Precursor Films from Ionic Liquids

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When a liquid drop contacts a solid surface a mesoscopically thin film can spread ahead of the bulk liquid at the three phase contact line region. These films are referred to as precursor films. They are formed when intermolecular forces of attraction between solid and liquid are sufficiently strong to create positive spreading coefficients, inducing spontaneous spreading. Spreading patterns in such films are influenced by the nature of the liquid (e.g. its volatility) and the solid. Ionic liquids are the perfect candidates for precursor film studies due to their negligible vapour pressure.

The presence of a precursor film from a droplet of imidazolium based ionic liquids (ILs) on different types of solids (mica, highly ordered pyrolytic graphite (HOPG), and gold <111>) are investigated. The macroscopic static advancing contact angle of ILs are, depending on the substrate and IL combination, between 9 and 45°, indicating good to partial wetting in such systems. Tapping mode atomic force microscopy (TM AFM) was used to investigate the morphology and thickness of the precursor film, as well as to assess its lateral extent.

Synchrotron based X-ray photoelectron spectroscopy (XPS) was conducted on the precursor film of [HMIM][TFSI] to provide elemental surface analysis as well as to investigate the extent of the interaction of IL ions with the substrate surface.

The morphology of precursor films was found to be substrate dependent with mica promoting the formation of 2D patchy 'films' and HOPG allowing for the formation of the continuous film (see Figure 1). Possible mechanisms as well as the role of chemical interactions between solids and ILs will be discussed.

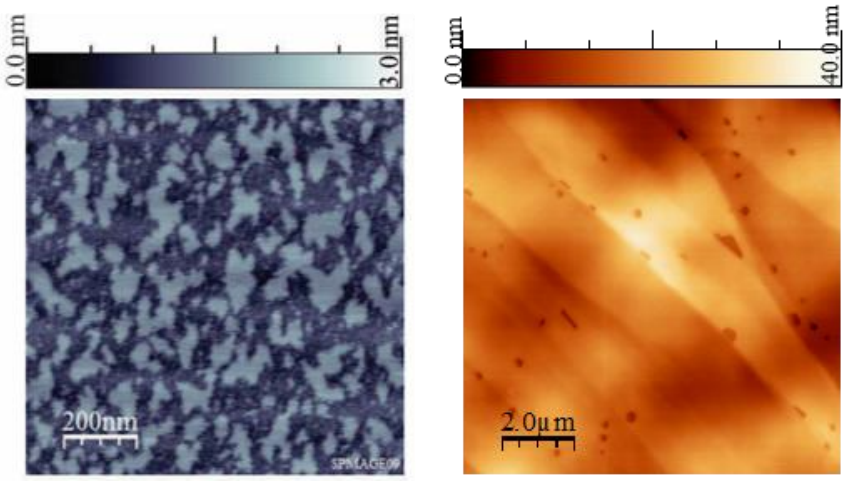

Figure 1. AFM height images of precursor films formed by 1-Hexyl-3-methylimidazolium bis(trifluormethylsulfonyl)imide on freshly cleaved mica (left panel) and freshly cleaved HOPG (right panel).