MgH_2 confined in a graphene-organosilica heterostructure for hydrogen storage

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Hydrogen is a promising alternative fuel that can push forward the energy transition because of its high energy density (142 MJ kg^{-1}), variety of potential sources, low weight and low environmental impact, but its storage for automotive applications remains a formidable challenge.[1] MgH_2, with its high gravimetric and volumetric density, presents a compelling platform for hydrogen storage; however, its utilization is hindered by the sluggish kinetics of hydrogen uptake/release and high temperature operation. Confinement of MgH_2 in nanoporous supports has been demonstrated to be an effective way to improve hydrogen desorption properties, since the particle size can be easily controlled by modifying the pore size of the scaffolds, and the direct inter-particle contact is avoided, which can further prevent particle agglomeration.

In this presentation, I shall discuss about our recent work, where we developed a novel layered heterostructure of reduced graphene oxide and organosilica with high specific surface area and narrow pore size distribution, which serve as a scaffold to host MgH_2 nanoparticles with a narrow diameter distribution around ~2.5 nm and superior hydrogen storage properties. Reversibility tests demonstrated that the dehydrogenation kinetics and re-hydrogenation capacity of the system remains stable over four cycles. Our results prove that MgH_2 confinement in a nanoporous scaffold is an efficient way to constrain the size of the hydride particles, avoid aggregation and improve kinetics for hydrogen release and recharging.[2]

References

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