Improved hydrogen storage performance of Mg via thin nanosheet structure catalyzed by 1D carbon matrix

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Hydrogen has attracted attention as a promising substitute for the current petroleum-based energy system because of its high energy density and environmentally benign properties. However, a safe and efficient hydrogen storage in the gas phase remains insurmountable due to its inherent explosion hazard. Therefore, various solid-state storage methods have been explored; however, they suffer from a lack of reversibility or harsh storage conditions. Here, we report a stable and fast solid-state hydrogen storage platform using Mg nanosheet decorated with 1D carbon matrix. Mg has distinctive advantages for hydrogen storage due to its cost-effectiveness and high reversible storage capacity, while sluggish sorption kinetics limits its practical application. Hydrogen storage properties can be improved by reducing thermal stability of MgH_2 and/or accelerating hydrogen diffusion through nano-sizing or use of catalysts. A thin Mg nanosheet is contrived for the first time, enabling fast hydrogen diffusion into Mg. Also, we demonstrate morphology-dependent catalytic effect of 1D carbon matrix on hydrogen sorption of Mg, in which Mg-C interaction promotes dis/association of hydrogen molecule.