Effect of the applied voltage on the electrodeposited Ru film

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Electrochemical deposition is an attractive technique to deposit a conformal seed layer because of good step coverage, low tool cost of ownership, and it is amendable to ECD Cu. This technology would have to address the Cu conformal deposition on high aspect ratio (A/R) features with a size of 22 and 33 nm nodes, and three-dimensional devices. In addition, it would need to address the deposition of Pt-Ru alloys for electro-oxidization of methanol. In this work ruthenium was electrochemically deposited onto blanket Ti substrates followed by Cu electrochemical deposition for metallization. Samples were characterized by FE-SEM, XPS, AFM, XRD, and RBS. With increasing voltage FE-SEM images indicated an irregular distribution and a non-homogeneous surface consisting Ru islands on the Ti film. At an optimal applied voltage of 2.0 V the sample was homogeneous and smooth with a RMS roughness of 8.2 nm. X-ray diffraction showed preferential <101> texture but a broad asymmetrical Ru peak at 2Θ= 44.0°. XPS analysis showed the presence of metallic Ru layer. The Ti substrate was stable with respect to ECD Ru but the Ru/Ti bilayer is not stable in the Cu acid bath.