Elucidating the structural effect of ordering-controlled PtCo@Pt core-shell catalyst in PEMFC

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A platinum catalyst is well known as an oxygen reduction reaction (ORR) and hydrogen oxidation reaction (HOR) catalyst in PEMFC. In the cathodic reaction, the Pt has insufficient activity and durability under the operating conditions to be real in a market. Therefore, we propose fct-Pt@PtCo/C as an electrocatalyst to improve the ORR through a combination study of computational and experimental approaches. The catalyst was prepared by synthesizing carbon-supported PtCo nanoparticles with a random alloy structure via sodium borohydride reduction method with ethylene glycol and structurally ordered fct-PtCo/C was obtained by heat treatment. Finally, we conducted galvanic replacement for the formation of fct-Pt@PtCo/C. The fct-Pt@PtCo/C was confirmed by X-ray diffraction (XRD), spherical aberration-corrected scanning transmission electron microscope (Cs-STEM) in combination with energy-dispersive spectrometry (EDS). Electrochemical analysis was carried out using RDE technology to understand the electrochemical properties of the catalyst. Additionally, density function theory (DFT) calculations were performed to investigate the catalytic activity and stability of fct-Pt@PtCo/C.