Sequestration of Single-Walled Carbon Nanotubes in a Polymer

Lyndon B. Johnson Space Center, Houston, Texas

Sequestration of single-walled carbon nanotubes (SWCNs) in a suitably chosen polymer is under investigation as a means of promoting the dissolution of the nanotubes into epoxies. The purpose of this investigation is to make it possible to utilize SWCNs as the reinforcing fibers in strong, lightweight epoxy-matrix/carbon-fiber composite materials. SWCNs are especially attractive for use as reinforcing fibers because of their stiffness and strength-to-weight ratio: Their Young’s modulus has been calculated to be 1.2 TPa, their strength has been calculated to be as much as 100 times that of steel, and their mass density is only one-sixth that of steel.

Bare SWCNs cannot be incorporated directly into composite materials of the types envisioned because they are not soluble in epoxies. Heretofore, SWCNs have been rendered soluble by chemically attaching various molecular chains to them, but such chemical attachments compromise their structural integrity.

In the method now under investigation, carbon nanotubes are sequestered in molecules of poly(m-phenylenevinylene-co-2,5-dioctyloxy-p-phenylenevinylene) [PmPV]. The strength of the carbon nanotubes is preserved because they are not chemically bonded to the PmPV. This method exploits the tendency of PmPV molecules to wrap themselves around carbon nanotubes: The wrapping occurs partly because there ex-