PROJECT FACTS

UNIVERSITY OF KENTUCKY CENTER FOR APPLIED ENERGY RESEARCH

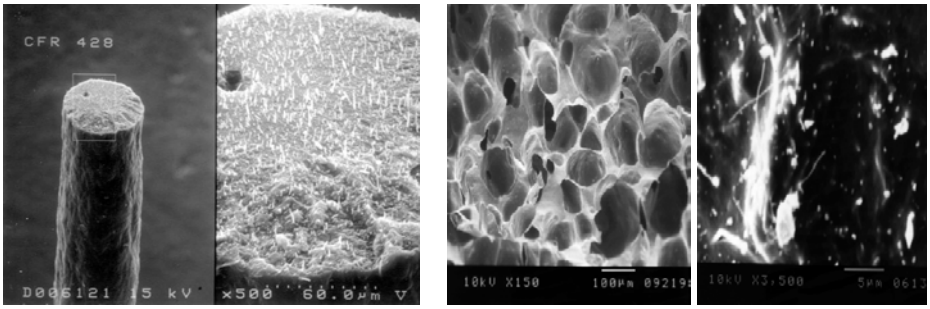
CARBON MATERIALS

NANOTUBE ENHANCEMENT OF COAL EXTRACT PITCHES: FIBER AND FOAM

High performance pitch based carbons are typically made from mesophase pitch. The mesophase pitch contains liquid crystal domains that tend to align in the axial direction of the fiber or ligaments of a foam so that when carbonized and ultimately graphitized, a highly ordered graphitic lattice is formed, imparting excellent physical, electrical, and thermal properties to the resultant materials. However, the high processing costs and low yields associated with the production of mesophase pitch suitable for these applications makes the pitch expensive to produce, and adds significantly higher costs to the product. Hence, if viable methods of producing high performance carbon fibers and foams from low cost isotropic pitch feedstocks could be developed, a significant cost advantage could be gained. It is the aim of this project to produce high value carbon fibers and foams via the co-processing of a low cost coal extract pitch with well-dispersed carbon nanotubes.

The carbon nanotubes will be dispersed in the pitch and selected mixtures will then be formed into filaments or foams. During fiber spinning, nanotubes will align axially with the fiber, resulting in a fiber with enhanced properties (taking a low cost general purpose fiber into the medium- to high-performance regime). The second product will be a lightweight high-strength porous carbon, usually referred to as carbon foam. Carbon foams pioneered by West Virginia University have, for a given density, resulted in higher strength and modulus than other known processes for carbon foam. The inclusion of nanotubes in the foam ligaments should greatly enhance these desirable properties.

The presence of nanotubes in these fiber and foams should impart high strength, modulus, electrical conductivity and thermal conductivity. The ability to generate higher value materials with a small addition of nanotubes to a coal extract pitch will result in materials of high commercial and military interest for structures, thermal management and electromagnetic shielding.



Left:: SEM micrograph of a pitch derived fiber containing axially aligned nanotubes. **Right:** Carbon foam containing carbon nanotubes.

PARTICIPANTS

UK Center for Applied Energy Research
&
West Virginia University Department of Chemical Engineering

SPONSORS

U.S. Department of Energy

PROJECT VALUE

DOE: $111,292
UK: $112,877

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