

A new challenge -nano processing and properties of Mg based materials for energy storage

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We are aiming at development of novel Mg-based materials for hydrogen energy storage, which may provide hydrogen fuel for high temperature fuel cell, using waste heat for continued hydrogen desorption. Principle of concept calculation of Mg-based energy storage working with SOFC, including heat transfer modeling was done.

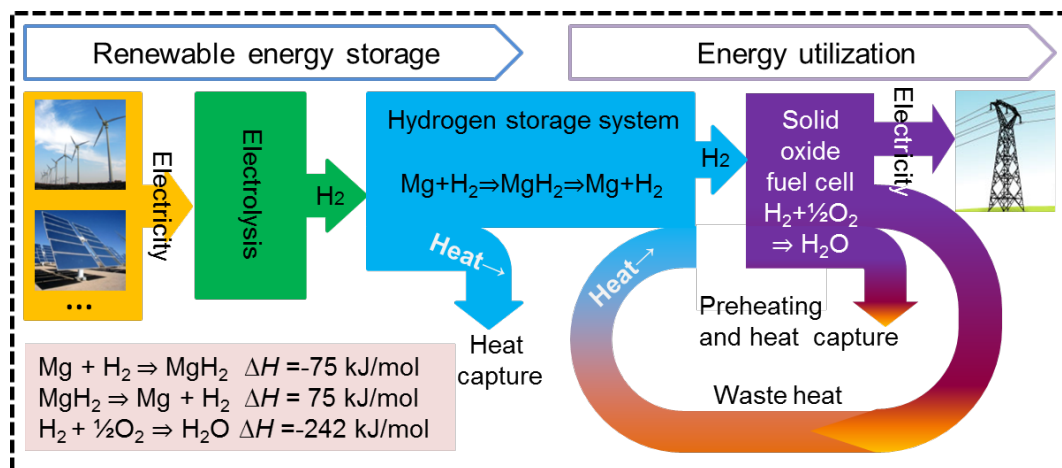


Figure 1. Mg-based hydrogen storage materials in future energy storage and utilization route.

Several nano processing methods have been used for material synthesis-ball milling (mechanical method), hydrogen plasma-metal reaction and sputtering thin film formation (physical method), catalyzed solution synthesis (chemical method)¹. Effect of downsizing on kinetics and thermodynamics was studied. Nano processing is necessary to obtain materials with fast hydrogen absorption/desorption kinetics. However, poor thermal conductivity in nanomaterials limits the reaction rate². We found using thin film morphology can achieve both rapid kinetics and thermal conductivity. Preliminary result shows over 10 times improved thermal conductivity, which implies that nano plate-like materials (not thin films) can be one possible future solution.

We also demonstrate in lab-scale the concept of renewable energy storage and utilization route connecting hydrogen production, hydrogen storage, fuel cell, etc. technologies.

¹H. Shao, G. Xin, J. Zheng, X. Li, E. Akiba, *Nano Energy*, 1 (2012) 590–601.

²E. Toberer et al., *Annual Review of Materials Research*, 42 (2012) 179-209.