

**SYNTHESIS OF ELECTROCATALYST
FOR POLYMER ELECTROLYTE FUEL
CELLS USING SURFACTANT
STABILIZED Pt/Ru ALLOY COLLOIDS**

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Abstract

A new process for the synthesis of carbon supported Pt/Ru electrocatalyst (denoted as SFT) is described. Borrowed from the technique for homogeneous catalyst preparation [1], this process uses the surfactant as a stabilizer, which prevents metal colloids from aggregation during alcohol-reduction and will not influence the deposition of colloids onto carbon support.

XRD result shows that a successful reduction of Pt precursor to metallic form has been achieved. The diffraction peaks slightly shift to higher Bragg angles for Pt,Ru/C (atomic 1:1) indicating the decrease of the lattice constant. Such evidence accounts for the presence of a Pt-Ru alloy in the catalyst [2]. From the line broadening of peak (111), the average particle size for Pt,Ru/C is estimated to be around 2.5nm. Consistent result was obtained from TEM analysis, which shows a good dispersion of mono-size colloids on the carbon support. The XPS analysis for SFT Pt,Ru/C and E-TEK Pt,Ru/C was also carried out to determine the chemical state of Ru. The deconvolution of Ru3p shows the presence of two components of Ru, attributed to Ru(0) and Ru(IV). Compared with the result obtained for commercial E-TEK Pt,Ru/C catalyst, the binding energies for these two components are 0.5eV lower, revealing the lower oxidation state of Ru. Therefore, more Ru is alloyed with Pt in the SFT catalyst.

Catalytic activity of the SFT catalyst was evaluated using the CO stripping voltammograms. It is clear that both bimetallic catalysts show promotion of the oxidation of the pre-adsorbed CO compared with Pt/C, evidenced by the cathodic shift in the onset of oxidation. Furthermore, the onset potential of CO oxidation for SFT Pt,Ru/C is more negative than that of E-TEK Pt,Ru/C. This can be attributed to more Ru is alloyed with Pt compared with E-TEK catalyst which allows an easier chemisorption of labile oxygen species, and thus enhanced CO oxidation kinetics [3].

Reference

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- [2]. M. Watanabe, M. Uchida, and S. Motoo, *J. Electroanal. Chem.*, 229 (1987), 395
- [3]. A. S. Arico, P. Creti, E. Modica, G. Monforte, V. Baglio, and V. Antonucci, *Electrochim. Acta*, 45 (2000), 4319.

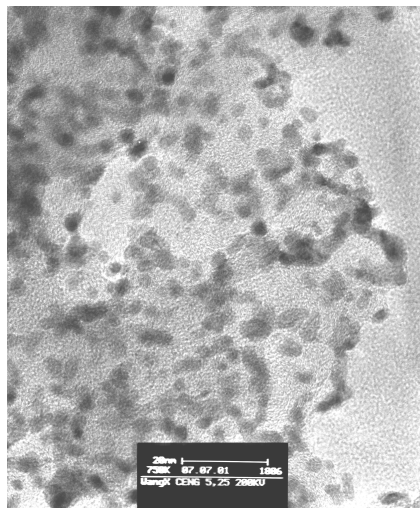


Fig. 1 TEM of the SFT Pt,Ru/C catalyst

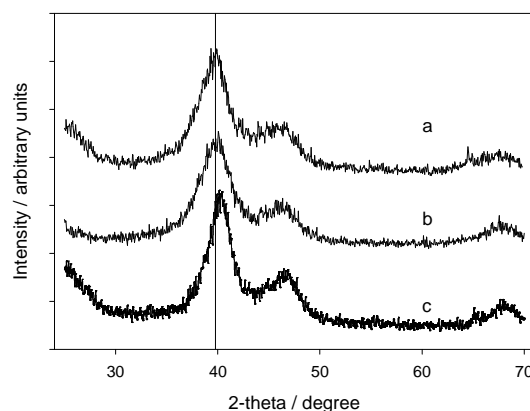


Fig. 2 XRD of the SFT Pt/C and Pt,Ru/C catalyst

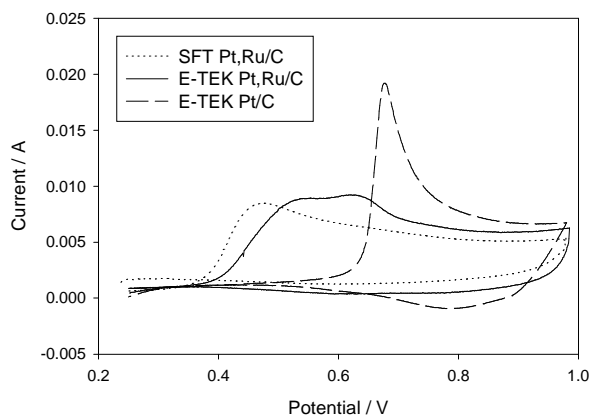


Fig. 3 CO stripping voltammetry for Pt,Ru/C, E-TEK Pt/C and Pt,Ru/C electrodes