

Synthesis and characterization of nanocrystalline $LaNi_5$ hydrogen storage materials

B. Joseph¹, B. Schiavo²⁻³, B. R. Sekhar¹, G. D'Alì²⁻³

¹*Institute of Physics, P.O. Sainik School, Bhubaneswar, 7511 005, India*

²*Dipartimento di Fisica e Tecnologie Relative-DIFTER, Università di Palermo, Italy*

³*Istituto Tecnologie Avanzate, Trapani, Italy*

With the growing environmental concerns of greenhouse gas emissions from the burning of fossil fuels, it is becoming increasingly important to switch to cleaner alternative fuels such as hydrogen [1]. Inter-metallic $LaNi_5$ is one of the most widely used and studied solid-state hydrogen storage material – a pet material for the prototype systems using hydrogen fuel. However, *nanostructuring* effects on this systems are not yet fully explored. Recently we have carried out systematic studies regarding the effect of nanostructuring on the hydrogen sorption properties of this material [2]. Unlike some other potential hydrogen storage materials, which shows faster kinetics upon nanostructuring, the long time ball-milling of the bulk $LaNi_5$ results in the formation of an *anomalous-state* resistant to hydrogen absorption-desorption reactions. In this contribution, we present the preliminary differential scanning calorimetry (DSC), x-ray diffraction (XRD) and x-ray photoemission spectroscopy (XPS) data on the nanostructured $LaNi_5$ powders. XRD and XPS results indicate the long-time ball-milled and annealed $LaNi_5$ to be of pure nanocrystalline phase. DSC results indicate a partial elimination of defects at 500°C, in a more efficient way for the short-time ball-milled powders compared to the long-time ball-milled samples. These results will be discussed in the light of the hydrogen sorption properties of the bulk and nanocrystalline $LaNi_5$ samples.

[1] S. Kahn Ribeiro, *et al.*, 2007: *Transport and its infrastructure* in *Climate Change 2007: Mitigation*. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Also available at <http://www.ipcc.ch/ipccreports/ar4-wg3.htm>

[2] B. Joseph, B. Schiavo, *J. Alloys Compd.* (2009-in press) [doi:10.1016/j.jallcom.2009.02.062](https://doi.org/10.1016/j.jallcom.2009.02.062)