

# Porous Energy Materials: From Fundamentals to Applications

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## Abstract

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 7800 m<sup>2</sup>/g.<sup>[1]</sup> They are promising materials for natural gas storage but also reveal fundamentally interesting novel phenomena.<sup>[2]</sup> The most intriguing phenomena were recently discovered in MOFs showing distinct structural transitions causing counterintuitive adsorption phenomena such as “negative gas adsorption” (NGA).<sup>[3]</sup> 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.<sup>[4]</sup> Especially lithium sulfur batteries require materials with a high specific pore volume for sulfur loading.<sup>[5,6]</sup> 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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## Biography



Stefan Kaskel studied chemistry at Eberhard Karls University, Tübingen (Germany), and received his Ph.D. degree in 1997 from the same University in solid state chemistry, under the guidance of Prof. J. Strähle. As a Feodor-Lynen Fellow of the Alexander von Humboldt foundation he worked with J. Corbett at Ames Laboratory, USA (1998-2000) on intermetallic compounds. He was a group leader at the Max-Planck-Institut für Kohlenforschung in Mülheim a.d. Ruhr (2000-2004) in the group of F. Schüth and after his habilitation at Ruhr University (Bochum) in 2004 in the area of heterogeneous catalysis, he became full professor for Inorganic Chemistry at Technical University Dresden. Since 2008 he is also business field leader at Fraunhofer IWS, Dresden (part time). Since 2021 he is Dean of the Faculty Chemistry and Food Chemistry (TUD).

His research interests are focused on porous and nanostructured materials (synthesis, structure, function) for applications in energy storage, catalysis, batteries and separation technologies. He has been working on MOFs and porous carbon materials, CVD, CNTs, adsorption, and printing. His major activity at Fraunhofer IWS is the development of lithium sulfur batteries. He received the nanotechnology award of the German Ministry of Science and Education in 2002, the JSPS award from Japan in 2016 and the Lee Hsun-Award of the Chinese Academy of Science (IMR) in 2020. He is Adjunct Professor at Northwestern Polytechnical University, China and Distinguished Visiting Professor at Tsinghua University. He is a Henriette Herz-Scout of the Alexander von Humboldt Foundation and Appointed member of the European Academy of Science.

Stefan Kaskel has authored more than 600 publications (h-index 111) and has contributed as inventor to more than 30 patent applications. He was recognized as a Highly Cited Researcher of world’s most influential scientific minds by Clarivate Analytics.

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