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INSIGHTS INTO THE ADSORPTION AND PHASE BEHAVIOUR OF FLUIDS IN NANOPOROUS MATERIALS: *TOWARDS AN ADVANCED TEXTURAL AND SURFACE CHARACTERIZATION*

Matthias Thommes is Full Professor and Head of the Institute of Separation Science and Technology at the Department of Chemical and Biological Engineering at the Friedrich-Alexander Universität Erlangen-Nürnberg (FAU). Matthias Thommes obtained his Ph.D. in Physical Chemistry in 1993 at the Technical University Berlin. From 1992 to 1995 he was a project scientist at the EURECA mission of the European Space Agency (ESA). In 1996, he moved as an ESA fellow/research associate to the University of Maryland, College Park, USA. In 1998, Matthias joined Quantachrome Corp (Boynton Beach, FL, USA) and was prior to accepting the position at FAU Scientific Director at Quantachrome Corporation, Boynton Beach, USA (from 2001 to 2018). Matthias Thommes' work involves investigating the effects of confinement on the adsorption-, phase- and wetting behavior of fluids in nanopores and developing novel methodologies (e.g., by combining techniques such as advanced adsorption methods, liquid intrusion, NMR relaxometry) for a targeted porous material characterization. Another focus is fundamental research in the area of gas and energy storage. His research forms a link between the adsorption properties of adsorbents and their characteristics with the development of nanoporous materials and their use in various applications and processes.

Nanoporous materials (e.g. carbons, zeolites, metal organic framework materials, ordered and hierarchically structured meso-macroporous oxides etc.) have been the subject of extensive research targeted towards a wide range of applications because of their unique textural properties (e.g., increased surface area and the ability to customize the pore size and pore size distribution). In addition, unique nano-confinement effects including shifts in the phase diagram of pore fluids and altered thermophysical properties can be observed. In order to utilize effects of nano-confinement in various application areas (e.g., separation, catalysis, gas-energy storage) a detailed understanding of the interplay between effective fluid-fluid and fluid-(pore) wall interactions on the one hand and the effects of confined pore space and pore geometry/pore network on the other hand is required.

Within this context, we discuss important aspects associated with the adsorption-, phase- and wetting behaviour of fluids in nanoporous materials and link these with recent advances in the development and application of advanced and novel adsorption methodologies for assessing key aspects of (i) their pore network characteristics (e.g., pore connectivity, characteristic parameters correlated with of pore network disorder/restrictions), and (ii) pore surface properties (e.g., hydrophobicity/hydrophilicity).