FLORIDA STATE UNIVERSITY

Planning Grant: Hydrogen storage using carbon-based adsorbent materials

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Description: We propose to theoretically investigate a variety of carbon based nano-porous materials, such as activated carbon or single-wall or multi-wall carbon nanotubes, which can be used to store and transport hydrogen. We find that by doping with metallic elements, the micro-surfaces of these carbon-based porous materials provide increased van der Waals forces to the adsorbed hydrogen molecules; this effect significantly enhances the volumetric energy density for hydrogen storage and we propose to carry out a full theoretical investigation to find the optimum conditions.

Budget: $15,000

Progress Summary

As a result of the realization that the originally proposed project has low funding priority we have recently turned our attention to a different idea which was not included in our original White Paper. The idea is to use a radically different class of materials to produce highly efficient solar cells. We have found that the photovoltaic effect, which as it is well known works with doped band insulators, works in addition, with a class of materials which are called Mott-Insulators. Namely, first, we can show that a p-n junction can be produced by making an interface between a p-doped and an n-doped Mott-insulator. Most importantly, we find that if we appropriately choose these materials to be narrow-band and narrow-gap Mott-insulators they give rise to very high quantum efficiency. We find, theoretically, that a solar photon when it is absorbed by the type of device produces several electron/hole pairs and only very little amount of energy is dissipated by photon emission or other dissipative processes. We are in the process of using Molecular Beam Epitaxy to produce the first such device.