Highly conductive, microporous carbon fibers by electrospinning of lignin/phosphoric acid/ethanol solutions

José Rodríguez-Mirasol, Francisco José García-Mateos, Juana María Rosas, Ramiro Ruiz-Rosas, Tomás Cordero

Universidad de Málaga, Departamento de Ingeniería Química, Andalucía Tech, Facultad de Ciencias, Campus de Teatinos s/n, 29010 Málaga - Spain

Functional carbon fibers are high added-value products with many different applications. Properties such as high surface area, high electrical conductivity, adequate pore size and surface chemistry, and elevated oxidation resistance are regarded as more relevant than mechanical ones. Most conventional preparation methods use synthetic polymers (mainly polyacrilonytrile) for the production of carbon fibers. The use of a low-cost, abundant and greener precursor like lignin would be an interesting alternative from both economic and environmental points of view. In addition, certain functional applications (related to high electrical conductivity and oxidation resistance) requires post-treatments (heat treatment ant 1500 – 3000 ºC) in order to enhance the structural carbon order of the fibers. However, a higher structural ordering is usually related to a lower surface area, what represents a strong disadvantage in some functional applications, such as electrochemical ones. Therefore, the optimization of the post-treatment of the carbon fibers with the goal of increasing both the structural ordering and the porosity development is an important challenge.

This contribution reports the influence of heat treatments at temperatures ranging from 900 to 1600 ºC in carbonized electrospun Alcell lignin fibers. The influence of the addition of phosphoric acid in the initial solution on the structural ordering, electrical conductivity and porosity development of the carbon fibers is studied in detail.