

THE EFFECT OF A MAGNETIC FIELD ON THE HER, THE PH-VALUE IN FRONT OF THE ELECTRODE AND THE DESORPTION OF HYDROGEN FROM THE ELECTRODE SURFACE

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The electrodeposition of less noble metals is usually overlapped by the reduction of hydrogen ions. This leads to an increase of the pH value in front of the electrode surface which can result in spontaneous formation of hydroxides. This changes the deposition behaviour, the morphology and the properties of the deposits.

The aim of the work was to investigate the effect of an uniform magnetic field applied parallel and perpendicular to the electrode surface, with flux density up to 1 T on the pH value close to the electrode, the hydrogen evolution reaction (HER) and the desorption of hydrogen from the electrode surface during the electrodeposition of Co, Fe, CoFe alloys as well as for the pure hydrogen evolution reaction (HER). Voltammetric and chronoamperometric experiments have been carried out with in-situ pH measurements at the electrode surface [1,2] for the parallel-to-electrode configuration. When the magnetic field is applied parallel to the electrode surface the limiting current increases for all investigated systems and the pH-E-curves exhibit a smaller hysteresis and lower increases of the pH-value. This behaviour is in good agreement with the magnetohydrodynamic theory which is attributed to the Lorentz force acting in the bulk electrolyte and generating additional convection. This increases the mass transport of the hydrogen and metal ions towards the surface. The depletion of hydrogen ions at the electrode surface is compensated by the magnetic field induced convection. As a result the hydroxide formation is suppressed [3]. In general the increase of the pH value at the electrode surface is lower in the applied magnetic field compared to the case without a magnetic field. The increase of the interfacial pH for the pure hydrogen evolution reaction is higher than in the electrolytes containing metal ions.

The effect of a uniform magnetic field in perpendicular-to-electrode configuration has been investigated for two different electrode and cells geometries. It was found that desorption of hydrogen is supported in the magnetic field. This effect is discussed with respect to the micro-MHD convection, which arises due to the fluctuation of the current distribution close to the H₂ bubble.

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