The Efficient Oxygen Reduction Catalysts Based on the Non-Noble Metal and Conducting Polymers

Tingting Yang¹, Min Wang², Xiuping Ju³, Jinsheng Zhao^{1,*}, Chonggang Fu^{1,*}

¹ Department of Chemistry, Liaocheng University, Liaocheng, 252059, P.R. China.

² Liaocheng People's Hospital, Liaocheng, 252000, P.R. China.

³ Dongchang College, Liaocheng University, Liaocheng, 252059, P.R. China.

*E-mail: j.s.zhao@163.com (j.s.zhao); cgfu@lcu.edu.cn (c.g.Fu)

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This paper describes the synthesis and assessment of a non-noble-metal electrocatalyst for oxygen reduction reaction (ORR). The transition-metal-coordinating nitrogen-doped carbon catalyst (M-N/C) is prepared by supporting copper ion on carbon-coated poly(2,7-dimethyl-10,12-di(thiophen-2-yl)thieno[3',4':5,6]pyrazino[2,3-f][1,10]phenanthroline) (PDTPP) complex to offer Cu-PDTPP/C/GC. The materials including PDTPP, PDTPP/C, and Cu-PDTPP/C are characterized by CV (cyclic voltammetry), RDE (rotating disk electrode) to confirm their catalytic performances. Among the four materials, Cu-PDTPP/C shows the best catalytic performance with the direct reduction of oxygen to water directly by a four-electron (4e) transferred process. The morphologies and chemical compositions of PDTPP/C, Cu-PDTPP/C were characterized by scanning electron microscopy (SEM) and X-ray photoelectron spectroscopy (XPS) methods respectively. It is revealed by the results that the copper ions have been coordinated to the composite and the M-N/C catalysts are successfully synthesized. According to these tests, this study essentially illustrates that Cu-PDTPP/C is an effective catalyst that can be used for ORR in fuel cells, such as microbial fuel cells, which conducted in an aqueous neutral medium.

Keywords: Oxygen reduction reaction; M-N-C electrocatalyst; Polymerization

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