An AFM study of thin films of [OMIM][BF$_4$]

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The study of solid/liquid interfaces involving ionic liquids is relevant for those applications where ILs are used as thin films deposited on solid surfaces, such as in lubricancy, microelectromechanical or microelectronic devices, electrochemistry and heterogeneous catalysis. Despite the interest of the knowledge of those interfaces, the amount of research in this area is still scarce. Most reported studies are based on sum-frequency generation spectroscopy [1], X-ray reflectivity [2], and a few refer to atomic force microscopic observations [3]. The goal of the present work was to characterize wetting films of [OMIM][BF$_4$], a room temperature ionic liquid with surfactant properties due to the length of the side chain in the imidazolium ring. Several substrates were attempted, namely, silicon, glass, aluminum and chromium and only the last two were wetted by the IL. The films were deposited by spin-coating from ethanol solutions with IL concentrations varying from 0.85 to 20 mg/mL, on aluminum and chromium sputtered silicon wafers. Films with liquid-like structure were observed on both substrates. Solutions with 1.25 mg/mL seem to give a full surface coverage. Less concentrated solutions create islands of uniform thickness rather then completely wetting films. For concentrations above 1.25 mg/mL, the exceeding material forms a layer on top of the interfacial layer with holes that decrease in number when the concentration increases. The following figure shows films deposited on aluminum from solutions with increasing concentration:

AFM pictures of [OMIM][BF$_4$] films deposited on aluminum sputtered silicon wafers from solutions with increasing concentration.