Nanocomposites and nanomaterials

Template synthesis of mesoporous carbon material

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The paper studied the effect of inorganic endotemplate on morphological state and porous structure of carbon materials (CM) derived by thermolytic destruction of disaccharides. The content of endotemplate method of porous CM synthesis is that the volume of carbon precursor is filled with nanoparticles of inorganic material-template (KOH, K_2CO_3, $ZnCl_2$, SiO_2, Al_2O_3), than oxide material (K_2O, ZnO, SiO_2, Al_2O_3) is washed out from CM by water, hydrochloric or hydrofluoric acid after carbonization of precursor.

The porous structure of CM derived using as template KOH, K_2CO_3, $ZnCl_2$ is formed mainly of pore 2-6 nm in size [1]. However, the total pore volume in the material does not exceed 1.2 cm^3/g when the weight ratio of template : precursor is 3:1 and 5:1. Use aerodispersive metal oxides, particularly SiO_2 and Al_2O_3 with an average particle size of 7-15 nm, for filling of disaccharide precursors not provides CM with a specific surface area more than 800 m^2/g.

The authors found that aluminum nitrate nonahydrate $Al(NO_3)_3 \cdot 9H_2O$ with an average pore size of 4.6 nm is an effective inorganic reagent to produce mesoporous CM. Composite material C-AlOOH, in which the volume of carbon matrix is filled by globules of boehmite phase of 3-5 nm in diameter, is formed at thermolytic destruction of disaccharide precursor that contains aluminum nitrate molecules in volume. Removing this phase from CM volume by leaching method allows to obtain mesoporous carbon with a large pore volume. In particular, synthesized mesoporous carbon has a total pore volume ~ 1.6 cm^3/g and specific surface area of 1707 m^2/g when the weight ratio saccharose: AlOOH is 1:1.

Mesoporous CM obtained in such way can be used in medical practice. They also should be used as electrode materials in the manufacture of electrochemical supercapacitors.

1. *Myronyuk I.F., Mandzyuk V.I., Sachko V.M., Lisovsky R.P., Rachiy B.I.* Morphological and electrochemical properties of the lactose-derived carbon electrode materials // J. Nano- Electron. Phys. -2016.-**8(4).-**P. 04006-1 – 04006-7.