Bimetallic Ru@Pt Core Shell Nanoparticles Prepared by an Atomic-layer Deposition Method and Their Electrocatalytic Activity

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Proton exchange membrane fuel cell (PEMFCS) is one of the promising candidates for efficient and zero-pollution energies which can be applied in vehicles, portable devices and stationary power stations[1-2]. Since the chemical energy of fuels directly converts to electrical energy, Carnot limitation can be avoided in fuel cells[3]. However, several problems are addressed during operation, which retards the commercialization of fuel cells. First of all, platinum, which acts as the anode catalysts, is easily poisoned even only trace CO in hydrogen. Low power output is surely expected[4-5]. To tackle this problem, anode catalysts of high CO tolarence is desired.

In our study, core-shell-like Ru@Pt bimetallic nanoparticles are proposed. Ru cores of 2 ~ 3 nm in size were firstly synthesized by the Watanabe's method. Decoration of platinum on the Ru surface was achieved by transmetalization reaction. With proper control of the reaction rate, the atomic-layer deposition of Pt on Ru cores can be realized.

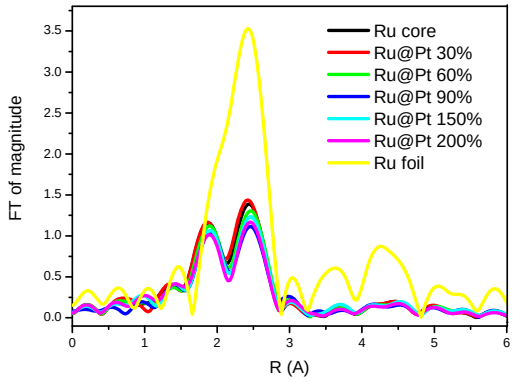

Fig. 1: FT EXAFS spectra at Ru K-edge

The FT of EXAFS spectra at Ru K-edge for the samples with different coverages are shown in Fig.1.

The bond length of the Ru-Ru and Ru-Pt is 2.68 and 2.74 Å, respectively. The FT EXAFS spectra at Pt L_{III}-edge for the samples with different coverages are shown in Fig. 2. The bond length of Pt-Ru and Pt-Pt are 2.74 and 2.77 Å, respectively. The atomic layer deposition of Pt on Ru clusters was evidenced by the alloying extent and coordination numbers extracted from the EXAFS data.

We are also able to monitor and characterize the chitosan during its electro-deposition of on gold electrode for the first time with the use of in-situ EC-FTIR technique due to its surface sensitivity.

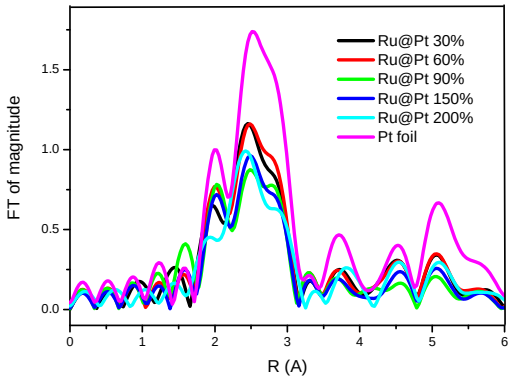

Fig. 2: FT EXAFS spectra at Pt L_{III}-edge

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