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An Investigation of Hydrogen Transport through Pd Foil Electrode by Analysis of Current and Deflection Transients

전류 및 deflection 시간 추이 곡선의 해석을 통한 Pd 박막 전극에서의 수소 이동에 대한 연구

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The hydrogen transport through Pd foil electrode with various edge areas has been investigated as functions of prior hydrogen charging capacity, hydrogen discharing potential ranging from 0.2 to 0.9 V(RHE) and foil thickness of 50, 75, 100 and 125 μm. For this purpose, potentiostatic current decay transient technique and laser beam deflection technique were employed in aqueous 0.1 M NaOH solution. In addition, the numerical calculation was carried out for hydrogen concentration profile corresponding to the measured deflection and current transients. From the shape change in measured current transient with increasing edge area of the electrode, the role of edge of the electrode in hydrogen transport through the electrode was discussed in terms of the hydrogen-charging/discharging-induced stress in the edge region. The simultaneously measured current and deflection transients have been analysed from the view point of diffusion-controlled constraint and cell-impedance-controlled constraint. From the comparison of experimentally obtained results with those theoretically simulated, it is suggested that the hydrogen charging/ discharging mechanism in Pd foil electrode was changed as the hydrogen discharging potential was increased. The transition of hydrogen charging/discharging mechanism is traced back to the change of hydrogen output flux at electrode surface with varying applied potential step.