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CARBON AEROGELS FROM 5-METHYLRESORCINOL AND FORMALDEHYDE IN ACETONITRILE WITH ORGANIC ACIDIC CO-MONOMER

Anna-Liisa Peikolainen, Kristiina Kreek, Mihkel Koel

Department of Chemistry, Tallinn University of Technology, Estonia

e-mail: anna-liisa.peikolainen@ttu.ee

Carbon aerogels are highly nanoporous materials with large specific surface areas. Being electrically conductive, carbon aerogels are attractive materials for applications such as electrodes for fuel cells and supercapacitors. Current study was focused on preparation of carbon aerogels from 5-methylresorcinol, a local raw material which is obtained as a by-product in oil-shale processing industry, via sol-gel polycondensation with formaldehyde in acetonitrile. 2,6-dihydroxy-4-methyl benzoic acid is a co-monomer in a reaction, but it also creates favourable acidic conditions for polymerisation. This approach allows to prevent from inorganic impurities in a resulting carbon aerogel.

The gel obtained is dried via supercritical carbon dioxide extraction. Acetonitrile as a solvent gives an important advantage because the solvent exchange step in the preparation process, which is necessary when water is used as a solvent, can be avoided.

Carbon aerogels were obtained via pyrolysis process where organic aerogels were taken to 900 °C in an inert nitrogen atmosphere. According to nitrogen adsorption measurements, thus obtained carbon aerogels have the specific surface areas ranging from 550 to 660 m²/g depending on the composition of the gel.

Scanning electron microscopy shows no strong influence of different ratios of 5-methylresorcinol to 2,6-dihydroxy-4-methyl benzoic acid on the size of the carbon aerogel particles.

There is a clear correlation between the ratio of the aromatic monomers in the sol and the decrease of the cross-section area of the gel piece during the supercritical drying step (Fig.1). Nevertheless, the cross-section area after the step of pyrolysis forms approximately 20 % of the cross-section of the original gel piece at every tested concentration.

The samples of the gel were also studied by means of infrared spectroscopy and the program for pyrolysis based on thermogravimetric analysis.

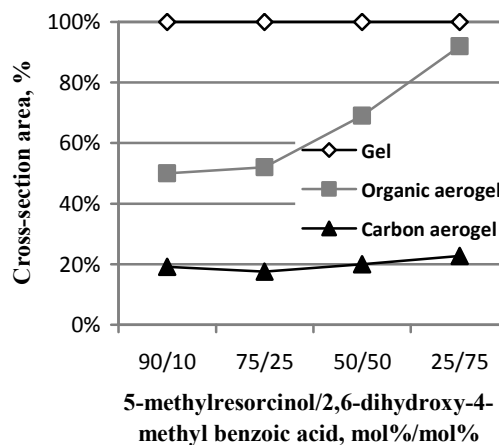


Fig.1. Changes in cross-section area of the gel piece during the processing of the material depending on the ratio of the aromatic monomers.