

Hydrogen cycling effect on MgH₂ nanocomposites

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MgH₂ is a very attractive material for safe and cheap solid-state hydrogen storage, due to a high theoretical gravimetric capacity, to the reversibility of the reaction with hydrogen and to a relatively low cost. Nanostructured composite materials obtained by ball milling MgH₂ with different additives (Fe, Nb₂O₅ or carbon-based materials) [1] were studied by a microstructural and kinetic point of view. The evolution of MgH₂ ball-milled during a sequence of hydrogen absorption and desorption reactions at different experimental conditions was explored by the Scanning Electron Microscopy (SEM) and by the analysis of the kinetic curves, in order to derive information about the reaction rates and the rate limiting step. The main features coming up by the cycling procedure was the presence of micrometric structures protruding from the particle surface and of hollow particles constituted by empty nanometric MgO shell box. Despite the microstructural evolution, the kinetics slightly changes in terms of H₂ capacity and sorption rate. Focusing the attention to the application of these metallic hydrides inside tanks for hydrogen storage, studies were carried out with MgH₂-based pellets prepared with the addition of Nb₂O₅ and carbon based materials [2]. The sorption kinetic of the pellets was studied revealing the material to have a similar kinetic with respect to the powder. SEM observations of the inner core of the pellets, before and after the cycling process, were performed. The effects of air exposure were also investigated.

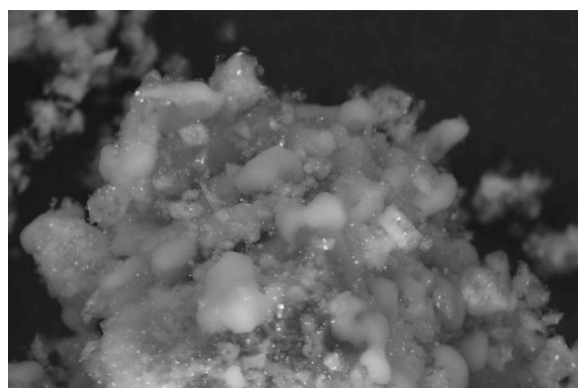


Fig.1 Secondary Electron image of ball-milled MgH₂ with Nb₂O₅ as additive after cycling.

References

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2. S. Garrier, A. Chaise, P. de Rango, P. Marty, B. Delhomme, D. Fruchart, S. Miraglia, Int. J. Hydrogen Energy 36 (2011) 9719