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Advances in Fundamental Materials Research

Ultra-high Surface Area Activated Carbon Derived From A Renewable Resource

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High surface area activated carbons are widely utilized in a variety of chemical and biological defense applications such as the adsorption of toxic substances such as chemical warfare agents in protective clothing, and the purification or separation of liquids and gases and the elimination or capture of ozone depleting chemicals/solvents and/or natural gases in gas/liquid purification/separation industry. Traditionally, activated carbons are prepared through gradual gasification of char with either steam, CO_2, or a combination of both, resulting in highly porous structures, and ultimately significant mass reduction (normally 80-90% weight loss) of the starting material. Therefore, agricultural by-products, such as cellulose, are considered as very important precursors to synthesizing activated carbons because they are renewable and available at low-cost. The aim of the present study is to apply lignocellulosic aerogels as precursors for ultra-high surface area activated carbon. The lignocellulosic aerogels are pyrolyzed and subsequently acid-etched in a tubular furnace under inert atmosphere to form the ultra-high surface area nanostructure. Samples are characterized at each state using scanning electron microscopy (SEM) and nitrogen sorption to study the morphology and the pore structure. BET analysis of the dehydrated aerogels show initial surface areas up to 440 m^2/g with pore diameters of 47nm. This effort aims to create ultrahigh surface activated carbon with surface area greater than 3,000 m^2/g. The effects of synthesis conditions and time-temperature profile during pyrolysis on the structure of the resulting activated carbon will be discussed, and the results will be compared with commercial activated carbons derived from coal. PAO #: U17-317

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