

Electrodeposition in ionic liquids: from nanoscale processes to macroporous materials

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Although ionic liquids are meanwhile well accepted in the field of electrochemistry, with a remarkable worldwide output of papers per year, their interfacial behavior, especially under electrochemical conditions, is far from being understood. Depending on the liquid it can be quite tough to probe by STM the surface of HOPG with atomic resolution, whereas this is a student's exercise with aqueous solutions. Together with Rob Atkin from the University of Newcastle, Australia, we could show that the interfacial behavior of ionic liquids depends on the liquid, on the applied electrode potential and on the level of impurities. A part of the usually wide electrochemical windows of ionic liquids is due to a type of a surface passivation that can be probed both with AFM and STM. As a consequence the electrochemical behavior of ionic liquids depends on the cation/anion combination, the water content and the level of impurities, and LiCl, as an example, has quite a strong effect on the interfacial behavior. This might explain why with one liquid nanocrystalline materials are obtained whereas with an apparently similar one microcrystalline materials are obtained under comparable conditions. This lecture will also show that the low surface tension of ionic liquids allows making a variety of macroporous metals and semiconductors as well as of nanowires, like Si, Ge, Al, Zn and conducting polymers. Such materials are potentially interesting for future battery applications but also, if chemically modified, for dye sensitized solar cells, sensors, catalysts and so on.

References:

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