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Graphene and carbon nanostructures/magnesium hybrid materials for hydrogen storage

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The shortage of non-renewable fossil fuels (petroleum, coal, oil, gas) and the increasing worldwide demand for energy together with the increasing widespread pollution make imperative developing new types of "green" energies sources. It is estimated that the world will need to double its energy supply by 2050 calling for new methods to produce, convert and store energy. The latter is considered as one of the most challenging objective for achieving an economy based on renewable energy sources. However, to date there are no efficient systems to store energy in large amounts. A promising solution is to accumulate energy in a chemical form using hydrogen, which can then be conveniently transported as a gas or stored. In this work we present recent developments in the research for magnesium/graphene, magnesium/carbon nanostructures hybrid materials and their hydrogen-storage properties. MgH_2 was synthesized by decomposing n-Dibutyl-Magnesium leading to direct formation of MgH_2 nanoparticles on the carbon substrates. TEM images show that the size of the MgH_2 particles formed on these substrates can be as low as 1-5 nm in diameters. It is demonstrated that demonstrate that playing with these nanoparticles the Mg-H bond enthalpy lowers. Experimental data show that the H desorption temperature lowers from 350°C typical of bulk MgH_2 to 140°C improving the system efficiency. However, still there are open challenges including of synthesis optimization, nanoparticle stabilization on the support and tank design to obtain an efficient hydrogen storage system. Perspectives for use these materials for mobile applications will be also discussed.

Biography

Giorgio Speranza is a Physicist graduated at University of Trento, Italy. He is Senior Researcher at the Fondazione Bruno Kessler, Trento. He is expert in material science and characterization of material surface properties by x-ray photoelectron spectroscopy. He is active in the areas of carbon nanostructures including graphene, carbon nanotubes, carbon dots for energy and biomedical applications. He has published more than 150 papers in reputed journals and has been serving as an Editorial Board Member of reputed journals.

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