Encapsulation of Palladium Nanocrystals into Reduced Graphene Oxide: Structural Effect on the Hydrogen Storage Properties

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For the demand of green energy, hydrogen has attracted much attention along with its inexhaustible property, and various hydrogen storage methods have been exploited including material-based one such as metal hydrides. There have been consistent efforts to improve hydrogen storage properties based on the confinement of metal hydrides into a matrix material. To achieve a sustainable solid-state hydrogen storage, it is imperative to understand the nature of structure-property relationships between host materials and metal hydrides. Specifically, palladium (Pd) has been studied as a model system to investigate the hydrogen sorption mechanism. Here, we prepared Pd nanoparticles encapsulated by reduced graphene oxide (rGO) to identify structural effects of rGO on the hydrogen storage property. In the system, rGO was expected to affect a thermodynamic property of PdH_x upon hydrogen sorption. It is shown that the rGO encapsulation has a greater effect on the hydrogen sorption dynamics than an intrinsic nanosizing. Our results provide a general platform for the future design of a variety of host-metal hydride nanocomposites.