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Surface and stability characterization of Fe/Pd thin films

M. Krupska, S. Sowa, A. Duda and N-T.H. Kim Ngan

[1] *Institute of Physics, Pedagogical University, Podchorazych 2, 30-084 Cracow, Poland.*
E-mail: krupska@up.krakow.pl

In our work we are focus on characterizing the stability of Fe, Pd thin films with the (001) texture grown on an amorphous substrates like a SiO_2/Si(001).

Thin films consisted of 10nm Pd/100nm SiO_2/Si(001) and 10nm Fe/100nm SiO_2/Si(001) have been prepared by a thermal evaporation method at a working pressure in the range of 10^{-6} Pa. After thin films preparation samples have been modified by: 1) a rapid annealing at 600°C for 90s or 2) a 1MeV Ar^+ irradiation with different ion fluences. The chemical composition of the films have been defined in the three different states (in the as grown state, after the thermal treatment and after being irradiated) by a Rutherforfd Backscattering Spectrosopy (2MeV He^+ ion beam, scattering angle of 171^0). For the data evaluation, the simulation program SIMNRA was employed. To confirm the data obtained from the RBS measurement, the X-ray reflectivity (XRR) measurements have been performed. To image the surface structure after a post- annealing the Atomic Force Microscope (AFM) and the Scanning Electron Microscope (SEM) have been used.

As an example we show in the picture the results obtained from SEM measurements for the samples after a rapid thermal annealing. In both cases a granular film morphology, similar to that observed in FePd alloy films [1, 2] can be seen. This effect is explained as due to the de-wetting process driven by differences in surface free energy of the Pd/Fe and the substrate.

SEM image of Pd/SiO2/Si(001) (left) and Fe/SiO2/Si(001) (right) upon a rapid annealing at 600oC for 90s

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