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FABRICATION OF CNT-BASED CONDUCTING POLYMER NANOCOMPOSITES AND THEIR APPLICATIONS IN DIRECT METHANOL FUEL CELLS

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Carbon nanotubes (CNTs) have attracted great interest as catalyst supports due to their unique properties, including excellent electronic conductivity, large surface area and high chemical stability. However, pristine CNTs are chemically inert and can't readily disperse in organic solvents or aqueous solutions, which would be disadvantageous for the assembly and dispersion of catalytic nanoparticles. It is necessary to functionalize CNTs in order to improve their surface properties and dispersions in solvents. We have reported the functionalization of CNTs with conducting polymers such as poly(3,4-ethylenedioxythiophene) (PEDOT) and polyindole (PIn) and used these nanocomposites as the support materials of Pt nanoparticles. It is found that the conducting polymer functionalization of CNTs not only remarkably enhanced the solubility of CNTs but also introduced homogeneous surface functional groups on the CNT surface. The conducting polymer functionalized CNTs supported Pt nanocatalysts, exhibit much higher electrocatalytic activity and stability than the Pt/CNTs and commercial Pt/C catalysts for methanol oxidation. Moreover, we have developed a novel strategy for the synthesis of sulfur-doped or sulphur and nitrogen co-doped CNTs as the highly efficient Pt-based catalyst support toward methanol oxidation. The doped CNTs were obtained by annealing PEDOT or PEDOT-based copolymer functionalized CNTs. The results indicate that the doped CNTs could significantly improve the dispersion of supported Pt nanoparticles and increase the electrochemically active surface area. The doped CNTs supported Pt-based catalysts exhibit much higher electrocatalytic activity, long-term durability and CO-tolerance ability for the methanol oxidation reaction compared to the undoped CNT supported Pt and commercial Pt/C catalysts.

Recent Publications:

1. **J J Fan, Y J Fan, R X Wang, S Xiang, H G Tang, *et al*. (2017) A novel strategy for the synthesis of sulfur-doped carbon nanotubes as a highly efficient Pt catalyst support toward the methanol oxidation reaction. J. Mater. Chem. A 5:19467–19475.**
2. **R X Wang, Y J Fan, L Wang, L N Wu, S N Sun, *et al*. (2015) Pt nanocatalysts on polyindole functionalized carbon nanotubes composite with high performance for methanol electrooxidation. J. Power Sources 287:341–348.**
3. **L Wei, Y J Fan, J H Ma, L H Tao, R X Wang, *et al*. (2013) Highly dispersed Pt nanoparticles supported on manganese oxide-poly(3,4-ethylenedioxythiophene)-carbon nanotubes composite for enhanced methanol electrooxidation. J. Power Sources 238: 157–164.**

Biography

You-Jun Fan is a Professor of Physical Chemistry at the Guangxi Key Laboratory of Low Carbon Energy Materials, College of Chemistry and Pharmaceutical Sciences, Guangxi Normal University, China. He received his MSc Degree in 2001 from China University of Geosciences, and his PhD in 2005 from Xiamen University. He was a Post-doctoral Fellow at the Research Institute of Electronics, Shizuoka University, Japan (2005–2007). His current research interests include electrocatalysis, electrochemical energy conversion and storage, and electrochemical biosensor. He has published more than 60 research papers, in journals including *J. Mater. Chem. A, Nanoscale, J. Phys. Chem. C, J. Power Sources, Electrochem. Commun., Electrochim. Acta, Dalton Trans., Microchim. Acta, Mol. Catal., Int. J. Hydrogen Energy, RSC Adv.,* etc. He has obtained 8 innovation patents, and contributed to 2 scientific books. His research interests are electrocatalysis, electrochemical energy conversion and storage, and electrochemical biosensor.

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