CoPt alloys electrodeposition for magnetic applications

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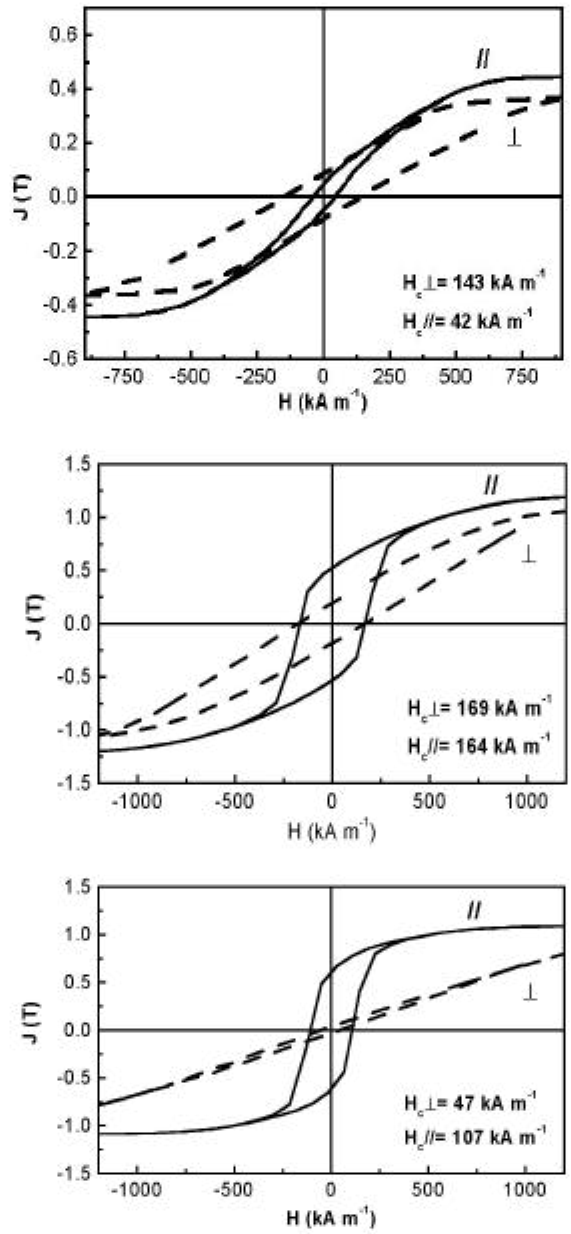
It is very important to obtain permanent micromagnets with in-plane or perpendicular maximum coercivity, according to the magnetic circuit design. The magnetic behaviour of layers of cobalt platinum alloys can be controlled mainly through the deposit P.O.. Controlling the growth it is possible to obtain different microstructures and preferred orientations, and as consequence, different shapes of hysteresis cycles. We obtained by electrodeposition thick layers (> 30 µm) of CoPt alloys from complexed sulfamate alkaline electrolytes with high coercivity and high magnetic moment. Tungsten and zinc were added to improve and control the properties of deposited layers. CoPtW alloys were obtained from sulfamate solutions, containing hypophosphite and ammonium citrate, at pH 8 and 60°C, with a Pt equivalent content in the alloys comprised in the range 8÷24%at. Addition of tungsten lowers the platinum content in the deposited films and allows to obtain strong [00.1] P.O. and perpendicular magnetic behaviour. CoPtZn deposits show different magnetic behaviour and correspondingly different crystallographic structure. CoPtZn deposits with strong *hcp* [00.1] P.O. show perpendicular magnetic anisotropy, those with mixed orientation are magnetically isotropic, and finally those with [11.0] P.O. have parallel magnetic anisotropy. Typical hysteresis cycles are shown in Figure 1.
To evaluate the Pt influence on the alloy ferromagnetic behaviour we have taken XPS patterns for the CoPt alloys and compared them with a weighted sum of the XPS spectra for Co, Pt and Zn. We see the difference reported in Figure 2 that can be related to a shift of some valence electrons of cobalt as a consequence of the cobalt platinum interaction.



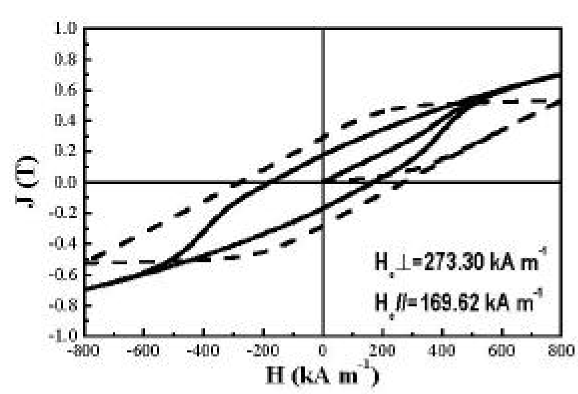


Fig. 1. Hysteresis cycles in perpendicular (dashed) and in parallel (continuous) field of CoPtW (first) and CoPtZn deposits (second through fourth).

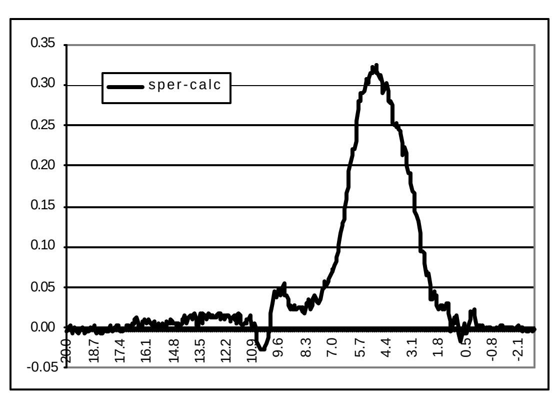


Fig. 2 Difference between experimental and calculated XPS patterns of a CoPtZn deposit (Co 87.48, Pt 9.54, Zn 2.78 at%; thickness 2.1 µm; on Si/Au).