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PII: S1572-6657(17)30124-8
DOI: doi: 10.1016/j.jelechem.2017.02.031
Reference: JEAC 3147

To appear in: *Journal of Electroanalytical Chemistry*

Received date: 30 October 2016
Revised date: 15 February 2017
Accepted date: 16 February 2017

Please cite this article as: Mohammad Hadi Moghim, Rahim Eqra, Mohsen Babaiee, Mohammad Zarei-Jelyani, Mohammad Mohsen Loghavi , Role of reduced graphene oxide as nano-electrocatalyst in carbon felt electrode of vanadium redox flow battery. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Jeac(2017), doi: 10.1016/j.jelechem.2017.02.031

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Role of Reduced Graphene Oxide as Nano-electrocatalyst in Carbon Felt Electrode of Vanadium Redox Flow Battery

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Abstract

Carbon-based electrodes are usually used in vanadium redox flow batteries and electrochemical performance of these electrodes can be modified by electrocatalysts. In the current study, reduced graphene oxide inks with different concentrations were used to modify a carbon felt electrode. It was observed that CF which was modified in 2 mg/ml ink (CF-G-2) had the optimum combination of electrochemical properties, because no significant peak current improvement was observed at higher graphene contents and it also had the minimum value of ΔE_p. The anodic and cathodic peak currents for positive redox couple reaction in CF-G-2 reached to 45.3 and 21.1 mA respectively, in comparison with 14.2 and 4.7 mA values for bare felt. Linear diffusion coefficient was also enhanced more than two times with the incorporation of graphene. Nyquist plots of CF-G in different electrolytes ($VOSO_4/V_2O_5$ and $VOSO_4$) showed different shapes and equivalent circuit data indicated much lower charge transfer resistance for modified carbon felts with graphene. The diffusion process was remarkably facilitated with the incorporation of reduced graphene oxide and graphene had desirable influence on the electrolyte absorption of carbon felt. Finally, scanning electron micrographs of electrodes demonstrated loaded graphene nanosheets on the surface of carbon felt fibers.

Keywords: Vanadium redox flow battery; Reduced graphene oxide; Electrocatalysis; Carbon felt

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