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Analysis of the Compressive and Tensile Stresses Generation/Relaxation During Hydrogen Ingress into and Egress from Pd Foil Electrode

Pd 박막 전극으로의 수소 흡수 및 방출시에 나타나는 압축 및 인장응력 발생/감퇴의 분석에 관한 연구

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The generation/relaxation of compressive and tensile stresses has been analysed as functions of hydrogen charging and discharging potential during hydrogen ingress into and egress from Pd foil electrode in the coexistence of two phases (α-Pd and β-Pd phases) in 0.1 M NaOH solution by using an improved laser beam deflection technique, combined with current transient technique. The laser beam deflection technique, improved by the introduction of PSD (Position Sensitive Detector), enables us to measure the larger deflection produced in the coexistence of two phases and to perform the preciser conversion than the previous work with a photo-diode. The transient of hydrogen concentration profile across the electrode is derived from the compressive and tensile deflection transients, measured simultaneously with cathodic and anodic charge transients during hydrogen ingress into the fresh electrode and hydrogen egress from the pre-charged electrode, respectively. From the value of the time to the maximum deflection, hydrogen diffusivity in the Pd foil electrode was determined. The build-up/decay of compressive and tensile stresses has been discussed in terms of the concentration profile of hydrogen in the coexistence of two phases and the phase transformation of hydrogen-poor α-phase into hydrogen-rich β-phase and vice versa.