A study on < 211> //ND texture formation of Ni deposits

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Abstract

It is known that Ni deposited in a chloride bath can have a strong < 211> //ND texture. Superior thermal stability has been demonstrated of the < 211> textured films as compared to its counterparts having a < 100> //ND, < 110> //ND or < 210> //ND texture, respectively. The formation mechanism of the texture has, however, seldom been discussed. In this work, an ex-situ method was used to study the deposition behavior of Ni onto a polycrystalline Cu substrate in chloride solutions. The orientations of the substrates and Ni deposits were analyzed through electron backscatter diffraction (EBSD), prior to and after the deposition, respectively, to reveal the orientation relationship between each deposit/substrate pair. EBSD analysis was also performed for thick deposits to clarify the growth behavior and microstructural evolution on grains having different orientations. Accordingly, the evolution of the film orientation and microstructure as well as the influence from the substrate were clarified. It was found that Ni deposited epitaxially on the (211) and (100) grains in the initial stage, but partly epitaxially on grains of other orientations. However, the deposited Ni crystals always possessed a shape of edge-on bivalve shell containing two twin-related valves. The valleys formed between the shell-like crystals provided nucleation sites of low activation energies through a twin-nucleation mechanism. Accordingly, the < 211> //ND deposits contains a high density of sigma 3 twins nearly perpendicular to the substrate surface which provide the high thermal stability..

Keywords: Electrodeposition, nickel, < 211> texture, EBSD

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