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Surface induced order in ionic liquids

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In supported ionic liquid (IL) phase catalysis, the chemical reaction takes place in a sub-micrometer IL film, wetting a solid support material with high surface area. To understand diffusion of reactants and products across the IL/vapor interface, knowledge of the interfacial structure is crucial.

We employ X-ray scattering techniques to investigate the near surface structure on the molecular length scale. Depending on the molecular architecture of the ILs containing long aliphatic side chains, we observe pinning of bulk correlations at the surface [1] and surface induced smectic order [2]. In the case of surface induced smectic order, lamellar structures extending up to 30 nm into the isotropic bulk are observed.

In microheterogeneous ILs, solvates aggregates site-specifically within high affinity domains. Non-polar molecules, for example, are preferentially situated in the aliphatic regions. At liquid/vapor interfaces, this can strongly affect the near surface structure. For different IL based multi component systems, we observe the formation of monomolecular adsorbate layers and solvate induced surface phase transitions.

Literature:

[1] M. Mezger et al., Proc. Natl. Acad. Sci. USA 110, 3733 (2013).

[2] J. Mars et al., Phys. Chem. Chem. Phys. 19, 2665 (2017).

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