

Wide pH range electroless copper deposition at room temperature. EQCM and CV study of autocatalytic copper(II) reduction by cobalt(II)-pentaethylenhexamine complexes

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Cobalt(II) complex with pentaethylenhexamine (*penta*) was found to be an effective reducing agent in the autocatalytic reduction of copper(II) to metal (electroless copper plating). It is worth to note, that no hydrogen is formed during this electroless copper deposition process. Cyclic voltammetry (CV) and electrochemical quartz crystal microgravimetry (EQCM) were used to study the autocatalytic copper(II) reduction by cobalt(II) in pentaethylenhexamine (*penta*) solutions. Electroless copper plating was studied by measuring the instantaneous copper deposition rate, open-circuit potential and electrochemical parameters of partial reactions. The process in EQCM measurements provided data on the rate of partial electrochemical reactions both in the separate Cu(II) and Co(II), and the complete electroless plating solutions. The anodic oxidation of the reducing agent, a cobalt(II) complex with pentaethylenhexamine in our case, is one of the two partial electrochemical reactions of the autocatalytic electroless metal deposition process, and its rate is usually the main factor determining the rate of the overall electroless deposition process. Evidently, the electrochemically active and easily oxidizable Co(II) complexes with *penta* are formed in a wide solution pH range, from acidic (pH 4.4) to alkaline (pH 9.5) medium. The maximum copper deposition rate was obtained at pH ca. 5.

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