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Porous Energy Materials: From Fundamentals to Applications

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Porous materials play a key role in the development of novel catalysts, but also mobile and stationary energy storage applications, which are important system technologies to promote the use of renewable energies and environmentally friendly electric vehicles.
Metal-Organic Frameworks (MOFs) synthesized in Dresden (named DUT-n) reach specific surface areas up to 6400 m^2/g.[1] They are promising materials for natural gas storage but also reveal fundamentally interesting novel phenomena.[2] The most intriguing phenomena were recently discovered in MOFs showing distinct structural transitions causing counterintuitive adsorption phenomena such as "negative gas adsorption" (NGA).[3] Hierarchical porous carbons are more robust and their high electrical conductivity renders them as highly useful components in the area of supercapacitors, batteries and electrocatalysts.[4] Especially lithium sulfur batteries require materials with a high specific pore volume for sulfur loading.[5,6] Lithium sulfur batteries are considered as highly promising next generation batteries because of the high theoretical capacity. An increase of energy density up to 350-400 Wh/kg is within reach. However, an interdisciplinary approach is needed to resolve remaining challenges of cycling stability due to the subtle interplay of anode, cathode, electrolyte and separator technologies.

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