

Title Metal-organic frameworks, (MOFs) for water sorption for cycling heat transformation processes

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Abstract

Water-stable MOFs with suitable water uptake capacity are gaining attention for reversible cycling water sorption in order to achieve low temperature heat transformation applications in adsorption heat pumps (AHPs), following our first report [1]. AHPs may be alternatives or supplements to conventional compression systems operating with high input of electricity. By using low grade heat as the driving energy, AHPs can significantly help to minimize electricity consumption. AHPs are based on the evaporation and consecutive adsorption of coolant liquids, preferably water. The process is driven and controlled by the microporosity and hydrophilicity. Yet, the specific temperature boundaries for evaporation, desorption, heat rejection temperature from the adsorbent and the condenser for a desired cycling water sorption application necessitate the tailoring of the adsorbent in terms of hydrophilicity/hydrophobicity for optimized working conditions, which we have addressed here with a mixed-linker concept of MOF-160/CAU-10-H [2]. Further, for applications of MOFs one of the biggest current issues is to find effective methods to shape these microcrystalline, powdery materials into manageable forms such as monoliths, pellets or surface coatings with sufficient mechanical and chemical stability, maximal bulk density etc. under preservation of the crucial MOF porosity properties. We have approached this task successfully with MOF@polymer in different binder composites under retention of MOF porosity and hydrophilicity [3].

[1] S. K. Henninger, H. A. Habib, C. Janiak, MOFs as adsorbents for low temperature heating and cooling applications;

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[2] C. Schlüsener, M. Xhinovci, S.-J. Ernst, A. Schmitz, N. Tannert, C. Janiak, Chem. Mater. 2019, 31, 4051-4062.

[3] S. Gökpinar, S.-J. Ernst, E. Hastürk, M. Möllers, I. El Aita, R. Wiedey, N. Tannert, S. Nießing, S. Abdpour, A. Schmitz, J. Quodbach, G. Földner, S. K. Henninger, C. Janiak, Ind. Eng. Chem. Res. 2019, 58, 21493-21503..

About the Speaker

Christoph Janiak studied Chemistry at the Technical University Berlin (TUB) and the University of Oklahoma. He obtained his PhD at TUB in 1987, followed by postdoctoral stays at Cornell University and at BASF AG, Ludwigshafen in the polyolefin division. From 1991-1995 he carried out his Habilitation at TUB. Following a non-tenured professor position at the University of Freiburg from 1996-1998 he got tenure there in 1998 as Associate Professor for Inorganic and Analytical chemistry. In November 2010 he moved to the University of Düsseldorf as Full Professor (Chair) for Nanoporous and Nanoscaled Materials. His research interests include the properties and utilizations of metal-organic frameworks, covalent triazine frameworks and metal nanoparticles. Christoph Janiak has co-authored over 600 research papers, book contributions and patents with an *h*-index of 86 (Google Scholar). Christoph received a 'Fonds of the Chemical Industry' fellowship and award (1985-1987, 1988), the Heinz-Maier-Leibnitz award (1991), the ADUC award for Habilitands (1996), a Heisenberg fellowship award (1997), was a visiting professor at the University of Angers, France, and at Wuhan University of Technology, China. Currently he is guest professor at the Hoffmann Institute of Advanced Materials at Shenzhen Polytechnic in China He is a Fellow of the Royal Society of Chemistry (FRSC). He teaches the general chemistry, coordination chemistry, main-group chemistry and analytical chemistry and has co-authored several text books on inorganic chemistry (in German).

Registration

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Host Prof. Bidyut Baran Saha

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