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Test of Abnormal Heat in Hydrogen Loaded Metal

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English translation by Bob Higgins of Accuiti Science & Engineering

Abstract: This report describes the experimental replication of the significant abnormal exothermic phenomenon observed with the Rossi E-CAT apparatus.

1.0 Description of the experimental device

1.1 Experimental reaction vessel

The reaction vessel is a cylindrical 310S stainless steel container having an outer diameter of 68 mm, length of 150 mm, and a wall thickness of 10 mm.

Figure 1: The reaction vessel

The reaction vessel end is drilled to form a gas I/O port within the wall of the reaction vessel and a 600 mm long stainless steel tube is welded to the vessel. This tube is connected to a vacuum pump for evacuation of the reaction vessel. The reaction vessel also has a separate, blind, thermowell hole drilled through the bottom of the reaction vessel and into its wall, penetrating roughly half-way through the length of the vessel.

Inside the reaction vessel, a nickel container is inserted as a hydrogen reaction crucible. The crucible has an inner diameter of 20 mm, outer diameter of 34 mm, outer length of 100 mm and inside depth of 93 mm. The crucible is sealed with a screw cap. The crucible is loaded with 12.7 grams of fuel comprised of 11.24 grams of nickel powder + 1.46 grams of lithium aluminum hydride.

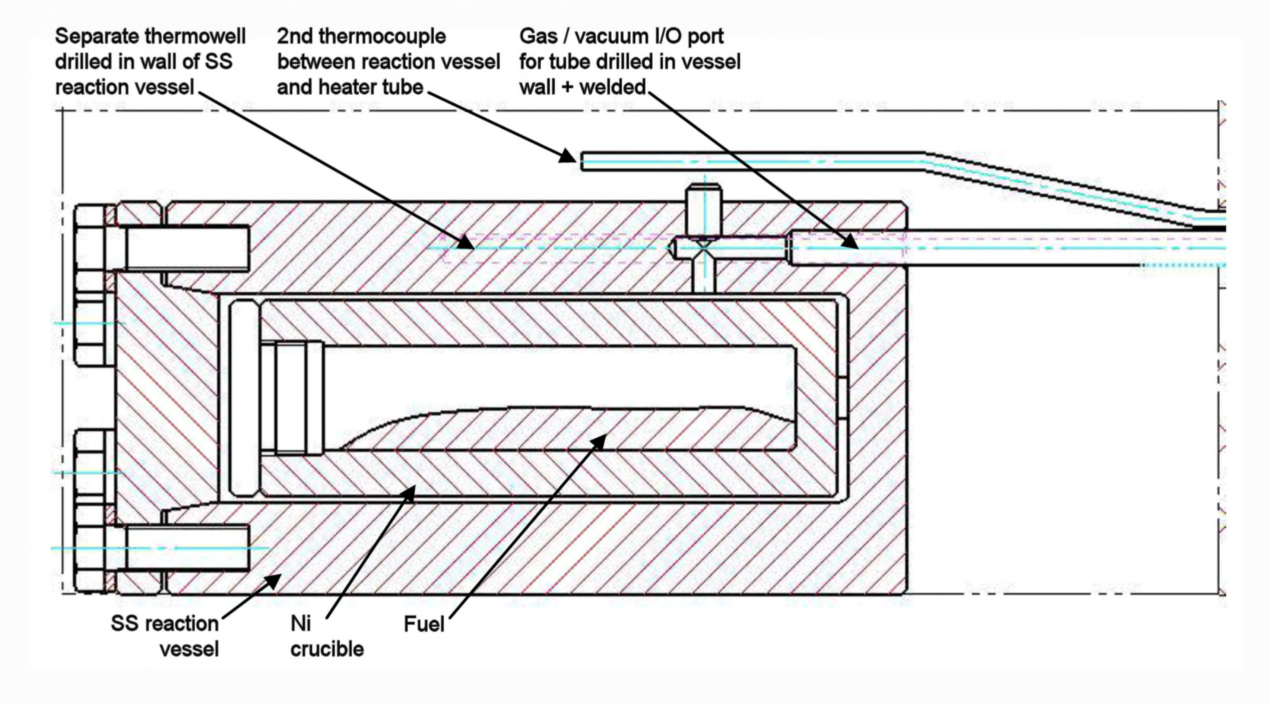

Figure 2: Cross-sectional drawing of the reaction vessel

1.2 Heater Assembly

Resistance heater wire (iron alloy, 1.2 mm) is coiled with a small radius and wound within the exterior grooves of molded into a porcelain ceramic tube of 80 mm diameter and 430 mm length, forming a 2000 watt tube furnace having a heated length of 200 mm on one end of the tube. The heater portion is then coated with refractory cement.

Figure 2: Ceramic heater tube furnace – wound end coated with refractory cement

The ceramic heater tube furnace assembly is installed in a thermally insulated housing with the insulation comprised of alumina fibers and mullite. The housing exterior shell is constructed of a stainless steel shell having a diameter of 500 mm and a length of 600 mm.

<u>Figure 3: Heater installed within the insulating shell</u>

1.3 Heater Power Supply

The power supply is chopped AC to control the RMS voltage delivered to the heater.

<u>Figure 4: Heater power supply</u>

1.4 The Paperless Recorder [Data Acquisition]

A paperless recorder [computer data acquisition] was used to record the furnace temperature, tank temperature, heater power, and the pressure inside the reactor vessel as a function of time.

1.5 The Vacuum System

The vacuum system was used to remove air from the reaction vessel initially to 10^{-4} Pa.

1.6 The Hydrogen Generator

A hydrogen generator is used for regulating the pressure of hydrogen within the reaction vessel.

1.7 The Container Placed in the Heating Tube

The reactor vessel was placed inside the porcelain ceramic heating tube, with a thermocouple inserted within the reactor vessel, and a second thermocouple between the reactor vessel and the inside of the heating tube. The heating tube end was then closed with a heat resistant ceramic plug that allowed the thermocouple wires and the stainless reactor evacuation tube to be passed through the closed end.

1.8 The Container with the Vacuum System and Hydrogen Generator Connections

Figure 5: The reaction vessel in the heating tube with vacuum tube and thermocouple leads passing out past the refractory plug

Figure 6: The reactor test system, the vacuum system, and the hydrogen generator all connected.   Power supply seen at right.

2.0 The Experimental Procedure

2.1 Fuel is added into the crucible in the reaction vessel, and the fuel is initially pre-treated.

2.2 The experiment formally began on January 18, 2016 at 22:50 hours and lasted 15 hours.   Beginning on January 19, 2016 at 13:50 hours the furnace temperature was slowly raised at to 1050°C.   After two cooling and warming cycles, the final reaction vessel temperature was higher than the tube furnace temperature by 42-50°C, which it maintained for 150 minutes until the end of the experiment.

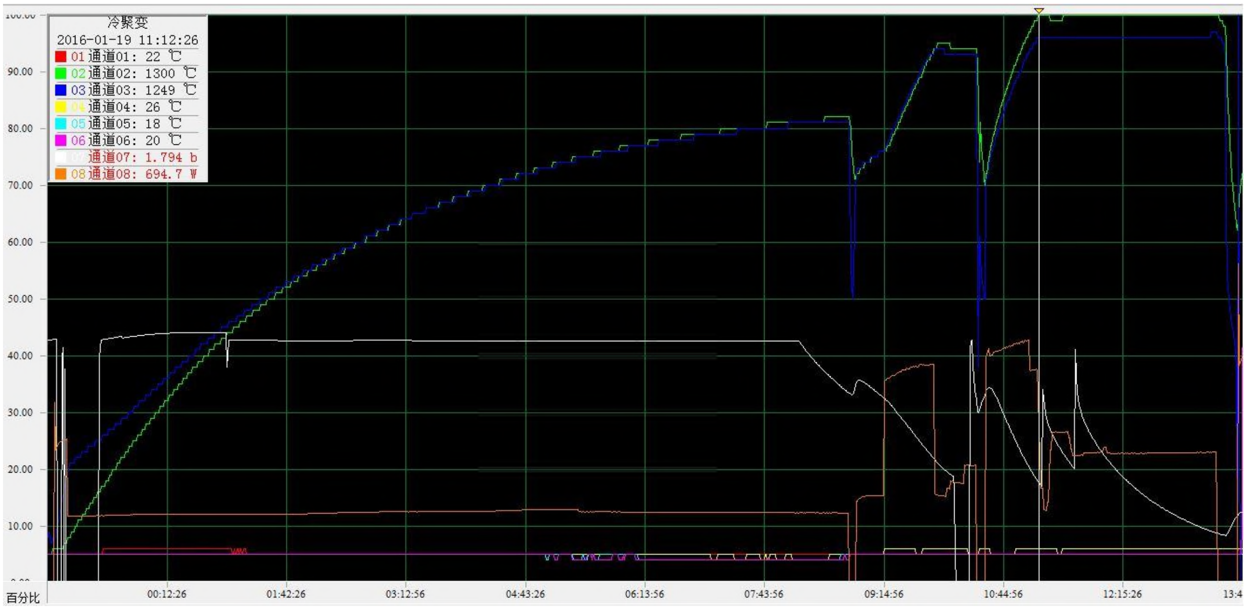

Figure 7: Computer display of temperatures, pressure, and heater power

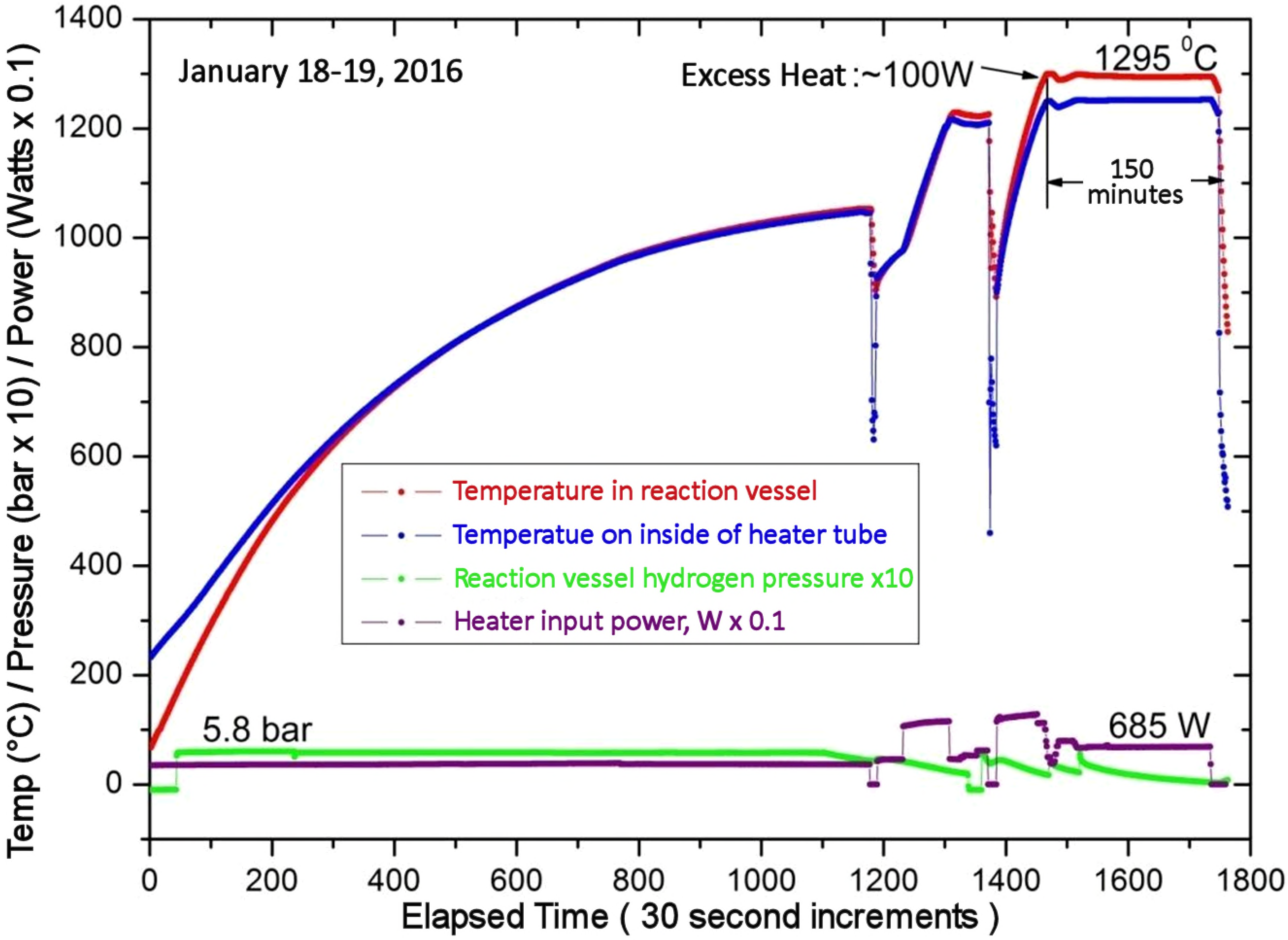

Figure 8: Relationship between temperature and heating power

3.0 Conclusion

An abnormal exothermic phenomenon was observed between nickel and lithium aluminum hydride fuel. The exothermic reaction lasted for 150 minutes. The temperature measured by the thermocouple at the outer wall of the reaction vessel was maintained 40-50°C higher than the temperature of the thermocouple is installed between the reaction vessel and the furnace tube. This temperature rise is estimated to correspond to 100 watts of excess heat produced within the reaction vessel. An excess heat of 100 watts with an input power 682 watts is a ratio of 0.14 [and a COP of 1.14].

Multiplying the 150 minute duration by the ~100 watts of excess heat, the excess energy is calculated to be approximately 0.9 MJ. The maximum possible energy yield of the chemical reaction to 36 kJ; thus, the excess energy measured in this experiment exceeds the possible chemical energy by a factor of 25.

Follow-up experiments will continue to attempt to improve the excess heat output.

Acknowledgements: The author is grateful for guidance by his teacher, Songsheng Jiang!

Postscriptum: The author supplied the following image of the hot reaction vessel being extracted from the tube furnace during an experiment. The image elucidates well the assembly and thermocouple placement.