Effects of nitrogen doping of graphene/magnesium nanocrystal composites on hydrogen storage kinetics

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Metals and other complex hydrides have been extensively studied for solid-state hydrogen storage because of their high storage density; however, strong binding enthalpies, sluggish kinetics, and poor oxidative stability impede their practical use. Among different strategies, encapsulating metal hydrides with graphene derivatives can be pragmatic since it allows metal hydrides to have an air-stability due to its hydrogen selective permeability, simultaneously offering a catalytic function. Additionally, graphene derivatives limit the growth of magnesium crystals to few nanometers in their size.
In this study, nitrogen elements were doped over graphene layers by thermal annealing of reactants at various temperature to boost hydrogen storage kinetics of graphene/magnesium nanocrystal composites. Heteroatom doped graphene acts not only as a support but also as a catalyst for (de)hydrogenation. It was shown that the annealing temperature upon the preparation of doped graphene plays a key role in determining its structure and doping density, leading to an optimized platform for superior hydrogen storage performance.