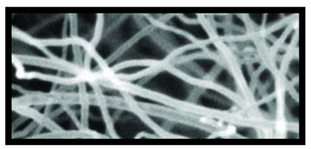
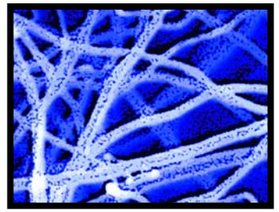
A company that manufactures polymer-based lithium-ion batteries for portable electronics would like to enhance the electrically conductive properties of an experimental polymer. It wants to maintain structural and thermal integrity while not significantly adding to the weight of a cell. Here is a product that can add conductive properties without adding weight.

Pyrograf®-III

How It Helps: Pyrograf-III provides polymers with electrically conductive properties, as do regular milled carbon fibers or carbon black. The advantage of adding nanofiber is twofold: it does not disturb the other properties of the polymer, and the nanofiber takes only up 5 to 20 percent of the volume required by bulkier additives. Another advantage is in the process of making Pyrograf-III itself. The use of sulphur dramatically improves the nucleation efficiency of carbon nanofibers. High-sulfur coal can be mined, not as a source of fuel for power plants, but rather as a chemical source of hydrocarbons.



How It Works: The Pyrograf-III composite material is produced by introducing a gas-phase catalyst into a heated hydrocarbon atmosphere. This creates carbon nanofibers having diameters of 100 to 200 nm. When added to polymers, carbon fibers convert the polymer from an insulating material to an electrically conductive material. The Pyrograf-III–based composite can be formulated to have electrical resistivities anywhere from 100 to 1010 ohm-cm. Concentrations as low as 0.5 percent have been shown to produce resistivities as low as 104 ohm-cm in injection-molded thermoplastic composites. Additionally, carbon nanofiber has a thermal conductivity of between 1,950 and 2,000 W/m-K, or close to five times that of copper.



How Much It Will Cost: The price is $85 to $110 per pound or less depending on the size of the order.

When It Will Be Ready: The product is available now. A pilot plant is producing 70,000 pounds per year of the composite. The existing production capacity from the pilot plant is sold out, but there are plans to double capacity.

Who Is Working On It: The innovator is Applied Sciences, Inc. (ASI). ASI, which specializes in the research and development of advanced materials and their applications, incorporated in 1984. As of November 2001, the company had annual sales of $1.5 million and employed 33 people. Pyrograf Products, Inc. (PPI), created in 1996, is an ASI subsidiary. PPI operates a modern 70,000-pounds-per-year facility in Cedarville, Ohio. The Pyrograf-III pilot plant is housed in a 22,200-square-foot facility. For more information, contact Kate Monaghan of ASI at (937) 766-2020, ext. 105, or monaghan@apsci.com. The company Web site is www.apsci.com.

MDA Origins

As early as 1987, ASI received funding from SDIO, the precursor to BMDO, and MDA. Since the inception of the SDIO program, ASI has received 12 SBIR Phase I contracts, three SBIR Phase II contracts, and an STTR Phase I contract to study and develop various carbon composite technologies for structural, thermal, and electronic applications. With funding from SDIO, DOE, and the U.S. Air Force, ASI began to study applications for the nanofibers. It joined forces with General Motors (GM) and licensed all of GM's intellectual property on the composites. In 1996, ASI, GM, Goodyear Tire & Rubber Company, and others joined together in a cooperative research agreement and received funding from NIST's Advanced Technology Program.