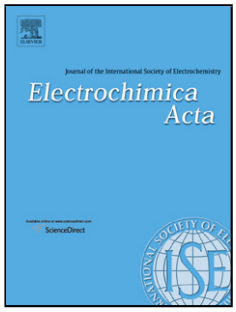

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Electrochemical Preparation of Platinum Nanoparticles from Bis(acetylacetonato)platinum(II) in Some Aprotic Amide-type Ionic Liquids

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Abstract

Electrode reaction of bis(acetylacetonato)platinum(II), $Pt(acac)_2$, and preparation of Pt nanoparticles have been studied in 1-R-1-methylpyrrolidinium bis(trifluoromethylsulfonyl)amide (R = butyl, hexyl and decyl, which are abbreviated as BMPTFSA, HMPTFSA and DMPTFSA, respectively) ionic liquids by means of cyclic voltammetry and rotating disk electrode (RDE) method. $Pt(acac)_2$ was suggested to be reduced to Pt via a two-electron transfer process at a glassy carbon electrode. The diffusion coefficient of $Pt(acac)_2$ at 50°C was estimated to be 1.3×10^{-7} cm^2 s^{-1} in BMPTFSA, by RDE measurements. It has been demonstrated that Pt nanoparticles were able to be prepared at the glassy carbon rotating disk electrode (GCRDE) by potentiostatic electrolysis at –1.8 and –2.5 V in the ionic liquids containing $Pt(acac)_2$. The prepared nanoparticles were characterized by transmission electron microscopy, energy dispersive X-ray spectroscopy and electron diffraction. No pronounced variation in the average particle sizes of Pt was observed with the rotation rates at RDE, indicating that the average particle size was independent of the rotation rate or current density. Pt nanoparticles of average sizes of 2.1 ± 0.8, 2.8 ± 0.8 and 3.0 ± 0.8 nm were obtained after electrolysis at –1.8 V with a rotation rate of 1000 rpm in BMPTFSA, HMPTFSA and DMPTFSA, respectively, suggested that the average particle size may depend on the kind of the ionic liquid.