Melting and freezing of water in ordered, nanoporous host structures with different surface polarities

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Materials

Goal of my work are structural and thermodynamic studies on the phase behavior of water in ordered, nanoporous host structures with different surface polarities.
The first step on the way to study structural and thermodynamic behavior of water in ordered, porous host structures is the synthesis of the host structure. Several MCM-41 materials were synthesized using the liquid-crystal template mechanism with ionic surfactants as structure-directing agents (SDAs). This is partially done. To begin with the thermodynamic studies of water in these nanopores the melting and freezing points of the inner pore water are studied. These can be done by differential scanning calorimetric (DSC) measurements. In figure 1 the melting and freezing points of some MCM-41 materials are shown.

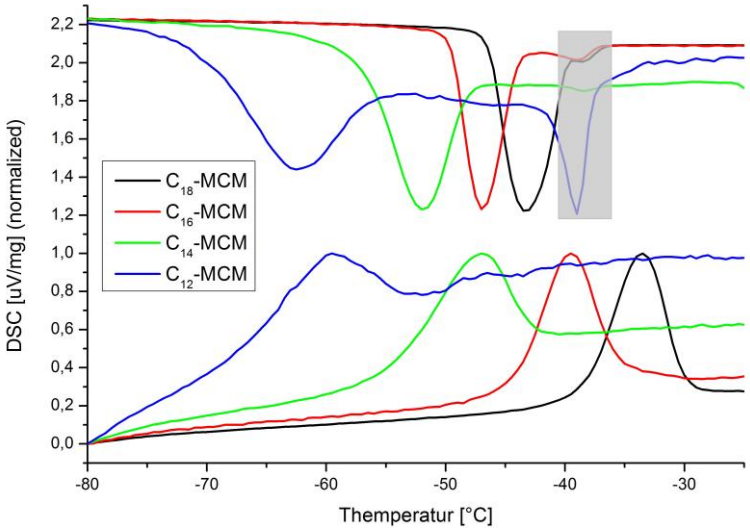

Figure 1: DSC measurements of some MCM-41 materials. Grey region: interparticular water.

How can be seen in figure 1, the melting and freezing points of the inner pore water is strongly depending on the pore size of the material.[1,2]

Further Conception:

Water Physisorption: PMO ↔ Silica: comparison
- same pore size, different surface polarity
- different pore size, same surface polarity

Thermogravimetric analysis (DSC): PMO ↔ Silica
- water melting points
- water freeze points
- same pore size, different surface polarity
- different pore size, same surface polarity
- different water loadings

[1] R. Schmidt, E. W. Hansen, M. Stöcker, D. Akporiaye, O. H. Ellestad, *J. Am. Chem. Soc.* **117** (1995) 4049.
[2] A. Schreiber, I. Ketelsen and G. H. Findenegg, *Phys. Chem. Chem. Phys.* **3** (2001) 1185.