Magnetism and structure of ultrathin fcc Fe_xCo_{1-x} films on Cu(001) (abstract)

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Ultrathin films of 3*d*-transition metal alloys, and in particular FeCo alloys, currently receive considerable interest because of their potential technological application and the possibility to adjust magnetic properties via the variation of composition and structure. To study magnetic and structural properties of the otherwise unstable fcc phase of FeCo, this structural phase was stabilized by epitaxial growth on Cu(001). Ultrathin Fe_xCo_{1-x} films were deposited at room temperature by coevaporation from two separate Knudsen cells, operated under stabilized conditions. The film thickness was varied between 2 and 9 monolayers (ML) and the Fe concentration between $x=0.2$ and $x=0.95$. The growth process was monitored by medium energy electron diffraction (MEED). Auger electron spectroscopy and low energy electron diffraction (LEED) were employed to analyze the composition and structure of the films. A nearly perfect layer-by-layer growth up to at least 9 ML, as seen by MEED, is encountered for $x\leqslant 0.7$. For higher Fe concentrations and thicknesses greater than 4 ML, deviations from the layer-by-layer growth are observed, indicating a structural rearrangement. LEED-I(V) curves reveal the coexistence of two structural phases with different interlayer spacings, the relative amount of which depends on the composition. Magnetic properties were characterized by the magneto-optical Kerr effect (MOKE). The remanent magnetization was found to lie within the film plane over the whole range of thicknesses and concentrations investigated. A linear increase of the Kerr signal at saturation magnetization with increasing thickness indicates that practically the whole film is magnetic. As a function of composition, the saturation Kerr signal develops continuously with increasing Fe content. This suggests that in fcc FeCo alloys the contribution of Fe and Co to the total magnetic moment is nearly constant over the whole compositional range. [S0021-8979(96)42908-5]

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