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Characteristics of Thin Cu Films Electrodeposited On Textured Ni-Co Substrates

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Abstract. An attempt has been made to study the effects of current density and the texture of the underlying substrate on electrodeposited copper. For this purpose five Ni-Co alloys, Ni-10 Co, Ni-20 Co, Ni-30 Co, Ni-40 Co and Ni-60 Co, in the cold rolled as well as in the annealed conditions, were used as substrates. Acid copper sulfate solution was used to deposit thin Cu layers on the substrates, using a Cu plate as anode, at four different current densities, 1, 10, 30 and 50 mA/cm^2. The thickness of the electrodeposited Cu layer increased nearly linearly with current density, but was independent of the texture and composition of the underlying substrate. In general, the X-ray diffraction line intensities for the deposited Cu layer sharpened and those for the substrate Ni alloys weakened with increase in current density. The textural developments in the Cu deposits appeared to be quite independent of the textures as well as the compositions of the substrate materials. The deposited Cu layers did not inherit the textures of the substrates at the lower current densities, and also developed their own textures at higher current densities. The Cu (220) peak ultimately became the strongest XRD peak for the electrodeposited layer. The surface roughness of the deposited layers was distinctly smoother for the annealed substrates, as compared to the cold rolled Ni-Co alloys.

1. Introduction

In the present work, five Ni-Co alloys (Ni-10Co, Ni-20Co, Ni-30Co, Ni-40Co and Ni-60Co) in cold rolled and annealed condition have been used as substrates for electrodeposition of Cu. The textures of Ni-Co alloys have been studied previously **[1-3].** As the Co concentration increases, the SFE decreases drastically (for pure Ni, the SFE is 130mJ/m^2). Pure Ni shows a rolling texture of copper or pure metal type, in which the Cu {112}<111>, S {123}<634> and Bs {110}<112> are equally strong. In the Ni-Co alloys, there is a texture transition from the copper type to the α-brass type at a cobalt content of around 40%. When the cold worked Ni-Co alloys having low SFE are annealed, the Bs texture transforms to {332}<113>. The compositions having higher magnitude of SFE (10, 20, 30%Co) yield {100}<001> cube texture. The intermediate composition Ni-40Co exhibits some amount of recrystallized cube texture along with some amount of twin of cube texture {122}<212>.

Electroplating on articles is widely carried out for purposes such as appearance, protection, special surface properties and engineering or mechanical properties. Electrodeposited films have textures, which influence their electronic, magnetic, optical and