

[OB.10.01]

Nanopores through salt templating: Micro- and mesoporous carbons and composites

N. Fechler*, M. Antonietti

Max Planck Institute of Colloids and Interfaces, Germany

The development of more efficient and sustainable synthesis approaches for nanoporous materials is highly demanding. Specifically, porous functional carbons and their composites are very attractive. Yet, besides the quest for convenient precursors, hard templating or activation processes still have to be applied for the introduction of an adequate porosity. Major drawbacks are the use of hazardous chemicals for the template removal and multiple, rather energy consuming synthesis steps.[2, 3]

Herein, we present a new tool called "salt templating", allowing both the synthesis of functional carbons/composites and the introduction of tunable, high porosity.[4] The general concept is based on crosslinking of a carbon precursor in the presence of a molten salt phase which simultaneously acts as solvent and template. This unique synthesis gives access to a wide variety of compositions, morphologies and porosities where the appropriate choice of salts controls the pore size and architecture on the nanoscale. The pore size can correspond to ion pairs, ion pair clusters and their geometric percolation structures. Contrary to current methods, it is possible to proceed in a single-step synthesis, while the porogen can easily be removed with water and in principal recovered afterwards for further use.

Exemplarily shown for (but not restricted to) ionic liquids (IL) as precursors, not only heteroatom-doped carbons but also composite materials can be synthesized. The IL constitutes the nitrogen-doped carbon matrix and also act as nitrogen source, e.g. for metal nitride formation. After aqueous removal of the salt phase, e.g. VN nanoparticles embedded in a nitrogen-doped carbon matrix with surface areas of up to 2400 m²g⁻¹, are obtained.

Adding to the simplicity of the salt templating approach, examples are chosen to demonstrate the potential of the method as a platform toward the rational design of nanoporous materials in a more sustainable fashion.

References

[1] H. Wang, H. Dai *Chemical Society Reviews*, 2013 42, 3088.

[2] K. P. Gierszal, M. Jaroniec *Journal of the American Chemical Society* 2006, 128, 10026.

[3] Y. Zhu, S. Murali, et al. *Science* 2011, 332, 1537.

[4] N. Fechler, T.-P. Fellerger, M. Antonietti *Advanced Materials*, 2013, 25, 75.

Keywords: salt, porous, composite, nitride