Brief Technical Description of the
Leonardo Corporation, University of Bologna, and INFN
Scientific Demonstration of the
Andrea Rossi ECat(Energy Catalyzer) Boiler
14 January 2011:1600-1800
Bologna, Italy

Background

Dr. Andrea Rossi, President of Leonardo Corporation, prepared in cooperation with scientists from the University of Bologna and INFN-Bologna an experimental demonstration of his ECat boiler for about 50 people, mostly scientists the afternoon of 14 January 2011. A video of some of the demonstration and other information is available at www.journal-of-nuclear-physics.com. The experiment was organized by Dr. Giuseppi Levi to establish the ECat's performance as a "black box". That is, Dr. Levi's instruments measured the electrical power and hydrogen supplied to and consumed by the ECat and measured the amount and temperature of the water to be heated to steam by the ECat, which was operated by Dr. Rossi.

Experimental Configuration

In the photo below we see Dr. Levi (in the Red Sweater) standing behind the

18:14 - We dismantled the equipment: all to celebrate!

table on which sits from the left on the floor a translucent plastic reservoir of water with a blue funnel and a plastic tube that runs to the yellow/black positive displacement pump that sits on table. The plastic tube runs from the output of the black pump over to the ECat and delivers water through the silver insulation. The hydrogen is supplied from the red topped pressure vessel on the floor through a line to the ECat. The Blue Box with the red electrical connections on the table next to the silver ECat is the Controller that regulates the supply of hydrogen and electrical power to the ECat. There are three thermocouples that measure T1, the temperature of the room, T2 that measures the temperature of the water in the reservoir, and T3 that is on sticking out of the vertical, silver insulation covered ECat and measures the temperature of the output of the ECat. There is another probe without its electronics that measures the dryness of the exiting steam. The instrument used was a Delta Ohm HD37AB1347 Indoor Air Quality Monitor that was operated by a specialist on the faculty of the University of Bologna.

There was also an input power meter that has not been identified or described in the information available to us at this time.

In addition to these instruments that are establishing the levels of input power and output(thermal) power there are a variety of nuclear radiation measurement instruments.

Operation

Dr. Rossi turned on the ECat from its Controller and the temperature of the output water began to climb during this transient phase of operation. After approximately an hour of operation, the ECat produces steam whose temperature is ~101 C. The IAQ Monitor has reported that the steam is “dry”, that is, the liquid water is all converted to steam. This is the steady state operation that will be used to describe the performance of the ECat in the following section.

Experimental Data(Preliminary)

Q1. How Much Power Did the Rossi ECat Produce during the Bologna Test on 14 Jan 2011?

<u>Parameters and Their Values that Describe Rossi's Boiler in Steady State</u>

T2 is the temperature of the water being pumped into the reactor by a positive displacement pump.

T2 = 13.3 C

T3 it the temperature of the output of the reactor as measured by a thermocouple and by the instrument from Prof Gallantini.

$T3_{Steady\ State}$ = 101.2 C

(All temperature measurements appeared to have a fluctuation of about 0.1 degree.)

Calibrated Injection rate of water from the reservoir into the reactor:

Flow Rate: 146 grams per 30 seconds = 4.9 g/s

Power input to the ECat controller from the public power lines.

Transient period. 1,000 W.
Steady State. 400 W

Calculations

1. **Dr. Levi quoted from his post experiment interview:**
   Energy required to convert 100 C water to steam **= 2272 joules per gram**
   Energy required to heat water 100.0 – 13.3 C = 86.7C x 4.2 J/g•C = **364.1 joules/gram**
   Flow rate: **4.9 g/s**
   Thermal Power
   4.9g/s (364.1 J/g + 2,272 J/g) = 4.9 x 2,636.1 J/s **= 12,917 W**

ECat produced Excess Power = Thermal Power – Input Power
= 12,917 – 400 = 12,517 W
Note: The contribution to the input of the hydrogen is not included here.

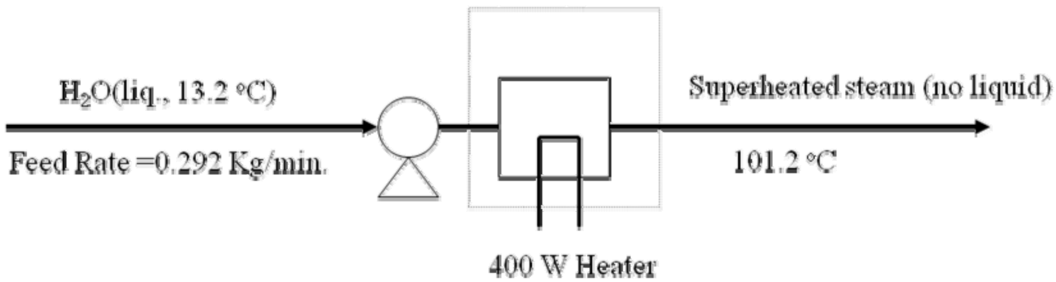
2**. Calculation by Prominent Physical Chemist**

I first calculated that 146 g of H_2O is 8.104 moles.
The heating of this H_2O from 13.3 C to 100.0 C requires:
(75.291 J/mol K)(100.0-13.3 K)(8.104 mol) = 52,903 J
The evaporation of this H_2O at 100 C requires:
(40,883 J/mol)(8.104 mol) = 331,320 J
This heat of evaporation at 100 C was calculated from the heat capacities using Kirchhof's Law.
My 1955 CRC gave 40,669 J/mol for this value at 100 C.
Heating the H_2O vapor from 100.0 C to 101.2 C requires:
(33.577 J/mol K)(1.2 K)(8.104 mol) = 324 J
The sum is: 52,903 J + 331,320 J+ 324 J = 384,550 J.
The Thermal Power is 384,550 J/30 s = 12,820 W.
Power Gain$_{\text{Steady State}}$:
The ratio of power out to power in is **12,400/400 =32.1.**

Estimate of the Mass of Hydrogen burning to water to Produce the Observed Thermal Energy = 0.1 grams per second
For the reaction $H_2 + 0.5\ O_2 = H_2O$ assuming the H_2O is produced as a gas and not as a liquid, the enthalpy change is -241,818 J/mol. The minus sign simply indicates that this reaction is exothermic. The moles of H_2 required to supply 384,550 J is therefore 1.590 moles of H_2 for the reaction with oxygen. This is (1.590 mol H_2)(2.016 g/mol) = 3.206 g of H_2 in the 30 second period or 0.1069 g H_2 per second.
If the (400 J/s)(30 s) = 12,00 J is subtracted, **one obtains 0.1035 g H_2 per second**.

3. **Calculation by Prominent Catalyst Chemist**

THERMAL SYSTEM



Heat Release = OUT - IN

ΔH = 2678.4kJ/kg x 0.292 kg/min. - 0.292 kg/min x 55.4 kJ/kg – 24 kJ/min

= 782.1 kJ/min - 16 kJ/min - 24 kJ/min

= 742.1 kJ/min = 44,526 kJ/hr

EQUIVALENCY

$2H_2 + O_2 \longrightarrow 2\,H_2O$ Heat of Reaction = -571.6 kJ/mol

Consumes 342.7 g of H_2/hr and 2,492 g of O_2/hr

Note: 44,526 KJ/hr x 1 hr/3600 seconds = **12,368 Watts**

Comment

The information collected together and the calculations presented are preliminary estimates of the thermal power generating capability of the ECat that was operated in Bologna, Italy on Friday, 14 January 2011. The INFN/U Bologna Technical Report should correct errors in the data used here and offer insight into the errors in the measurements themselves. This synopsis is based upon the data made public by the experimental team and Leonardo Corporation.