11th International Conference
on Advanced Materials
Rio de Janeiro Brazil
September 20 - 25
ICAM2009

Influence of thermal treatment for porosity formation on carbon fiber.

Jossano S. Marcuzzo[1*], Choyu Otani[1], Heitor A. Polidoro[2] and Satika Otani[2]

(1) Instituto Tecnológico Aeroespacial – ITA, São José dos Campos, SP, Brazil;
e-mail jossano@gmail.com

(2) Multivácuo Indústria e Comércio Ltda, São José dos Campos, SP, Brazil;
*Corresponding author

Abstract - Activated carbon fibers (ACFs) are known as an excellent adsorbent material for a lot of applications. While, the ACFs are produced from commercial structural carbon fiber (CF) by standard activation process, in this work it has been studied the preparation of CFs from textile polyacrylonitrile (PAN) fibers. The commoly used carbonization processes were performed by thermal treatment under argon atmosphere at different final temperatures and heating rates. The surface characteristics of produced CF are strongly dependent on the heating rate and can be infered as ACFs surfaces. The overall results indicates that, if is it possible to apply a well controled carbonization process on the textile PAN fibers, it is possible to produce ACFs in one step carbonization process.

Carbon fiber (CF) is recognized as a high performance material suitable for reinforcing composites for structural applications. The activation process can transform the carbon fiber to an adsorbent material suitable for the following uses: gas storage media and purification by removal of pollutants [1]. In order to attain the mechanical properties demanded by high technology industries, carbon fiber is usualy produced by specially produced PAN precursor. In this work, a commercial textile PAN fiber is stabilized and carbonized using home made equipment. The stabilization was continuously processed in air at 250°C. The carbonization was performed in argon atmosphere at temperatures ranging from 600°C up to 1100°C, during 20 min, applying two differents heating rates: 10°C/min (AM1) and 100°C/min (AM2). The surface characterizations of CFs samples were performed using Scanning Electronic Microscopy (SEM) and the specific gravities were determined by two methods: sink-float and helium ultra pycnometer. The pore structure, strongly dependent of the heating rate, has been considered to be due to the differences on kinetic of volatile gases release, while the longitudinal grooves are dependet of the carbon net work domain development. The Figure 1a, 1b shows SEM images of CF processed at 10 and 100°C/min at 950°C. The surface of AM1 sample is more irregular than AM2, showing deep grooves between well developed carbon fibrils. The AM2 sample presented circular pores which can classify as meso and macro pores absent in AM1 sample. These results complementary analysed by density measurements indicated that depending on the heating parameters it is possible to produce carbon fibers with different pore structures. This in turn, lead us to the conclusion that depending on suitable choice of PAN fiber and adjusting the carbonization process parameters, it is possible to realize a prodution of activated carbon fiber in one step process.

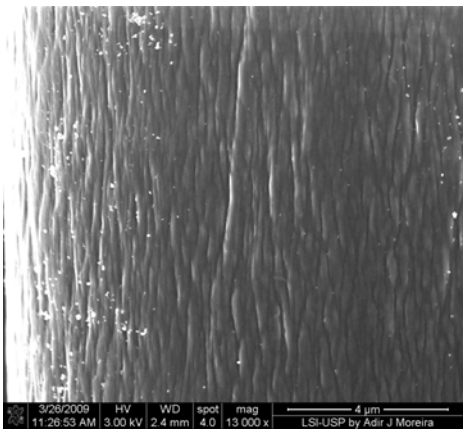

Figure 1a. SEM images of AM1 sample.

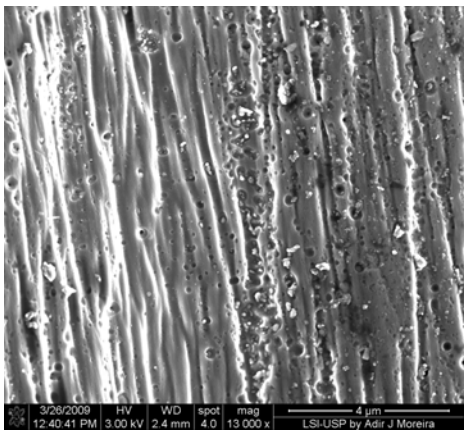

Figure 1b. SEM images of AM2 sample.

[1] Yoon SH, Korai Y, Mochida I. Carbon fibers and activated carbon fibers. In: Marsh H, Rodriguez-Reinoso F editors. Sciences of carbon materials. Spain: University of Alicante; 2000.