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Unraveling Supercritical H2 and D2 Adsorption in Nanoporous Carbon: Insights from Neutron Scattering

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Neutrons serve as invaluable tools for probing hydrogen (H2) storage within porous materials, particularly in the context of investigating supercritical H2 and deuterium (D2) adsorption in nanoporous carbon. Through the application of Small-Angle Neutron Scattering (SANS) and using an analytical scattering function resembling slit pores, corresponding to Meso-, Supermicro-, and ultramicropores according to IUPAC guidelines, allows to fit the SANS signals accurately. Further utilizing a hierarchical contrast model, pore size-dependent densities have been calculated, revealing a noteworthy observation: both H2 and D2 exhibit a tendency to approach solid density within ultramicropores. Moreover, essential exchange of H with D, predominantly present at the surface, has been observed [1]. Further elucidating the dynamics of adsorbed H2, Inelastic Neutron Scattering (INS) and Quasi-Elastic Neutron Scattering (QENS) techniques have been employed in studying ordered mesoporous and microporous carbon structures. This multifaceted investigation sheds light on the mechanisms underlying H2 storage in nanoporous carbon, offering significant insights for future developments in this critical field.
References:
[1] S. Stock, M. Seyffertitz, N. Kostoglou, M.V. Rauscher, V. Presser, B. Demè, V. Cristiglio, M. Kratzer, S. Rols, C. Mitterer, O. Paris, Hydrogen Densification In Carbon Nanopore Confinement: Insights From Small-Angle Neutron Scattering Using A Hierarchical Contrast Model, Submitted for publication. https://doi.org/10.2139/ssrn.4617430.

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