Fundamental aspects of ionic liquid interfaces

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Abstract

Ionic liquids (ILs) are salts with melting points below 100 °C. Typically, they are characterized by an extremely low vapour pressure. Since their physical and chemical properties can be tailored over a wide range, they represent a fascinating class of liquid materials with interesting applications in catalysis. Two important concepts in this context are Supported Ionic Liquid Phase (SILP) and Solid Catalyst with Ionic Liquid Layer (SCILL). In both, a high surface area solid substrate is covered with a thin IL film. In SILP, the film contains a homogeneously dissolved transition metal complex; in SCILL, the film modifies catalytically active surface sites at the support. The interfaces of the IL with the gas phase and with catalytic nanoparticles and/or support materials are thus of critical importance. These interfaces can be investigated in great detail under well-defined ultrahigh vacuum conditions using surface science methods like angle-resolved XPS, STM and AFM, along with in situ deposition of ultrathin IL films on solid supports. Not only information on the surface and bulk composition of non-functionalized and functionalized IL films or the reactivity of catalytically active metal complexes in ILs can be deduced, but also their interfaces can be studied on the molecular level. The obtained information includes the adsorption geometry and growth mode of IL on various support materials. A number of examples will be discussed.

Keywords: Ionic Liquids, SIPL, SCILL, adsorption, photoelectron spectroscopy, STM, AFM