Structure and Magnetoresistance of Ni/Cu Superlattices Prepared by Electrodepositon

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We have grown a series of Ni/Cu superlattices from a single electrolyte with different electrolyte pH values using potentiostatic method. Polycrystalline Cu sheets and single crystal Cu(100) disks were used as substrates. The total nominal thickness of films was fixed at 1μm. During deposition, the films were characterized by recording current-time transients. It has been observed that the superlattices grown from the electrolyte with different pH values have different growth modes. The structural characterizations were studied by X-ray diffraction (XRD) technique. The XRD patterns show that the films have crystal structure the same as their substrate. The modulation wavelengths calculated from satellite peak positions in the XRD patterns agree quite well with the nominal bilayer thicknesses. After the films are removed from their substrates electrochemically, the magnetoresistance measurements were made at room temperature in a magnetic field of 8 kOe. When the Cu layer thickness is less than 0.6 nm, the films grown at all pH values have the anisotropic (AMR) effect, like a single ferromagnetic film. When the Cu thickness exceeds 0.6 nm, the films show giant magnetoresistance (GMR) effect. For the films with the same bilayer and total thicknesses, the GMR magnitude increases as the electrolyte pH value decreases. These results are similar to those observed in CoNi/Cu superlattices [1]. It may be concluded that electrodeposited superlattices exhibit larger GMR values when they are grown from electrolytes with low pH values.

References:

[1]. M. Alper, W. Schwarzacher, and S. J. Lane, *J. Electrochem. Soc*., 144(7), 2346-2352, (1997).

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