

**Studies on the formation of Nano films of
copper by redox replacement of
underpotential deposited Lead with Copper:
Metal EC-ALE.**

C.Thambidurai, J.Kim, Y.G.Kim and

J. L. Stickney⁺

Department of Chemistry, University of
Georgia, Athens GA 30602

Ph: (706) 542 1967, Fax: (706) 542 9454

⁺Stickney@sunchem.chem.uga.edu

⁺To whom correspondence should addressed

Redox replacement of a less noble metal by a more noble metal is an established phenomenon. Recently, there has been some work done on the replacement of metal adlayers by R.R.Azdic, et. al. The same principle has been employed in our group to replace underpotentially deposited (upd) lead by copper at open circuit, and incorporating this into an EC-ALE cycle. Electrochemical atomic layer epitaxy (EC-ALE) is the electrochemical analog of atomic layer epitaxy (ALE), which utilizes surface limited reactions called underpotential deposition (upd) to form atomic layers of elements.

It has been shown that the concentration of dissolved oxygen affects lead upd layer. To reduce this oxygen effect, a thin layer electrochemical cell (TLE) has been used for these experiments. A TLE employs a very small quantity of solution, thereby reducing the effect of oxygen. The upd lead was deposited using a 1mM lead perchlorate solution at -0.40V, which was then replaced by copper in a copper sulfate solution at open circuit. This constituted one cycle. The growth rate was 0.45ML/cycle. However, 0.6 ML of lead was deposited each cycle. The multiple cycles were performed, with 7 cycles producing copper films with a coverage of 3.56 ML. This same system is being studied using an automated flow cell system to grow thicker films of copper.

