Progress in Energy Generation Research using Nano-Metal with Hydrogen/Deuterium Gas

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The field of condensed matter nuclear science originated in 1989 with Fleischmann and Pons' electrolysis of Pd with heavy water. Electrochemistry is an excellent method for packing deuterium into Pd metal at high density. However, from the perspective of using the excess heat generated for practical purposes, temperature increase of a few degrees in room temperature heavy water does not have much practical impact, although it was an epoch-making event from scientific point of view.

On the other hand, various phenomena such as anomalous heat generation and nuclear transmutation, which occur when deuterium or hydrogen gas interacts with metals such as Pd, Ni, and Ti, were reported from a very early stage. Among them, Ni began to attract attention from industry because of its abundance on earth, lower cost, and its ability to react with hydrogen at several hundred degrees centigrade. It also became increasingly clear that nanoscale metals were important for inducing anomalous reactions.

Recently, there has been an increasingly strong demand around the world for energy sources that do not emit CO_2 to prevent global warming. Hydrogen energy using nano-metal in this field could be just the technology to meet this global social demand.

In this presentation, we will briefly review the research on anomalous heat generation induced by the interaction of hydrogen or deuterium gas with nano-metal. We will also describe recent progress in our research team.

We have been studying energy generation using nano-sized multilayer metal composites with hydrogen gas. Two nano-sized metal multilayer composite samples, which were composed of Ni, Cu, and the other thin films on bulk Ni (25mm×25mm×0.1mm), were used. These samples were fabricated by Ar ion beam or magnetron sputtering method. Heat burst and excess energy generation were observed during the experiments under vacuum condition (< 10^{-5} Pa) using nano-sized metal multilayer composites on Ni substrate and hydrogen gas. Up to now, the value of averaged released energy evaluated with total amount of absorbed hydrogen reached as high as 21 keV/H or 2.0 GJ/H-mol [1]-[2].

We will talk about “heat burst phenomena induced by intentional change of input electrical power”, radiant calorimetry of excess heat production” and “optical observation of spontaneous heat burst phenomena.

References

[1] Y. Iwamura et.al, *J. Condensed Matter Nucl. Sci.* **33** (2020) 1–13.

[2] Y. Iwamura et.al, Proceedings of 21st Meeting of Japan CF-Research Society, December 11-12, 2020, Online Meeting, to be published.