Graphane green synthesis by hydrogenation of graphene oxide by atomic hydrogen spillover platinum nanoparticles for hydrogen storage

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Graphane is the next interest of graphene derivatives material research. It has been theoretically predicted, simulated, and recently synthesized by using liquid ammonia at low temperature or plasma low pressure or ultra-high pressure hydrogenation. These methods are either non-environment friendly or in a specific technical condition, which causes the limitation for further fabrication techniques of using graphane in its applications. Here we report that highly hydrogenated graphene can be synthesized at room temperature by atomic hydrogen generated via H_2 dissociate and spillover platinum nanoparticles. The resulting hydrogenated graphene was characterized in detail. The HRG has a high level of graphene oxide reduction with C:O ratio as high as 22, which is one of the highest values ever reported for chemically converted graphenes. The hydrogen storage capacity reached 8.2 wt% in the HRG/Pt 1wt% nanocomposite. This HRG/Pt allows storage of hydrogen in amounts that exceed the capacity of the gravimetric target announced by the U.S Department of Energy.