Error Analysis in D(H)/Pd Gas-loading System

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Previously, referring to Focardi's earlier work[1], nearly one hundred watts of excess heat power was measured by using isothermal calorimetry in the hydrogen/palladium and deuterium/palladium gas-loading systems[2,3]. In order to verify the reliability and accuracy of the measured excess heat, a large volume and high power heat-flow (Seebeck) calorimeter[4] was introduced into the D(H)/Pd gas-loading system.

An ideal calorimeter will fully sense and measure the heat released inside the reaction chamber. But in the actual situation, the generated energy can not be collected completely for some seasons, leading to a part of the heat escaping to the outside of the system before measurement. A high-precision calorimeter will minimize this part of the heat as less as possible.

Due to the structure of the reaction chamber (calorimeter) and the differences of the thermal conductivities of the gases used in the calibration and triggering experiments (nitrogen and deuterium respectively), the chamber will have different temperature gradient and the generated energy will not be totally measured.

The different temperature gradient leads to errors when calculating the excess heat power using isothermal calorimetry. In the heat-flow calorimeter, this part of energy would be misunderstood as excess energy due to heat escaping. According to the experimental data, it can be concluded that the error is not obvious at low applied power, and it increases significantly with the increase of applied power.

References

[1] Focardi S, Gabbani V, Montalbano V, et al. Large excess heat production in Ni-H systems. IL Nuovo Cimento A, 111 (1998), 1233-1242
[2] Tian Jian, Lu Xin, Shen Bingjun, et al. An excess heat phenomenon triggered by pressure in a H/Pd gas-loading system. Advanced Materials Research, 399-401(2012), 1433-1438
[3] Tian, J., et al., Excess Heat Triggered by Different Current in a D/Pd Gas-loading System. J. Condensed Matter Nucl. Sci., 2014. 13.
[4] Zhang Wushou. Construction, calibration and testing of a decimeter-size heat-flow calorimeter. Thermochimica Acta, 499 (2010), 128-132