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Hydrogen Transport through Amorphous $Pd_{82-x}Ni_xSi_{18}$ Alloys by Analysis of Anodic Current Transient

애노딕 전류추이곡선의 해석을 통한 비정질 $Pd_{82-x}Ni_xSi_{18}$ 합금에서의 수소 이동에 관한 연구

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Hydrogen transport through amorphous $Pd_{82-x}Ni_xSi_{18}$ (x = 0 to 32) alloys was investigated in 0.1 M NaOH solution by using potentiostatic current transient technique. All the anodic current transients measured during hydrogen extraction from the electrodes did not show the Cottrell behaviour; however, the initial current remained nearly constant, irrespective of the hydrogen discharging potential. From the results, it is proposed that the hydrogen flux at the electrode surface is given by the rate of hydrogen transfer from absorbed state just beneath the electrode surface to adsorbed state at the electrode surface. On the basis of the theoretical current-time relation derived from the diffusion equation under this constraint, the anodic current transient experimentally measured was analysed to estimate the kinetic parameters governing hydrogen extraction such as the hydrogen diffusivity and the rate constant of hydrogen transfer. The hydrogen diffusivity was found to have an almost constant value of about 1.3×10^{-8} cm^2 s^{-1}, regardless of the Ni content in the electrode. This means that hydrogen diffusion through the electrode is not impeded by the Ni atoms within the bulk electrode. On the other hand, it is inferred that the rate of hydrogen transfer during hydrogen extraction is retarded by the $Ni(OH)_2$ layer formed on the electrode surface.

Reference

1. A. Lundqvist and G. Lindbergh, J. Electrochem. Soc. 145 (1998) 3740.