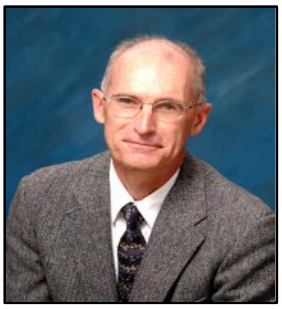
Investigation of the Nickel-Hydrogen Anomalous Heat Effect



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Experimental work was undertaken at The Aerospace Corporation to reproduce a specific observation of the gas-phase Anomalous Heat Effect (aka LENR).[1] This task required the production of a quantity of heat energy by a mass of material so small that the origin of the energy cannot be attributable to a chemical process. The goal is to enhance its credibility by reproducing results first demonstrated in Japan and later reproduced in the U.S. by a solitary investigator. The technique heated nanometer-sized Ni:Pd particles (20:1 molar ratio) embedded in micron-sized particles of an inert refractory of ZrO_2. It was not within the purview of this work to investigate the physical origin of the AHE effect or speculate on its source.

An apparatus was built that comprised identical test and a reference heated cells. These thermally isolated cells each contained two thermocouples and a 10 cm^3 volume of ZrO_2NiPd particles. Calibration functions to infer thermal power from temperature were created by electrically heating the filled cells with known powers when they were either evacuated or pressurized with 1 bar of N_2. During the experimental trial, the test cell was pressurized with hydrogen and the control cell was pressurized with nitrogen. After conditioning the cells, both were heated to near 300°C for a period of 1000 hours (40 days). During this period, the test cell registered 7.5% more power (approximately 1 W) than the input power. The control cell measured approximately 0.05 W of excess power. The error in the excess power measurement was ±0.05 W.

Time-integrating the excess power to obtain an excess energy and normalizing to the 20 gram mass of the ZrO_2NiPd sample yields a specific energy of 173 MJ/kg. Assuming that the active material is the 5.44g of Ni+Pd yields a specific energy of 635 MJ/kg. For comparison, the highest specific energy of a hydrocarbon fuel (methane) is 55.5 MJ/kg. The highest chemical specific energy listed [see Energy Density in Wikipedia] is 142 MJ/kg for hydrogen compressed to 700 bar. Based on these results, it is unlikely that the source of heat energy was chemical in origin.

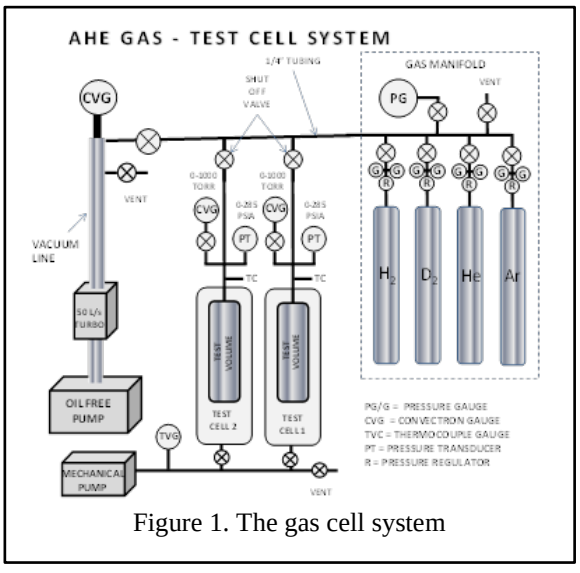

Figure 1. The gas cell system

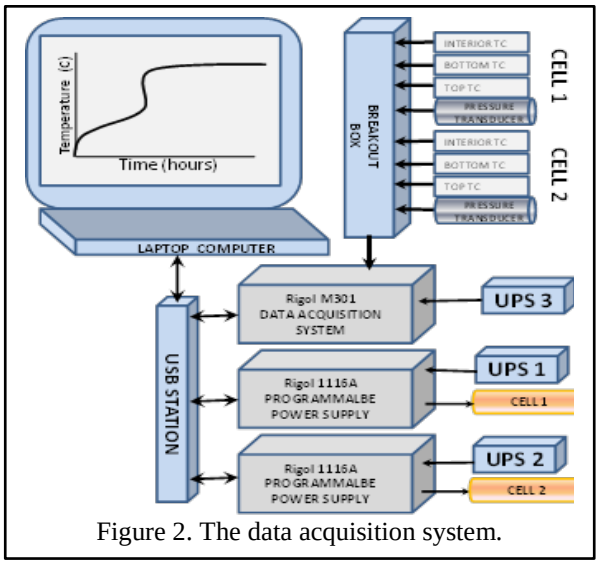

Figure 2. The data acquisition system.

[1] E. Beiting, "Investigation of the nickel-hydrogen anomalous heat effect," Aerospace Report No. ATR-2017-01760, The Aerospace Corporation, El Segundo CA, USA, May 15, 2017.