MAR09-2008-002559

Abstract for an Invited Paper
for the MAR09 Meeting of
the American Physical Society

Nanomaterials for Hydrogen Storage

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The success of a hydrogen economy critically rests on our ability to find materials that can store hydrogen with large gravimetric and volumetric densities and operate at near ambient conditions. To meet the large gravimetric density requirement, the storage materials must be lighter than Al. Unfortunately, in these light materials hydrogen is bound either too strongly or too weakly, thus leading to poor thermodynamics. I will discuss how the chemistry of these elements can be manipulated at the nanoscale so that hydrogen can be stored in quasi-molecular form with binding energies that are appropriate for near ambient conditions. Examples will include functionalized carbon fullerenes and nanotubes and doped AlN nanostructures. Using carbon nanostructures as catalysts I will demonstrate unambiguously the dehydrogentation mechanism of sodium alanate. A cluster perspective of the intermediate phases in the dehydrogenation of borohydrides will also be presented.