



Making Activated Carbon by Wet Pressurized Pyrolysis

Raw materials other than the traditional ones can now be used.

Ames Research Center, Moffett Field, California

A wet pressurized pyrolysis (wet carbonization) process has been invented as a means of producing activated carbon from a wide variety of inedible biomass consisting principally of plant wastes. The principal intended use of this activated carbon is room-temperature adsorption of pollutant gases from cooled incinerator exhaust streams.

Activated carbon is highly porous and has a large surface area. The surface area depends strongly on the raw material and the production process. Coconut shells and bituminous coal are the primary raw materials that, until now, were converted into activated carbon of commercially acceptable quality by use of traditional production processes that involve activation by use of steam or carbon dioxide.

In the wet pressurized pyrolysis process, the plant material is subjected

to high pressure and temperature in an aqueous medium in the absence of oxygen for a specified amount of time to break carbon-oxygen bonds in the organic material and modify the structure of the material to obtain large surface area. Plant materials that have been used in demonstrations of the process include inedible parts of wheat, rice, potato, soybean, and tomato plants. The raw plant material is ground and mixed with a specified proportion of water. The mixture is placed in a stirred autoclave, wherein it is pyrolyzed at a temperature between 450 and 590 °F (approximately between 230 and 310 °C) and a pressure between 1 and 1.4 kpsi (approximately between 7 and 10 MPa) for a time between 5 minutes and 1 hour.

The solid fraction remaining after wet carbonization is dried, then acti-

ated at a temperature of 500 °F (260 °C) in nitrogen gas. The activated carbon thus produced is comparable to commercial activated carbon. It can be used to adsorb oxides of sulfur, oxides of nitrogen, and trace amounts of hydrocarbons, any or all of which can be present in flue gas. Alternatively, the dried solid fraction can be used, even without the activation treatment, to absorb oxides of nitrogen.

This work was done by John W. Fisher of Ames Research Center and Suresh Pisharody, K. Wignarajah, and Mark Moran of Lockheed Martin Corp.

This invention is owned by NASA and a patent application has been filed. Inquiries concerning rights for the commercial use of this invention should be addressed to the Ames Technology Partnerships Division at (650) 604-2954. Refer to ARC-14929-1.

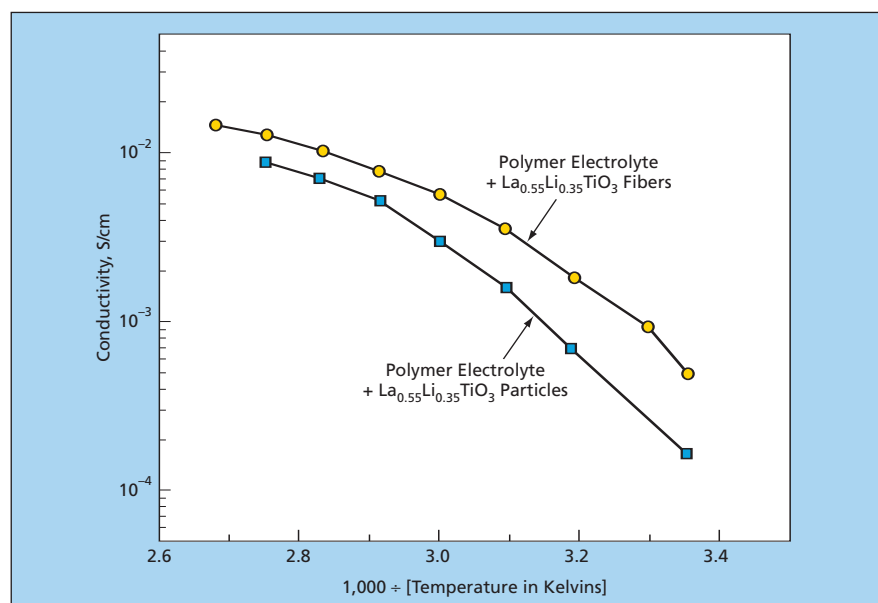
Composite Solid Electrolyte Containing Li⁺-Conducting Fibers

Li⁺-ion conductivities are greater than those achieved before.

John H. Glenn Research Center, Cleveland, Ohio

Improved composite solid polymer electrolytes (CSPEs) are being developed for use in lithium-ion power cells. The matrix components of these composites, like those of some prior CSPEs, are high-molecular-weight dielectric polymers [generally based on polyethylene oxide (PEO)]. The filler components of these composites are continuous, highly-Li⁺-conductive, inorganic fibers.

PEO-based polymers alone would be suitable for use as solid electrolytes, were it not for the fact that their room-temperature Li⁺-ion conductivities lie in the range between 10⁻⁶ and 10⁻⁸ S/cm — too low for practical applications. In a prior approach to formulating a CSPE, one utilizes nonconductive nanoscale inorganic filler particles to increase the interfacial stability of the conductive phase. The filler particles also trap some electrolyte impurities. The achievable increase in conductivity is limited by the nonconductive nature of the filler particles.



These Arrhenius Plots were derived from Li⁺-ion conductivity measurements on two CSPEs that were identical in the proportions of all ingredients (including the La_{0.55}Li_{0.35}TiO₃ filler), except that in one CSPE, the filler was in particle form, and in the other CSPE, the filler was in fiber form.