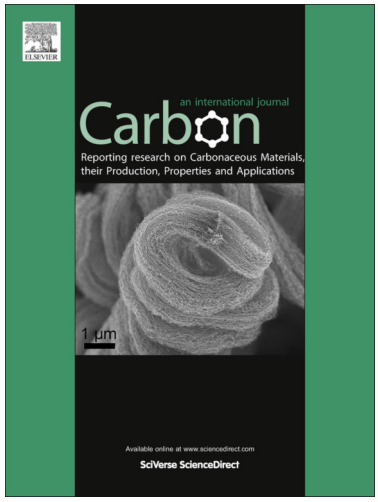

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PII: S0008-6223(14)00621-6
DOI: http://dx.doi.org/10.1016/j.carbon.2014.06.075
Reference: CARBON 9118

To appear in: *Carbon*

Received Date: 6 December 2013
Accepted Date: 30 June 2014

Please cite this article as: Melke, J., Jakes, P., Langner, J., Riekehr, L., Kunz, U., Zhao-Karger, Z., Nefedov, A., Sezen, H., Wöll, C., Ehrenberg, H., Roth, C., Carbon Materials for the positive electrode in all-Vanadium Redox Flow Batteries, *Carbon* (2014), doi: http://dx.doi.org/10.1016/j.carbon.2014.06.075

Carbon Materials for the positive electrode in all-Vanadium Redox Flow Batteries

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Abstract

The electrode material in all-vanadium redox flow batteries often consists of fibrous carbon felts. It is believed that surface functional groups such as carboxyl and hydroxyl groups, e.g. introduced by heat-treatment, increase the activity of the carbon electrodes due to a facilitated electron transfer. However, other properties of the carbon material have not been investigated in detail. In this paper, the structure of morphologically different carbon materials, such as graphite flakes, two carbon blacks and a carbon fiber material, was correlated with the electrochemical activity obtained by cyclic voltammetry in a three-electrode configuration in vanadyl sulphate solution. Furthermore, the respective carbon materials were heat-treated in air at 400°C and the corresponding structural changes in sp^2 carbon content and amount and kind of surface functional groups determined by NEXAFS analysis were correlated with the activity.Our work shows that the sp^2 carbon content on the surface is an important parameter significantly affecting the activity. The results can be utilized to choose a suitable carbon powder material to impregnate the felts in order to increase their reactive surface area.