Wood to Supercapacitors: Sustainable highly conductive electrode materials from ultrathin carbon nanofiber aerogels derived from nanofibrillated cellulose

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Carbon aerogels are ultralight, conductive materials, which are extensively investigated for applications in supercapacitor electrodes in electrical cars and cell phones. Chinese scientists have now found a way to make these electrodes sustainably. The aerogels can be obtained directly from cellulose nanofibrils, the abundant cell-wall material in wood, finds the study reported in the journal Angewandte Chemie.

Carbon aerogels are ultralight, conductive materials with a very large surface area. They can be prepared by two production routes: the first and cheapest starts from mostly phenolic components and produces aerogels with improvable conductivity, while the second route is based on graphene- and carbon-nanotube precursors. The latter method delivers high-performance aerogels but is expensive and non-environmentally friendly. In their search for different precursors, Yu and colleagues have found an abundant, far less expensive, and sustainable source: wood pulp.

As it turns out, the method was not as straightforward as expected because ice crystal formation and insufficient dehydration hampered carbonization, according to the authors. Here, a trick helped. The scientists pyrolyzed the dried gel in the presence of the organic acid catalyst para-toluenesulfonic acid. The catalyst lowered the decomposition temperature and yielded a "mechanically stable and porous three-dimensional nanofibrous network" featuring a "large specific surface area and high electrical conductivity," the authors reported.

The authors also demonstrated that their wood-derived carbon aerogel worked well as a binder-free electrode for supercapacitor applications. The material displayed electrochemical properties comparable to commercial electrodes. The method is an interesting and innovative way in which to fabricate sustainable materials suitable for use in high-performance electronic devices.

(C3306 charcters)

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