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Solid-State Hydrogen Storage: Advancements in Nanoporous Materials and Neutron Scattering Techniques

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Hydrogen, lauded for its potential as a clean energy carrier, occupies a pivotal position in the quest for sustainable energy solutions. Yet, the challenges tied to its safe and efficient storage persist, rendering conventional methods less suitable due to inherent safety risks and high operating pressures. An innovative avenue emerges in solid-state storage within nanoporous materials, which promises significantly enhanced storage densities and improved safety margins.

In this context, we present recent and ongoing research aimed at developing a robust solid-state hydrogen storage system using in situ neutron scattering[1, 2]. This cutting-edge approach has allowed us to provide physical evidence of solidified hydrogen confined in the optimal porous structure. Advanced in situ neutron scattering techniques have been instrumental in this discovery, illuminating the mechanisms at play within the porous materials.

Furthermore, based on the insights derived from this theoretical study, we have engineered porous composites with augmented hydrogen storage performance[3]. The marriage of theory and practical application in this research underscores the potential for solid-state hydrogen storage, opening new pathways toward realizing a more efficient and secure hydrogen energy landscape.

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