ELECTRODEPOSITION OF Co, Fe, CoFe IN APPLIED HIGH MAGNETIC FIELDS

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The influence of high magnetic fields during the deposition of Co, Fe and CoFe alloys from simple sulphate electrolytes on the electrochemical behaviour, the morphology and structure of the deposits has been investigated in dependence on the magnetic field strength (0-13T) and the orientation towards the electrode, the deposition potential, and the geometry of the cell. All of these parameters affect the convection generated by the applied magnetic field.
When the magnetic field is applied parallel to the surface the main driving force for convection is the Lorentzforce, which leads to the expected increase of the limiting current density and enhanced mass transport to the surface (MHD-effect). The increase of the limiting current density and the onset of convection depend strongly on the cell geometry. It shifts to higher field strength and leads to a decrease of the metal current efficiency in a perfect cylindrical cell without edges Fig.1. In the case of perpendicular-to-surface configuration the Lorentzforce should be negligible but interesting electrochemical and structural effects are observed [1]. In this configuration the limiting current density decreases slightly with increasing B followed by an up and down behaviour in the perfect cylindrical cell without edges Fig1. The hydrogen reaction dominates this process. The morphology of the deposits changes significantly with increasing magnetic field. Without magnetic field the surface is covered with oxides. At 10 T the layer is shiny without any defects and oxides in perfectly cylindrical cells without any adges. In contrast, the layers deposited in a larger cell with edges exhibit, that a rotational convection is induced. In this cell-type the magnetic field generates complex convective phenomena analysed in more detail in [2].

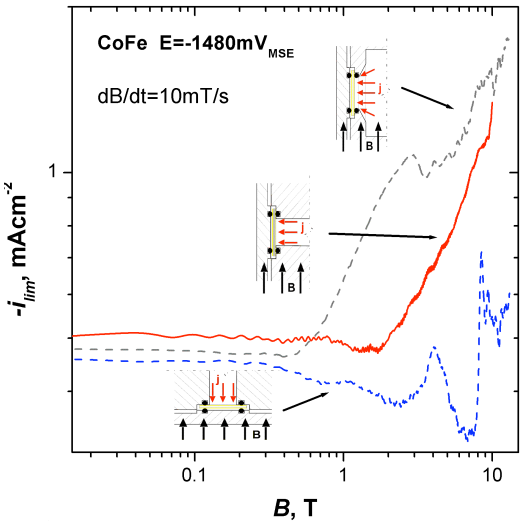

Figure 1: Change of limiting current density for CoFe deposition dependence on B for different cell configuration and magnetic field orientation

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