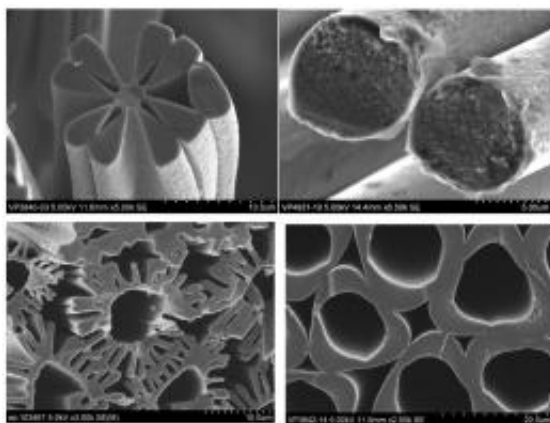


New process converts polyethylene into carbon fiber

March 27 2012



Carbon fibers having unique surface geometries, from circular to hollow gear-shaped, are produced from polyethylene using a versatile fabrication method. The resulting carbon fiber exhibits properties that are dependent on processing conditions, rendering them highly amenable to myriad applications.

(PhysOrg.com) -- Common material such as polyethylene used in plastic bags could be turned into something far more valuable through a process being developed at the Department of Energy's Oak Ridge National Laboratory.

(PhysOrg.com) -- In a paper published in [Advanced Materials](#), a team led by Amit Naskar of the Materials Science and Technology Division outlined a method that allows not only for production of carbon fiber but also the ability to tailor the final product to specific applications.

"Our results represent what we believe will one day provide industry with a flexible technique for producing technologically innovative fibers in myriad configurations such as fiber bundle or non-woven mat assemblies," Naskar said.

Using a combination of multi-component fiber spinning and their sulfonation technique, Naskar and colleagues demonstrated that they can make polyethylene-base fibers with a customized surface contour and manipulate [filament](#) diameter down to the submicron scale. The patent-pending process also allows them to tune the [porosity](#), making the material potentially useful for filtration, [catalysis](#) and [electrochemical energy](#) harvesting.

Naskar noted that the sulfonation process allows for great flexibility as the [carbon fibers](#) exhibit properties that are dictated by processing conditions. For this project, the researchers produced carbon fibers with unique cross-sectional geometry, from hollow circular to gear-shaped by using a multi-component melt extrusion-based fiber spinning method.

The possibilities are virtually endless, according to Naskar, who described the process.

"We dip the fiber bundle into an acid containing a chemical bath where it reacts and forms a black fiber that no longer will melt," Naskar said. "It is this sulfonation reaction that transforms the plastic fiber into an infusible form.

"At this stage, the plastic molecules bond, and with further heating cannot melt or flow. At very [high temperatures](#), this fiber retains mostly carbon and all other elements volatilize off in different gas or compound forms."

The researchers also noted that their discovery represents a success for

DOE, which seeks advances in lightweight materials that can, among other things, help the U.S. auto industry design cars able to achieve more miles per gallon with no compromise in safety or comfort. And the raw material, which could come from grocery store plastic bags, carpet backing scraps and salvage, is abundant and inexpensive.

More information: "Patterned functional carbon fibers from polyethylene," [onlinelibrary.wiley.com/doi/10 ...
2/adma.201104551/pdf](https://onlinelibrary.wiley.com/doi/10.1002/adma.201104551/pdf)

Provided by Oak Ridge National Laboratory

Citation: New process converts polyethylene into carbon fiber (2012, March 27) retrieved 16 April 2024 from <https://phys.org/news/2012-03-polyethylene-carbon-fiber.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.
