like ball lightning have been shown to exist in transmutation experiments during the past 20 years. Shoulders elucidated some of their properties. There is no size limit of these objects, and their traces may remain undetected without superior microscopic analysis. It is supposed that **normal atoms convert** to these objects under the right conditions.

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P_1059

Cold Fusion Is a Scientific Revolution: the Usefulness of this Knowledge

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That scientific revolutions in physics happened at about 80 year intervals from 1506 to 1905[1] is an undeniable fact of history. This author believes that **cold fusion (CF)** phenomena are basic anomalies for another paradigm that he resolved in 1992[2]. It would be odd if there were no Kuhnian "crisis period" for a scientific revolution in the late 20th century. *The Structure of Scientific Revolutions* will help you understand my terminology and basic concepts. Researchers of CF transmutation phenomena and related plasmoid phenomena can understand what a **scientific revolution** is, how it usually proceeds, and what **cold fusion researchers may expect in the future**.

The elucidation of basic anomalies was accomplished in a "**crisis period**" in physics from 1972 to 1992. Low-energy transmutations and related anomalies were discovered such as HTSC, astrophysical plasmoid anomalies, anomalous plasmoid phenomena such as Shoulder's EVs, and micro ball lightning (BL)[2][3]. A **valid general theory** for this paradigm will explain or at least incorporate **all of these phenomena** and allow astrophysical rendering and is **very different than Quantum Mechanics**.

Inevitable progress can be expected because the new experimental devices such as electronic microscopes, lasers, powerful telescopes, and analysis software are becoming more powerful, cheaper, and more widely used as the Quantum Mechanics technology matures. So investigators will find more anomalies. In the current harsh environment where they refuse to look at evidence due fear or whatever, someone is probably bound to find anomalies and a way to use them to make money.

Two modes of theory development is happening as QM scientists and any like me try to understand the phenomena. Each scientific revolution has always had two theoretical streams since the people who believed the superceded paradigm **couldn't change their basic assumptions[1]**.

The current plasmoid paradigm was resolved by an **accurately predictive** theory. Based on Matsumoto's earliest reports of strange traces and tracks (he hadn't shown a photograph yet), this author assumed that tiny BL were forming and traveling around and off electrodes[2]. I imagined what kinds of markings and effects tiny BL would produce, and people discovered them[3,4]. The **idea that electricity clumps** contradicts QM theory, but perhaps explains the existence of atoms and anomalous astrophysical phenomena[3,4].

The technological development of this paradigm is predictable. Based on the past pattern, this paradigm's theory may be developed by 2032 (1992+40). After 2052 (1982+60), mainly younger people will begin to build the major industries[5]. This model logically ties together industrial revolutions, technological innovation, and economic depressions (the long wave)[1]. It is reliable. The predictions of 20 years ago were an economic boom in the 2000s, a financial crash about 2009 (1929+80) and a high-productivity-growth depression period lasting 10 years or more in the 2010s[1,5,6]. This happened.

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P_1060

Nickel Transmutation and Excess Heat Model using Far-From-Equilibrium Blackbody Theory and Reversible Thermodynamics

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This research includes new physical theory to model cold fusion observations in Ni microspheres. In particular, it develops a far-from-equilibrium blackbody equation and uses that model to show how fusion temperatures might be masked from observation inside a Fleischmann and Pons[1] electrode at laboratory temperature. Energy storage occurs within the Ni Lattice, first as excited electronic states, and then excited nuclear states. This energy storage, and the fusion/fission reactions that it sponsors, are proposed to be thermodynamically reversible processes, while the subsequent evolution of waste heat is entropic.

An analysis of Miley's [2] thin coated nickel microshere data shows how deuterium nuclei fuse with nickel isotopes, and impurities in the electrode, to form unstable nuclei that then undergo β^+, β^-, alpha, and IT decay to the low atomic weight isotopes (less than ${}^{75}_{33}As$) in Miley's data. Two other classes of reversible nuclear reaction also occur; fission of Ni and electrode impurities, and α-decay of Ni and electrode impurities. A few isotopes occur that are not found in Mile's data. However, these are noted to undergo fission to observed isotopes. Deuterium Fusion is un-necessary in this model and is in fact omitted. ${}^{4}_{2}He$ observed in similar experiments appears to originate from α-decay.

The theory proposes that higher atomic mass isotopes, all of which require significant neutron additions, probably result from rapid neutron capture processes, and in particular, nucleosynthesis in r-process reaction flow along the neutron drip line, with subsequent decay to stable products. The model proposes that far-from-equilibrium blackbody theory can produce internal energy levels that mimic solar core temperatures, and even those in supernovae.

Because this is a blackbody theory where complete emission and absorption of photons occurs, gamma emissions from the nuclear reactions are completely absorbed into the far-from-equilibrium blackbody spectra, and in this way are never emitted beyond the limits of the electrode. They are merely masked from observation by the blackbody dynamics.

The model provides plausible explanations for:

1. The long loading time in cold fusion experiments,
2. A mechanism for energy storage until ignition,
3. A plausible mechanism for excess heat evolution,
4. Nuclear transmutation observations, and also
5. Nuclear transmutation reactions in living cells

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P_1061

A change of tritium content in D_2O solutions during Pd/D Co-deposition

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An early report on the experiments of the Pd/D system suggested that fusion of deuterium atoms occurs within the Pd-lattice when the system is under prolonged cathodic polarization. Among the observed results attributed to nuclear events, significant tritium found in electrolytic cells using a palladium cathode raise questions concerning the origin of tritium

In this study the electrochemical co-deposition of Pd/D on nickel electrodes has been performed to confirm the possibility of nuclear fusion reaction occurred in palladium metals that were co-deposited from the palladium salt/ D_2O solution as shown in figure 1.

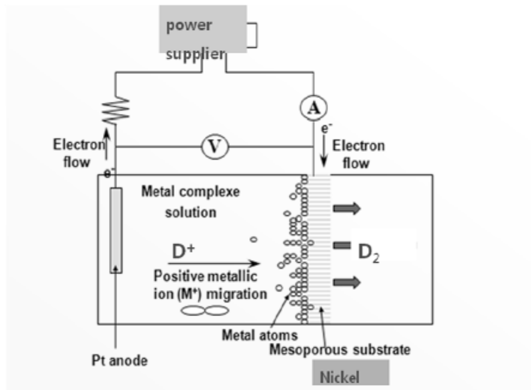

Figure 1. Electro co-deposition of Pd and D_2

The concentration of tritium in D_2O solution was varied depending on the electrolysis procedure of Pd/D co- deposition.

A comparison between the co-deposition of Pd/D and the simple electrolysis of D_2O was performed to investigate the change of tritium concentration in D_2O solution.

The morphologies of Pd deposited film and substrate were observed by scanning electron microscope (SEM), and the composition and phase structure were determined by energy dispersive analysis (EDS) and X- ray diffraction (XRD)

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P_1063

The possibility of the Reuse of Nano-Pd Particles for Solid Fusion

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Abstract. According to the measuring results of our paper presented at ICCF15(2009), Helium as an important evidence of Solid-state fusion has been confirmed clearly by mass analyzer "QMS". It is well known that the D/Pd ratio larger than 0.88 is favorable to observe an excess heat during the loading of Palladium with deuterium. As for our Nano-Pd particles, the D/Pd ratio was expected to reach to 200%~400%. However, after a Solid-fusion cycle, the produced helium remained inside Pd lattice. The remained helium is considered an awful impurity that restricts the absorption rate of deuterium in palladium, and then destroyed the solid fusion reaction. As the nano-Pd particle is expensive material, to realize the practical utility of Solid fusion technology, the reuse of the nano-Pd particle is considered to be the most important thing. In this paper, several possible methods to solve the problem of the reuse of the nano-Pd particle are discussed.

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III. Technical Program

P_1064

Generation of Short-lived Isotopes in Experiments with Bismuth Salts

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In experiments with bismuth salts the bismuth isotopes ^{210}Bi, ^{212}Bi, ^{214}Bi and ^{212m1}Bi. generation was observed. The most reliable data were obtained for ^{212}Bi, and ^{212m1}Bi.and six independent decay characteristics for the isotopes were identified. Together with the generation of isotopes macroscopic clusters emission from bismuth salts samples was observed.. All the effects were explained in terms of the same model.

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P_1070

Erzion Model Interpretation of our Experiment with Intermetallic Powder LaNiCuCeAl Loading by Hydrogen and Rossi & Focardi results

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It is presented the main results of our experiment with intermetallic powder LaNiCuCeAl loading by hydrogen and Rossi & Focardi results. It is proposed the Erzion model of Catalytic Nuclear Transmutation for the theoretician interpretation of both these results.

P_1072

Cold Plasma in Multibubble Sonoluminescence

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A simple reactor for multibubble sonoluminescence(MBSL) is designed to achieve very unusual high temperature and high pressure reaction condition. The MBSL can be generated from circular flat piezoceramic transducer with about 0.2 ~ 0.3 W/ml that is very low power density compared to other research power condition. We applied frequency span from 20 kHz to 140 kHz with function generator, and selected four frequencies showing very active reaction. On 127 kHz, most clear MBSL appeared and were distributed in whole area of the chamber. The light from the MBSL is radiated not in the shape of cloud light but in the shape of horizontally parallel light with certain distance between the lights. It is because bubbles are trapped which are generated by cavitation in antipressure area of standing wave and emit light. In the experiment, total twelve light bands are generated in the condition that sound wave is 127kHz with 1.1cm of wave length, lambda.

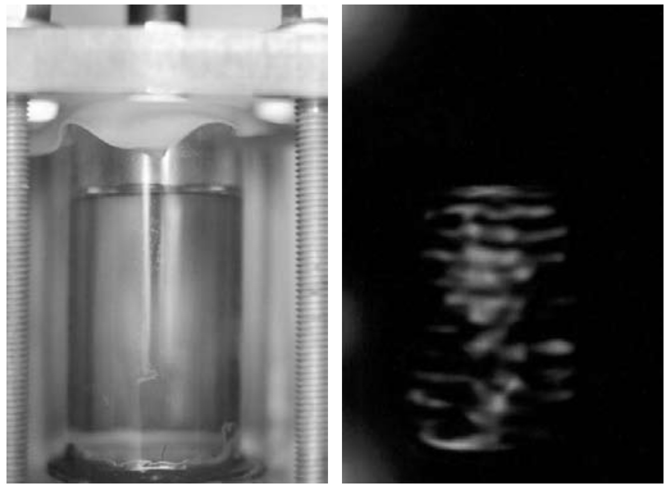

Figure. MBSL from 127kHz ultrasonic irradiation in the distilled water

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P_1075

FORCING THE Pd/^{1}H–^{1}H$_2$O SYSTEM IN A NUCLEAR ACTIVE STATE

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The emission of soft X–rays and production of tritium led us to the conclusion that an electron capture by a deuteron might be one of the nuclear reactions generating the F–P effect in the polarized Pd/D–D_2O system. Recently, Widom and Larsen presented a novel approach to explain the induction of a nuclear active state in the polarized Pd/D–D_2O system. Their model implies that, under the same conditions, the energetically less demanding Pd/H–H_2O system should show signs of nuclear activity, but this has not been reported.

To resolve this issue, we concluded that the answer lies in the content and meaning of the reaction

$$e^- + p_l^+ \rightarrow n + \nu \quad (1)$$

Nuclear reactions of this type can be treated as chemical reactions. The condition for the reaction to proceed is $\mu(e^-) > \mu(n) - \mu_l^+ > 0$, where $\mu(p_l^+$ is the chemical potential of the interacting proton. If $\mu(p_l^+) > \mu(n)$, then for the reaction to proceed, the energy of interaction must be reduced. This can be achieved by placing the cell an external magnetic field which lowers the interaction energy and forces the system in a nuclear active state. One dramatic evidence of nuclear activity is the occurrence of a catastrophic thermal event.

Catastrophic thermal events. A catastrophic thermal event has occurred that resulted in cell deformation, loss of electrolyte due to evaporation and leaking through a punctured cell bottom, Fig. 1a. The damage, about 1/3 of total area, is consistent with placing a very hot object in contact with plastic material.

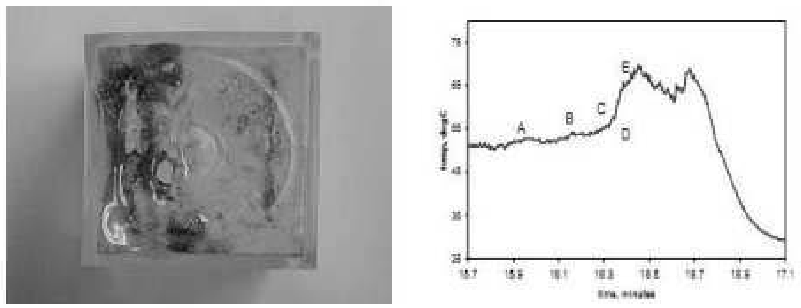

Figure 1:

Examination of Fig. 1a of the cell damage, suggests that an explosive fragmentation of the Pd/H deposit occurred and a large segment hit the surface. The wall deformation implies that sufficiently high temperature softened the acrylic plastic. The intensity of the heat source can be estimated from the temperature raise of the electrolyte during the last 170 minutes of cell operation, Fig. 1b. Using reasonable assumptions, the intensity of the heat source can be estimated to be more than 10 eV/Pd atom, i.e. outside the limits of chemical reaction. The non–chemical origin of the thermal run–a–way was confirmed by detection of deuterium and traces of tritium in the Pd/H deposits.

1

III. Technical Program

P_1077

Deep-electron orbits in Cold Fusion

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The Schrodinger equation is made relativistic in two forms, the Klein-Gordon (K-G) equations for spinless particles (e.g., Bosons) and the Dirac equations for spin-1/2 particle (Fermions). These pairs of equations both have two solutions each. In each case, one of the two equations has been rejected for various reasons (primarily having to do with the singularity at r = 0). In the rejection of these solutions, recognition of the possible existence of very-deep (~ 500keV) electron orbits has been lost. The lochon (paired-electrons) model of cold fusion, CF, and the model's extension into the nucleus have proposed deep-energy electrons as the active agent in producing a fusionable result. While the models do not require stable electron orbits to mediate the fusion, the existence of such orbits would support the deep-energy-electron portion of the lochon models and would explain other results that have been observed in CF experiments.

Details and implications of the deep-orbits predicted by the K-G and Dirac models are described in terms of binding energy and electron orbital radius. The applicability of both models to the lochon models is explained in terms of the tightly bound lochons (Bosons), and electrons (Fermions). The lochon model, for successful cold fusion, depends on the spatially paired electrons remaining together for as long as possible during the collision process. The K-G equation would allow the decay from a filled 1s orbital (e.g., the lochon in a D^- ion) to the bosonic-filled nought orbit. The Dirac equation would allow a transition from the D^- to the one-dimension, allowed, nought orbit of two adjacent hydrogen atoms. The atoms would share the electron(s) as a femto-molecule. The transition pathways and probabilities for both possibilities will be explored. The Cold Fusion results would indicate experimental evidence for the proposed models and their theoretical basis from relativistic quantum mechanics. The consequences of such transitions are explored in other papers.

P_1080

RESEARCH INTO EXCITED LONG LIVED 0.6 – 6.0 keV ENERGY LEVELS IN THE CATHODE SOLID MEDIUM OF GLOW DISCHARGE BY X-RAY SPECTRA EMISSION

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The experiments were carried out using a device of high-current glow discharge, which consisted of a water-cooling vacuum chamber, water-cooling cathode and anode units. X-ray emission was removed through a diagnostic window placed above the cathode. The discharge was realized in H2, D2, Ar, Kr and Xe at the pressure 1 – 5 Torr using the cathode samples made of Al, Sc, V, Ti, Ni, Zr, Nb, Mo, Pd, Ta, W, at current up to 300 mA and discharge voltage of 1500 – 4300 V. The pulse-periodical power supply of the glow discharge was used. The X-ray spectra were registered in film using the curved mica crystal X-ray spectrometer.

The X-ray spectrum were registered both as bands of the continuum with energies ranging 0.6 - 10.0 keV and as spots resulting from the emission of series of high-density monoenergetic X-ray beams (with energies of 0.6 - 10.0 keV) characterized by small angular divergence. The The X-ray spectra were repeatedly recorded during the Glow Discharge operation and after the Glow Discharge current switch off (for up to 20 hours afterwards). The X-ray emission bands energy correlated with K – L and L – N X-ray transitions. X-ray spectra include bands: K – M_3 X-ray transitions with 3.19 keV energy for Ar (discharge in Ar), L_3 – M_1 (1.65 keV) for Kr (discharge in Kr), L_1 – N_3 (2.503 keV) for Zr (discharge in He), L_2 – M_4 (2.395 keV) and L_2 – N_2 (2.623 keV) for Mo (discharge in He). The X-ray monoenergetic beams were recorded as dark spots. The spots energy were determined the cathode samples material. All the experimental results have 100% reproducibility.
The obtained results were the direct experimental evidence of existing the excited metastable energy levels with the energy of 0.6-6.0 keV in the solid of the cathode sample.

P_1083

Electroweak reactions in solid lattices and fluid substrates.

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The electroweak unification implies that under certain conditions the two forces will, albeit not with very high probabilities, co-effect or cross-effect in some favourable energy bands. In the standard EW theory W^3_μ and B_μ are combined to give Z^0_μ and A_μ using the Weinberg angle θ_W. Z has a very large mass (90 GeV) and A is massless (the photon field). The other two fields, W^1_μ and W^2_μ , are combined to give W^+_μ and W^-_μ (80 GeV).

The Weinberg angle θ_w is a characteristic of the "vacuum"**. In a lattice/substrate a different combination of W^3_μ and B_μ is possible (necessary) in which Φ^w_μ, a phonoton field** (with characteristics partially similar to phonons and photons) **of a very small mass, can be postulated/created.** Symmetry breaking is an idea from solid-state theory taken over into particle physics, and here it finds its return back to lattice physics to give a very small mass to this "phonoton" particle (estimated mass ca. 10^{-21} J ~10^{-37} kg ~10^{-2} eV ~120 Kelvin, i.e. lesser than neutrino mass). The smallness of the mass allows it to exist for a longer time (ca. 10^{-13} s) and in this time it can travel a few Angstroms (at phonon velocity) in which it can mediate a H nuclei (proton) to overlap into/with a lattice point nucleus or ion. The Coulomb barrier is thus "switched off" or **"re-gauged"** for a short duration. In case Deuterium (np) is used, a very different interaction may occur. The probabilities of these reactions are low. But certain elements/alloys (or nanoparticles of) Ni, Ce, Ca etc. or certain lattice configurations may act as "catalysts" in this reaction. 10^{-13} s is a sufficiently long time to allow such "long distance" (comparable to the lattice constant) reactions. **The weakon fields, W^1_μ and W^2_μ , can be re-combined to give low mass weakons or "feeblons F^a_μ".** Even a supermixing of all 4 gauge fields is possible. The vacuum is replaced/filled by a Bloch-type potential field, as found in a lattice, instead of a Higgs field.

Especially advantageous would be, if this reaction takes place in a fluid(ized) substrate since the resulting phonotons become real "pressure" phonons (the enthalpy of an explosion-like event results in more pressure-increase than temperature-increase) exerting real forces which can be used for direct conversion to mechanical energy - bypassing thermalization or the need for a thermodynamic-cyclic process for energy conversion. Furthermore fluid substrates can generate and sustain soliton-(instanton?) type pulses.

LANR/LENR/LENT may find their explanation - as well as reason for their low probabilities and indeterminate or difficult reproducibilities - in this conjecture. The task is to construct a suitable **gauge-mixing matrix G** for the electroweak gauge fields so that **(Φ//F)=GW**. This matrix **G** must on the one hand satisfy some very complicated conditions as required by the standard theory and also mix the gauge fields anew. The periodic Bloch-field can produce a spectrum of masses for the gauge-particles.

P_1084

Surface Effect for Gas Loading Micrograin Palladium for Low Energy Nuclear Reactions LENR

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Following the experimental results with small power cells based on low energy nuclear reactions [1] some theoretical aspects are discussed about the mechanism of surface effects at gas loading of small size grains of palladium for the reactions. The surface processes of the swimming electron layer were evident [2] from the beginning when evaluating the measurements of Prelas et al. [3] with gas loading. This was evident also by the experiments of Li et al [4] and Arata et al. [5]. On top the discovery of clusters [6] and their use at laser-plasma interaction [7] arrived at new aspects for studying the related mechanisms. The distinguishing between very high density deuterons located in the clusters at the surface differing from the volumetric Schottky defects [8] provided an access for the discussion of the state of Bose-Einstein condensation [9]. Taking these results into account, a model is discussed for the explanation of the measured small numbers of emission of MeV particles under the conditions of the low temperature states of the particles within the clusters. In view of the different screening in the swimming surface layers and the difference in clusters at surface or volume crystal defects, an interpretation of the recent experiments [1] is discussed. This is a further result adding to the measurement of the Maruhn-Greiner local maximum in the generation probability of the distribution of nuclei as a significant proof of LENR [9].

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P_1087

A Rugged, Isoperibolic Calorimeter for Electrochemical and Gas Loading Experiments

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We have further developed our design of an isoperibolic calorimeter for monitoring power production in electrochemical cells and gas loading experiments.[1] To reduce inadvertent contaminants, the electrolyte is only exposed to PEEK, platinum, and the cathode material. The cell is made of non-conductive materials so any excess power observed cannot be attributed to ground loop issues. The closed cell was designed to be inexpensive, air tight and yet easy to remove, disassemble and clean. Ports are provided to allow chemical additions to the electrolyte without stopping the electrolysis. Heat from gas loading cells can also be monitored. Currently, six electrochemical cells are run simultaneously for screening cathode materials with additional cells planned as results and funding permit. The design criteria and performance of the system will be discussed.

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P_1094

Sonofusion's Transient Dense BEC Clusters

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A number of experimentalists and theoreticians in our LENR field have posited that it is the boson nature of the deuteron, D^+, incorporating a Bose Einstein Condensate, BEC, that is responsible for measured fusion products of ^{4}He and heat. My past papers point not to an atomic BEC, but to a picosecond nucleon BEC cluster of pure deuterons at a moderate temperature that may explain sonofusion's experimental results after 22 years of experiments. The D^+ nucleons are responsible for the BEC's very high critical temperature, Tc. This DD fusion path shows no measurable radiation by-products.

Sonofusion is an acoustic piezo driven cavitation device producing resonant collapsing bubbles in D_2O. Experiments were controlled by adjusting sonoluminescence parameters, and showed by experimental results that implanting, via a z-pinched nm bubble jet, a charge-separated plasma into a metal target foil initiates a cluster formation. A plasma cloud of free electrons surrounds the less mobile D^+ that range in number from 10^4 to 10^6 and begins a cluster squeeze. Coulombic and image state compression drive the cluster interface into a phase barrier BEC state. The DD fusion occurs in a transient environment, a high-density squeezed D^+ BEC cluster, producing ^{4}He and heat and observed target foil ejecta sites 50 nm in diameter. These sites have been surveyed in one square micron of target foil lattice and yield 10^7 clusters per acoustic cycle. Sonofusion transient clusters and muon fusion are similar in density.

The deuteron cluster separation is maintained well below the de Broglie wavelength, λ_{dB}, via increasing density and cluster surface evaporative cooling. This is important to the mesoscopic nuclear BEC cluster during its adiabatic compression heating. The deuteron transient nuclear BEC cluster's Tc is very high with the absence of free electrons within the cluster, where the cluster's nuclear groundstate energy level is 2.23 MeV. This is larger than the deuteron's nuclear dissociation energy. The collective transient magnetic fields are tangent to the spherically centered dipole. Electric forces and the compressing deuterons direction are parallel to the accelerating electrons. The E and B forces and fields and the charge image states in and about the cluster's particles collectively produce compression pulse forces, F_E, that are larger than escape forces, F_{EX}. [1] Nabil Lawandy's paper translates into cluster squeezing forces via changing electron cloud interface and image charges. These forces result from large dielectric and relative e^- and D^+ mobility differences. Image force states combined with other transient coulombic forces, add to F_E squeeze and the cluster's DD fusion probability. The cluster's transient lifetime of a picosecond, with its small squeezed deuteron clusters having densities around 10^{36} D^+/m^3, will produce one fusion event per cluster. The heat of fusion generated will be dispersed from a nuclear BEC superconducting environment before any radiation mechanism is in place. Evidence of ^{4}He can still be found in old target foils along ejecta site boundaries of sonofusion target foils, an area for future work. Laser heating techniques can recover and measure ^{4}He trapped in sub-micron size bubble chambers in Pd target foils years later.

The utility of this small 20-gram MHz sonofusion reactor is a single unit that can be ganged together to make any sized device. Resonance bubbles produce 10^{13} lattice implanted clusters per second that produced 40 watts of Qx heat from 50 watts of acoustic input, producing a total of 90 watts of recoverable heat. These squeezed dense picosecond sub-nanometer clusters provide a transient nuclear BEC fusion environment and explain sonofusion's experimental results. The heat measurements used a flow through delta temperature type calorimetry system, and ^{4}He measurements used a mass spectrograph from the Department of Energy [2]. Samples were measured by Brian Oliver's He isotope separation in 1994.

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P_1095

Patents and Cold Fusion

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No patent is going to issue for the person who finally provides the correct theory that explains the source of the Cold Fusion effect. That is properly the subject for a Nobel Prize. Patents relate to products, articles, machines, or chemicals that are to be delivered to consumers or can be used by producers, i.e. a physical arrangement that can be carried-out industrially.

For an arrangement to become patentable, three critical conditions must be met:

1. There must be a feature or aspect of the arrangement which is new,
2. The arrangement must actually work and deliver a useful result, and
3. The patent disclosure document that accompanies a patent application must describe how others can obtain the promised useful result.

There is a concern that the United States Patent Office has a rule of refusing to grant patents that address Cold Fusion inventions. This is not correct. But it does apply special procedures.

A patent can only validly issue for an arrangement which delivers the useful result promised in the disclosure. Normally examiners assume this is true. But if an examiner has good reason to suspect that the promised useful result is not available, or if the examiner simply suspects that the disclosure is inadequate to allow other people to build the invention, then the examiner may require that the applicant provide proof that these requirements are met. He may issue a request that says: "Prove it!" This has been a block to the granting of many Cold Fusion patent applications.

Examiners primarily review patent applications for novelty. But they are also entitled to question whether a patent disclosure addresses an invention which is useful and whether the disclosure is sufficient to obtain the promised results. As a general practice, they demand this of Cold Fusion applications.

An example of a patent application pending for cold fusion and its processing before the US patent office will be reviewed.

To obtain a quality patent an applicant must not only describe the procedures to obtain the benefits of the invention, but also identify a feature in that procedure or arrangement which is new. A patent, once granted, cannot take away from the public anything that was previously available to the public. The applicant must draft a one or more "claims" at the end of the patent that define what the public cannot do.

A patent claim is only meaningful if it precludes competitors from marketing closely similar arrangements to the invention. The claims should be drafted to cover such alternatives. Many patent applications are deficient in this regard. This is a key issue in patenting.

If an invention is a success, a patent can enhance the profitability of exploiting that success. But patents cannot make an invention succeed. It all starts with the invention, and a well-prepared patent disclosure.

You must have a successful application of technology before a patent becomes relevant. But if you have such a technology success, patents can enhance the profitability of marketing that technology.

P_1098

Changes observed in the element compositions of palladium and rhenium specimens irradiated in dense deuterium by γ-quanta with boundary energy 23 MeV

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Studies have been carried out into the element composition of palladium and rhenium specimens irradiated in dense gaseous deuterium (see Fig.1) by γ-quanta of continuous spectrum with the threshold energy 23 MeV. Significant anomalies are found in the structure and element composition of the irradiated specimens. At both ends of the palladium wire, considerable changed (see Photo 1), the form of blowouts (resembling congealed "Solar protuberances") of molten metal with a complex element composition was observed (see Photo 2). The palladium surface proved to be covered with small, approximately 1-2 μm, particles composed of rhenium oxide Re_2O_7 while near the cracks and fractures with rhenium, carbon and oxygen crystallites. The phenomeno-logical model of nuclear reactions leading to the observed element composition of rhenium and palladium is discussed. Presented work is continuation of the studies first announced in [1].

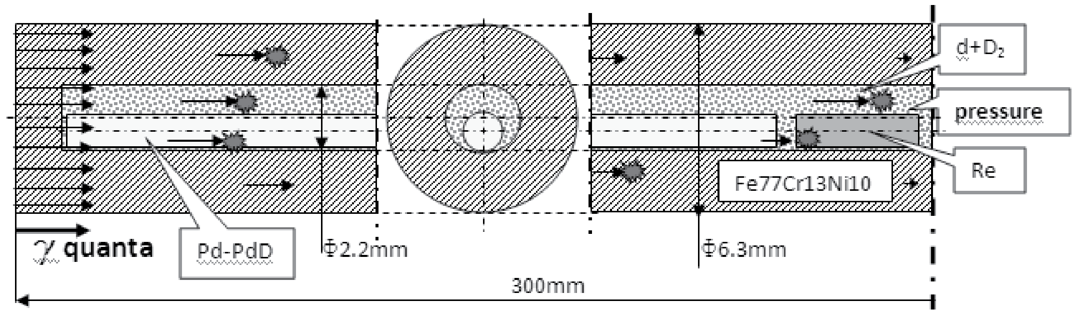


Fig. 1. Deuterium high pressure apparatus used in experiment.

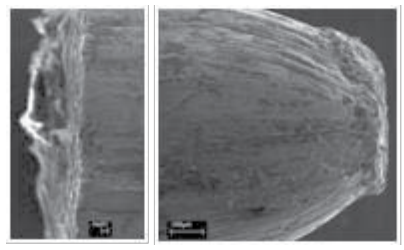
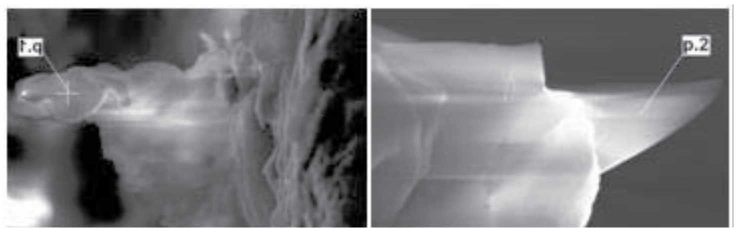


Photo 1.Changes of ends specimen from its regular form



P_1099

Electrochemical Deuterium Absorbed at Palladium Nanoparticles - Carbon Composite Electrode

Dawei Dong[1], Shan Jin[2], Yue Wang[1], #Zhong-Qun Tian[1]
[1]Dept. of Chem, Xiamen Univ, China, zqtian@xmu.edu.cn
[2]Dept. of Chem, Huazhong Normal Univ, China, jinshan1999@gmail.com

We report a facile approach for synthesizing large scale Pd nanoparticles in aqueous solution at mild temperature. And then the nanoparticles are assembled into the palladium - carbon composite electrode to study the deuterium absorption at the cathode during the electrolysis of heavy water. The composite electrodes are characterized using transmission electron microscopy (TEM), X-ray photoelectron spectroscopy (XPS), and Mass spectrometer(MS). Abnormal behaviors of the cathodes possible are observed under different experimental conditions such as cathode loading, laser triggering, palladium nanoparticles size.

P_1106

Deposition of Pd nano-particle on silica for high surface area and thermal stability for gas loading excess heat generation

Seunghwan Seok and #Do Hyun Kim
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dohyun.kim@kaist.edu

Palladium is one of the essential materials used for electrodes in an electrochemical system of cold fusion researches since Fleischmann and Pons in 1989 [1]. Recently, gas loading systems draws more attention because gas loading system can give higher temperature than electrochemical system. Among gas loading system, Pd-D2 system is one of the systems with intense research [2-3]. Also it has been reported that Pd particles with nano size are more effective to generate excess heat [3]. But, Pd nano-particles can be agglomerated to lose its nature as nano-particles at high temperature. To solve this problem, our research group has attempted to synthesize stable palladium nano-particles with high surface area by depositing palladium on silica nano-particles. Using silica nano-particles as support, the deactivation of palladium particles due to sintering can be prevented. Palladium with a size of around 3-4nm on silica support will have a high surface area, and increase the probability of excess heat generation. The size of silica particles was controlled using the Stöber synthesis method [4]. In order to deposit palladium on the silica nano-particle, palladium nitrate was used as a precursor and sonochemical treatment was applied using an ultrasonic micro horn. These Pd nano-particles will be used in Pd-D_2 gas loading system to generate excess heat.

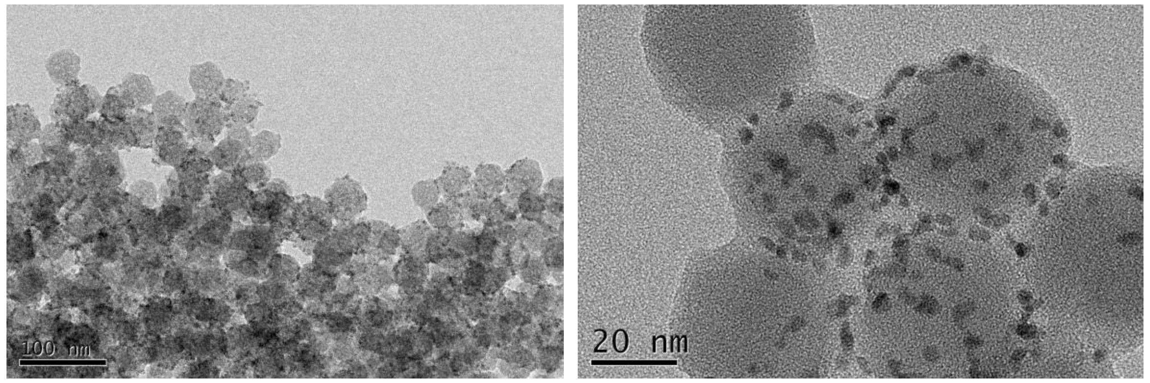


Figure 1. TEM images of Palladium particles on Silica particle.

[1] M. Fleischmann, S. Pons, M. Hawkins "Electrochemically Induced Nuclear Fusion of Deuterium," J. Electroanal. Chem., 261, 301, errata in Vol. 263, 1989.
[2] Zhan M. Dong, Chang L. Liang, Bin Liu, Qing M.Wei, Jian Tian, Shu X. Zheng, Jin Z.Yu, Xing Z. Li "Studies on Anomalous Phenomena of D/Pd Systems using a Gas-loading Process – A Stride Towards Neutrino Detection," J. Condensed Matter Nucl. Sci., Vol. 5, 2010.
[3] J.P. Biberian, N. Armanet, "Excess Heat Production During Diffusion Of Deuterium Through Palladium Tubes," 8th International Workshop, 2007.
[4] Werner Stöber, Arthur Fink, Ernst Bohn "Controlled Growth of Monodisperse Silica Spheres in the Micron Size Range," Journal of Colloid and Interface Science, Vol. 26, pp. 62-69, 1968.

P_1107

Ni-H Replication

Peter Mobberley
Advanced Energy Technologies, UK

A pictorial poster is presented indicating anomalous thermal emission commensurate with gamma emission in an electrically heated cell containing 3 micron nickel powder in contact with gas at 10 atm pressure.

IV. Conference Information

1. Registration

Conference Registration		Early Bird	On-site
Conference	Regular	$700	$800
	Student	$300	$400
Accompanying Person		$200	
Additional Banquet		$70	
Additional Conference Proceedings		$50	

The Participants' registration fee includes:

- Participation to all scientific sessions
- Welcome Reception
- Banquet
- Conference Proceedings
- Coffee Breaks
- Lunches for 4 days

The Accompanying person fee includes:

- Welcome Reception
- Banquet
- Coffee Breaks
- Lunches for 4 days

Tutorial / Package Registration		Early Bird	On-site
KAIST EEWS Workshop (ICCF-17 Tutorial)	Regular	$300	
	Student	$100	
Special Package (Conference + Tutorial)	Regular	$950	$1,050
	Student	$350	$450

The Participants' tutorial fee includes:

- Participation to all tutorial
- Tutorial Book
- Coffee Break
- Lunch for 1 day

The Participants' registration fee includes:

- Participation to all tutorial
- Tutorial Book
- Lunch for 1 tutorial day
- Participation to all scientific sessions
- Welcome Reception
- Banquet
- Coffee Breaks
- Conference Proceedings
- Lunches for 4 conference days

2. Social Event

Welcome Reception

Enjoy the Welcome Reception with the dinner! Reunite with your friends and break the ice with new colleagues. Registration includes a ticket for Welcome Reception. The place is subject to change according to the situation.
Date & Time: August 12, 2012/ 18:00-20:00
Place: Terrace, DCC Korea

Banquet

The banquet will be a time to promise next ICCF. Enjoy the great performance with the tasty dinner! Regular registration includes a ticket for banquet. Additional banquet ticket can be purchased at a price of $70 per person at on-line registration or on-site. The place is subject to change according to the situation.
Date & Time: August 16, 2012/ 17:00-20:00
Place: Grand Ballroom 201, DCC Korea

3. Venue

Daejeon Convention Center (DCC Korea)

Daejeon Convention Center (DCC Korea) is equipped with a lot of professional and convenient conference facilities: all technical devices, 2 restaurants, a business center, a convenient store, a flower shop and a tour agency. Moreover, Daejeon Convention Center (DCC Korea) offers a one-stop service from planning to execution processes on conventions, exhibitions, and events by directly operating and managing DCC Korea. All equipment is state-of-the-art and will surely meet all participants of ICCF-17.

Address: 4-19, Doryong-dong, Yuseong-gu, Daejeong, Korea
Tel: 82-42-821-0143

Daejeon Metropolitan city

Daejeon Metropolitan City is a center of knowledge and information, situated at the center of the Korean Peninsula. Daejeon is easily accessible from any place in Korea as it is the hub of national transportation, linking the whole country from east to west, and from north to south. It is an important place where traffic diverges into two major expressways, the Gyungbu Expressway going to the east and the Honam Expressway to the west.
The science festival, the largest-scale ever in Korea, is to be held at the Expo park in Daejeon. The international exposition (Expo '93) at Daejeon created the Hanbit Tower and the Expo Bridge.
Daejeon is home to Daedeok Valley, a cradle for high-tech industry, where Daedeok Science Town, the best R&D park in Korea, is located. Daedeok Science Town is home to around 70 research institutes, including Korea Research Institute of Standards and Science (KRISS). As the home to world-class research institutes that are focused on fundamental science, information technology, biotechnology, nanotechnology, and space technology, Daejeon offers a highly favorable environment for the successful exchange of knowledge, close cooperation, and innovative research results.

4. Transportation

We recommend 2 main ways from Incheon Int'l Airport to Daejeon Convention Center (venue):
by Airport Limousine bus and Express Train (KTX). The picture and explanation below will help your comfortable travel.

WAY1. Incheon Int'l Airport ⇒ Daejeon Government Complex

▪ Incheon Int'l Airport ⇒ Daejeon Government Complex

1) Take an Airport Limousine Bus from Incheon Int'l Airport to Daejeon.

Bus Stop	Bus Schedule	Operation Hour	Ticket Fare
9D	06:00~23:10	180~200 min	KRW 22,100(Deluxe) / KRW 24,300(Deluxe Night)

2) Get off the Government Complex Daejeon bus stop

You take a taxi to get to hotels or Daejeon Convention Center upon arrival at Government Complex Dejeon bus stop. It takes you around 5~10 minutes by tax and cost about KRW3,500~4,000.

WAY2. Incheon Int'l Airport ⇒ Seoul Station ⇒ Daejeon Station ⇒ Daejeon Government Complex

▪ Incheon Int'l Airport ⇒ Seoul Station

1) By Airport limousine bus

Purchasing Limousine Bus tickets, and also can get information at Bus Ticketing Office: Exit 4, 9 (Indoors), Exit 4, 6, 7, 8, 11, 13 and 9C (Outdoors). Please take a Limousine Bus at Bus stop 6A, 12B for standard Limousine and 4A 10B for Deluxe Limousine.

Bus stop	Bus	First Departure	Last Departure	OperationHour	Interval	Fare(KRW)
6A, 12B	Limousine (Standard) (6001)	5:00	20:00	75 mins.	20~30mins	14,000
4A, 10B	Limousine (Deluxe)	5:20	21:40	65 mins.	10~15mins	15,000

2) By Subway

Please take AREX(Airport Railroad train) at Incheon International Airport Station, then take off the Train at Seoul Station (KTX)

3) By Taxi

Alternatively, participants can take a regular taxi or a deluxe taxi to Seoul Station. To take a taxi, please use the taxi stop in front of the passenger terminal of Incheon Int'l Airport

▪ Seoul Station ⇒ Daejeon Station

Use KTX of Gyeonbu Line and take off at Daejeon station (Please check the exact departure time, number of train and seat.). It will take approximately 1 hour.

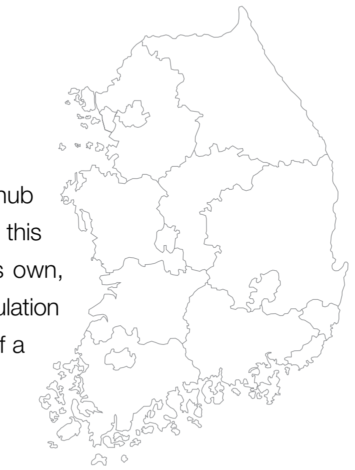
Division	Going Trip(KRW)					
	1st class		Standard class		Standing/Not assigned	
	Adult	Child	Adult	Child	Adult	Child
Week Rate	30,800	19,800	22,000	11,000	20,900	10,400
Weekend Rate	33,200	21,300	23,700	11,800	22,500(Fri) 20,100(Sat, Sun)	11,200(Fri) 10,000(Sat,Sun)

▪ Daejeon Station ⇒ DCC Korea

1) By Taxi / By Subway

We strongly recommend that you take a taxi to get to hotels or Daejeon Convention Center upon arrival at Daejeon Station. There are always some taxis in front of Daejeon Station waiting for fares such as you. After getting in a taxi, please tell the driver the name of hotel or Daejeon Convention Center. It will take you about 20~25minutes and cost about KRW 6,000~8000. You can also use Daejeon subway with the fare of KRW 1,200 and have to get off at Yuseong Spa Station. But please note that the subway can take you only to the hotel area.

5. Useful Information



Korea

Korea, traditionally known as the Land of the Morning Calm, is today a modern, bustling hub of East Asia. It is a peninsula jutting off of China, and Japan is only two hours away. Despite this close physical proximity to the neighboring countries, Korea has a distinctive culture of its own, which has developed during its 5,000 years of history. Visitors can expect to meet a lively population with its own language, writing system, architecture, cuisine, and many other manifestations of a unique cultural heritage.

Capital Seoul

The capital of South Korea is Seoul. Seoul has been the capital city of Korea since 1392. This city is the heart of the Republic of Korea, home to 10 million of the nation's 48 million people. Seoul is located in the central region of the Korean Peninsula. Seoul is the center of finance, politics, commerce, recreation, education and culture, and is home to major corporations, banks, government offices, schools, theaters, and entertainment facilities. The wide and beautiful Han River (Hangang) flows through Seoul and serves as a lifeline for the heavily concentrated population. There are rich and satisfying varieties of things to see and do for residents and visitors liked.

Climate

Korea's climate is regarded as a continental climate from a temperate standpoint and a monsoon climate from a precipitation standpoint. The climate of Korea is characterized by four distinct seasons. Spring and autumn are rather short, summer is hot and humid, and winter is cold and dry with abundant snowfall. Temperatures differ widely from region to region within Korea, with the average being between 6 °C (43°F) and 16 °C (61°F). The average temperature in August (in the middle of summer), ranges from 25°C to 28°C.

< Monthly Temperature >

Month	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Temperature	-4	0	5	12	17	22	26	28	17	10	0	-4

Currency

Basic unit of Korean currency is won. The exchange rate is subject to change with minor daily fluctuation. As of July 9, 2012, the exchange rate is approximately US$1 to KR ₩1,143. Foreign bank notes and traveler's checks can be exchanged into Korean Won at the airport, hotels and at all Korean banks. Credit Cards, e. g. VISA, MasterCard, American Express and Diners Club, are all widely accepted.

Language

Hangeul was invented in 1443, during the reign of King Sejong. It is composed of 10 vowels and 14 consonants. Hangeul has 11 compound vowels, 5 glottal sounds. The chart below represents the 24 Hangeul letters and their romanized equivalents. 'The Hunminjeongeum,' a historical document which provides instructions to educate people using Hangeul, is registered with UNESCO. UNESCO awards a 'King Sejong Literacy Prize, ' every year in memory of the inventor of Hangeul.

English	Korean (Hangeul)	Korean Pronunciation
How are you?	안녕하세요?	Annyeong-haseyo?
Thank you.	감사합니다.	Gamsa-hamnida.
Yes.	예.	Ye.
No.	아니오.	Aniyo.
I am sorry	미안합니다.	Mian-hamnida.
I enjoyed the meal.	잘 먹었습니다.	Jal meogeot-sseumnida.
Please give me some more of this.	이것 더 주세요.	Igeot deo juseyo.
The check, please.	계산서 주세요.	Gyesanseo juseyo.
Do you take credit cards?	카드로 계산할 수 있습니까?	Kadeuro gyesan halsu isseumnikka?
How much is it?	얼마입니까?	Eolma-imnikka?
It is ________won.	__________원입니다.	________won imnida.
5,000	오천	O-cheon
10,000	만	Man
15,000	만오천	Man-o-cheon
20,000	이만	I-man
30,000	삼만	Sam-man
Where is the rest room?	화장실 어디입니까?	Hwajangsil oedi-imnikka?
Goodbye.	안녕히 계세요	Annyeonghi gyeseyo.

V. Author Index

The 17th International Conference on Cold Fusion

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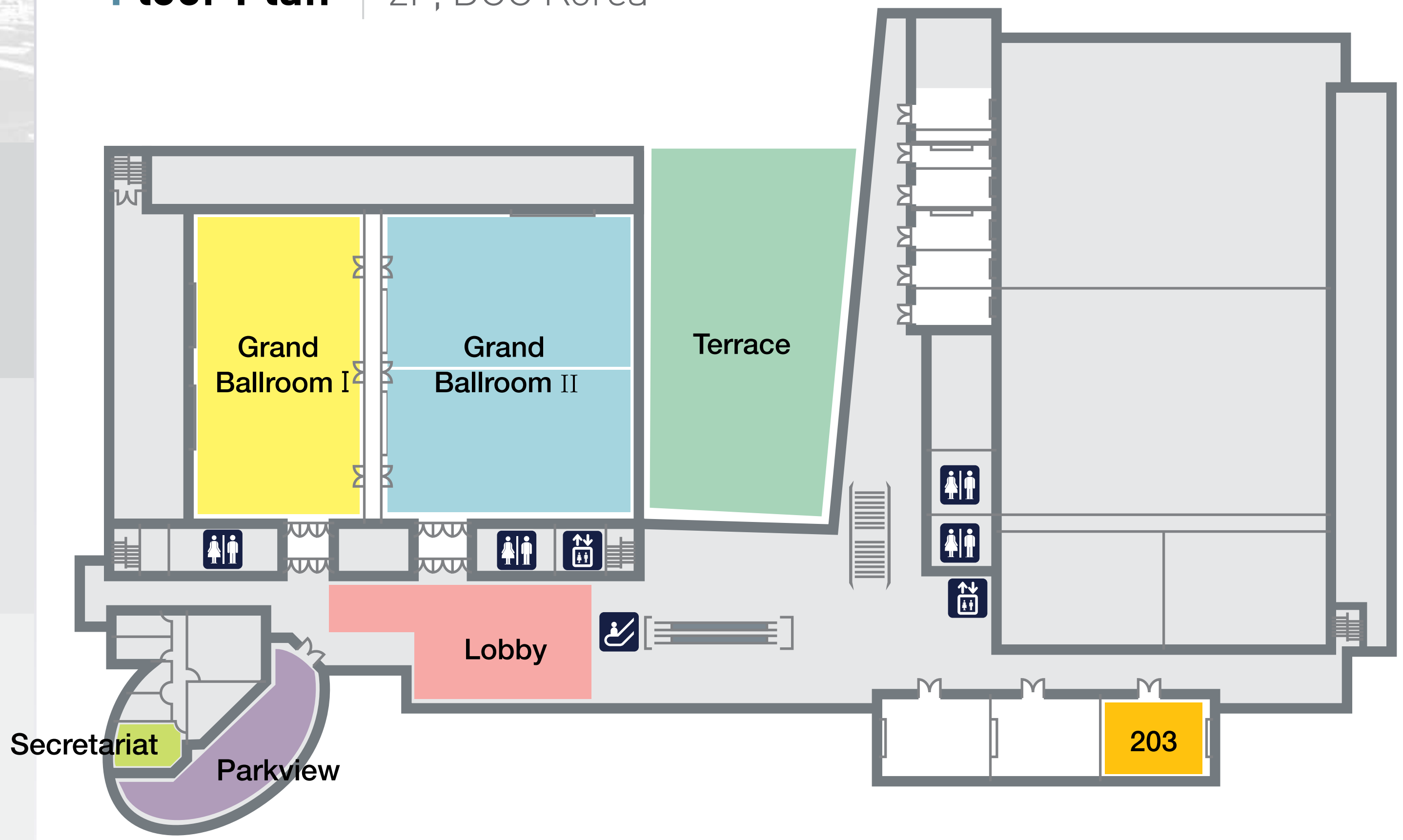
ICCF-17

The 17th International Conference on Cold Fusion

August 12~17, 2012
DCC Korea, Daejeon, South Korea

Floor Plan | 2F, DCC Korea



Grand Ballroom I	
Use	Date
Banquet	8/16

Grand Ballroom II	
Use	Date
Opening/Plenary	8/13
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Use	Date
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Terrace	
Use	Date
Welcome Reception	8/12

203	
Use	Date
IAC Meeting	8/14

Organized by ICCF-17 Organizing Committee

Co-sponsored by ISCMNS, KIChE, 한국원자력학회, KIM 대한금속·재료학회, 한국화학연구원, KAIST EEWS Initiative, INFINITE ENERGY, DIME 대전마케팅공사, 한국관광공사