Pejman Hojati-Talemi, J Material Sci Eng 2014, 3:3
http://dx.doi.org/10.4172/2169-0022.S1.014

OMICS Group Conferences
Accelerating Scientific Discovery

3rd International Conference and Exhibition on
Materials Science & Engineering
October 06-08, 2014 Hilton San Antonio Airport, USA

Modification of advanced conducting polymer coatings for efficient oxygen reduction electrodes

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Advanced energy storage devices are a critical necessity for a sustainable society. Due to their high energy density, metal-air batteries constitute one of the most promising new classes of energy storage devices. However the cathodic, or oxygen reduction, reaction of these batteries is very sluggish and requires appropriate electrocatalysts to increase the reaction rate to an acceptable level. Unfortunately, the most effective electrocatalysis for this reaction is platinum. To date many materials have been put forward as possible candidates to replace the price prohibitive platinum which offer the potential electrocatalytic activity required for an air-electrode. They include materials such as: carbon nanotubes, nitrogen-doped graphene and platinum-gold nanoparticles. Despite these studies, no air-electrode has yet been developed which has forgone the use of noble metals somewhere within its architecture, while providing enough efficiency to warrant a direct comparison to platinum (Pt) which remains the current benchmark in such systems.

Our research group has recently turned its attention to using conducting polymers as electrocatalyst materials for oxygen reduction reaction. The main focus of our work has been on the synthesis and chemical modification of poly (3, 4ethylenedioxythiophene) (PEDOT) to improve its electrical and electrocatalytic properties. We have shown5 that due to the semi-metallic properties the polymer possessesit has the potential for being used as an electrocatalytic material, and by applying the appropriate chemical treatments tits electrocatalytic properties can exceed that of platinum.

Biography

Pejman Hojati-Talemi is a Research Fellow at the Mawson Institute, University of South Australia. He completed his PhD at Monash University and during his PhD studies he worked on the development of nanostructured electrodes for field emission application. After finishing his PhD, he spent some additional time at Monash University and the University of Melbourne studying physical chemistry and applications for nanomaterials. Since joining the Mawson Institute in 2011 he has worked on investigating the fundamental aspects of conducting polymers as well as expanding their applications into energy storage and harvesting. His research has been published in more than 30 peer reviewed papers.

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