Nanoscale characterization of electroplated, thick permalloy films

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Permalloy ($Ni_{81}Fe_{19}$) films and foils were fabricated by means of electroplating. Two different types of samples were produced, (1) a patterned permalloy film on a Si wafer and (2) a NiFe foil. For samples of type (1), a 4" silicon wafer with a sputtered titanium seed layer of 100 nm and a patterned resist structure acts as the substrate for electroplating. The current density was J = 2 A/dm². The grain sizes of the permalloy samples were measured employing atomic force microscopy (AFM) and transmission electron microscopy (TEM) to be of the order of 50 nm (type (1)) and around 200 nm (type (2)). TEM further reveals that along the substrate, larger elongated grains are located, and after this layer, the regular grain growth sets in. Electron backscatter diffraction (EBSD) was employed to obtain Kikuchi patterns of permalloy, and via them the individual crystallographic orientation of the grains. The samples required a mechanical polishing procedure down to 40 nm colloidal silica particles, yielding a smooth surface with a roughness of nm dimensions. Due to the thickness of the permalloy layer, the Kikuchi pattern of permalloy can be unambiguously identified. With the recently achieved high spatial resolution of the EBSD technique, the individual grain orientations in such samples can be determined for the first time. The EBSD results reveal a fibre-texture of the electroplated permalloy,

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