Confining ionic liquids in solid supports

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The peculiarity of the ionic liquids is that they are liquids at room temperature or have melting points below 100°C while keeping their ionic nature and with it several typical ionic properties, such as ultra-low vapor pressures, non-flammability, and high thermal stability [1,2]. In addition, a wide range of different cation and anion choices enable to tailor their solvent properties as desired. These properties can provide superior performance in a range of application, From solvents in catalytic reactions and non-catalytic processes to non-volatile solvents in lithium-ion batteries and lubricants in repellent surfaces, ionic liquids have been proved to be highly beneficial in the engineering industry [3,4].

In some applications, it is crucial to confine an ionic liquid film on a solid surface. In slippery liquid-infused repellent surfaces, a highly stable omniphobic surface is created by locking a lubricating liquid (the ionic liquid) in a nano- or micro-structures, which are previously formed on the substrate of interest [3]. In the same way, though different in its final application, in the supported ionic liquid phase catalysis, a molecular catalyst dissolved in an ionic liquid is confined to a porous solid support [5].

The design of a stable liquid films requires minimization of the interfacial energy between the solid and the liquid phase [6,7].

Here, we show that the chemical anchoring of a thin polymer network film with a chemical composition matching that of the ionic liquid can be used to further maximize the chemical affinity of the ionic liquid to the solid support.

Our strategy consists on the design of active-ester polymers containing that can be subsequently functionalized with amino-functionalized ionic liquid moieties [8]. A crosslinkable group is further polymerized into the polymer chain. The final product is a crosslinked polymeric network with the same chemical composition as the ionic liquid. Such a polymer network is capable to be swollen with ionic liquid and retain it in its structure in the fashion of a super-absorbent material. The active ester platform is very versatile and allows the incorporation of a range of different functional groups to close match the polymer properties to that of the chosen ionic liquid.

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