

# **STUDIES OF CU ATOMIC LAYER REPLACEMENT, FORMED BY UNDERPOTENTIAL DEPOSITS, TO FORM PT NANOFILMS USING ELECTROCHEMICAL ATOMIC LAYER EPITAXY (EC-ALE)**

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## **Abstract**

Underpotential deposition (UPD) involves the electrochemical deposition of a surface limited layer of an element onto a substrate [1]. If two elements can be deposited by separate UPD processes, an epitaxial compound can be formed using a cycle. This process is referred to electrochemical atomic layer epitaxy (ECALE). EC-ALE is the electrochemical analog of atomic layer deposition (ALD) and atomic layer epitaxy (ALE). However, metals are known to be difficult to deposit in a layer by layer fashion electrochemically [2]. In this presentation, a novel technique of replacing copper UPD by platinum (IV) will be introduced. In this process, a gold (111) substrate was cleaned by solution and argon ion bombardment, and a (1X1) pattern was observed for the surface using low-energy electron diffraction (LEED), after annealing. This gold sample was then transported from the main analysis chamber to an antechamber, and a monolayer of copper was deposited on the gold from a copper sulfate solution, at an underpotential. The gold sample with the Cu UPD was then immersed in a platinum (IV) solution at open circuit, and the copper UPD was replaced by platinum (IV) spontaneously. The gold sample with the platinum was then transported to the main chamber, and the surface was analyzed and quantified by LEED and Auger electron spectroscopy (AES). This was the first study by this group of metal EC-ALE.

## **References**

- [1] M.D. Lay and J.L. Stickney, *J. Electrochem. Soc.* 151, C431 (2004).
- [2] S.R. Brankovic, J.X. Wang, and R.R. Adzic, *Surf. Sci.* 474, L173 (2001).