

## Abstract from International Seminar on Manufacturing of Advanced Materials

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## **Mechanical Properties of Carbon Fiber Composites for Environmental Applications**

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Activated carbon fiber composites have many potential applications for treatment of gaseous and liquid waste streams. However, engineering design of these reactive filters requires some knowledge of the mechanical properties of the composites. This study reports the mechanical and flow properties of ACF composites made at the Center for Applied Energy Research.

High gas and liquid velocities are likely in the liquid and gas phase applications envisioned for the ACF composites. Filter fabrication would be an advantage. However, these would require low pressure drops and reasonable flexural strength. We report the results of 3 point bend tests and pressure drops as a function of gas velocity. Samples were sliced to shape from cylindrical forms, and measurements were made both across and along the direction of fiber alignment. Variables evaluated included fiber length, binder content, and activation level.

A binder content of 5 parts per hundred was the minimum level for reproducible composite fabrication. The binder wicks to fiber contact points during the curing process, and excess binder coats the fiber. Yield strength and modulus is adequate in all samples, and increases with increasing binder weight fraction. Shorter fibers increase the density, yield strength and modulus of the composites. Along-fiber yield strength is 1.1 to 2.0 times the cross-fiber strength. For most samples, the failure mechanism is fiber pull-out.

Permeability of the composite to gas and liquid flow correlates with the velocity of the continuous phase.

## **Liquid Crystal Behaviors from Carbonaceous Mesophase to Polymeric Liquid Crystals**

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Carbonaceous mesophase, raw material of high performance carbon fiber, is a thermotropic and lyotropic liquid crystal, though following aspects are quite different from other liquid crystals: 1. Consists of numerous kind of molecules. 2. Each molecule is composed