Supercritical Fluids as Electrolytes for Electrodeposition

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Supercritical fluids are potentially attractive media for the electrodeposition of metals and semiconductors into complex nanostructures; they have essentially zero surface tension so that they can penetrate porous and nanoporous structures, they have low viscosities and show enhanced mass transport rates and, depending on the choice of electrolyte and solvent they can have very wide electrochemical windows. Despite these significant potential advantages there are no examples of electrodeposition from single phase supercritical systems beyond some early work in supercritical ammonia and water.

We have focussed on electrodeposition from supercritical fluids (such as CO2/acetonitrile and hydrofluorocarbons) that have reasonable critical temperatures and pressures and are less corrosive. The work of Abbott’s group on electrolyte solubility [1] and conductivity [2] already suggests that these supercritical fluids might be suitable for electrodeposition.

By developing electrolytes [3-5] and reagents we have been able to use supercritical CO2/acetonitrile and supercritical fluorinated hydrocarbons for the deposition of a range of materials including copper, silver, cobalt, iron and germanium. In this lecture I will provide an overview of this area and its potential applications and I will present some of our recent results on electrodeposition under supercritical conditions.

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References: