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Periodic Mesoporous Organosilicas as Model Host-Compounds to Study Water in Nanoconfinement

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Periodic mesoporous organosilicas (PMOs) have attracted attention in many research fields, for example catalysis, energy storage or light harvesting.
PMO materials are obtained by a sol-gel process from organo-bridged alkoxysilanes ([(R'O)3-Si-R-Si(OR')3]; R: incorporated organic-bridging group), in presence of structure-directing agents (SDAs). This leads to well-ordered inorganic-organic hybrid systems with cylindrical nanopores, whose diameter (usually in the range from approx. 3 to 10 nm) can be easily adjusted by varying the SDAs. If suitable precursors are used (rigid, π electron-rich) crystal-like pore walls are obtained, in which an alternating sequence of inorganic and organic domains parallel to the pore axis are present. These features make PMOs ideal candidates for studying the behavior of water and other liquids in a nanoconfined environment.
Here, we study the behavior of water in these systems using quasi-elastic neutron scattering (QENS), water vapor physisorption, and differential scanning calorimetry (DSC). In particular, the fluorinated systems are of high interest, due to their very hydrophobic nature and because of other well-known anomalous properties of fluorine.

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