

## Synthesis and Characteristics of PtCu/MWCNTs Electrocatalyst

Shao-Ming Chen (陳勁銘)<sup>1</sup>, Tsun-I Lin (林存翊)<sup>1</sup>, Yuh-Jing Chiou (邱郁菁)<sup>1\*</sup>,  
Hong-Ming Lin(林鴻明)<sup>2</sup>, Andrzej Borodzinski<sup>3</sup>

<sup>1</sup>Department of Chemical Engineering and Biotechnology, Tatung University, Taipei, Taiwan

<sup>2</sup>Department of Materials Engineering, Tatung University, Taipei, Taiwan

<sup>3</sup>Institute of Physical Chemistry, Polish Academy of Sciences, 01-224 Warsaw, Poland

[zh13839292@gmail.com](mailto:zh13839292@gmail.com)

### Abstract

Platinum catalyst is used in direct methanol fuel cell DMFC or direct formic acid fuel cell DFAFC, and has good catalytic properties, but it is expensive and easy to be poisoned to reduce its activity. In this study, platinum copper/nanotube anode catalysts with solid solution phase were synthesized by different process methods, and the electrocatalytic activity in methanol and formic acid fuel was discussed to summarize the more appropriate process conditions.

In the study, sodium borohydride reduction method, polyol method and X-ray synthesis method were used for synthesis. By controlling the pH value as the research parameter, Five parameters: Sodium borohydride method pH 1 (N) and pH 10 (N10), polyol method pH 7 (P7), x-ray synthesis pH 7 (X7) and pH 10 (X10). SEM, XRD, ICP-OES, Raman, FT-IR were used to detect the basic characteristics, and the electrochemical active area (ECSA) and cyclic voltammetry (CV) were used to detect the electrocatalytic capability.

Experimental results show that X7 has a smaller average particle size of about 6.0 nm, N and N10 are about 7-8 nm, P7 has a larger average particle size of 14.1 nm, and PtCu/MWCNTs synthesized by the sodium borohydride method, its the metal ratio of 1:0.92 is closer to the solid solution phase of mol ratio 1:1, and P7 has better crystallinity.

According to the results of electrochemical cyclic voltammetry, P7 has a stable oxidation potential in formic acid and a high current value of about 210 mA/mg Pt, which is the most excellent of all synthetic samples in formic acid. Among methanol, X7, X10, and P7 all have stable and less than the oxidation potential of commercial platinum catalysts, which is conducive to the electrical oxidation of methanol. Among them, the current performance of N10 in the 60th cycle is about 286 mA/mg Pt, which is the catalyst with the best electrocatalytic activity in methanol.

**Keywords** – *Fuel cell · Anode catalysts · PtCu alloy*