

CARBON FIBER PRODUCTION BY MICROWAVE ASSISTED CARBONIZATION OF PRE-OXIDIZED PAN-PRECURSOR

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ABSTRACT

Carbon fiber is the material of choice for manufacturing high performance, low mass structures. Its exceptionally high stiffness and strength-to-mass ratios, corrosion resistance, damage tolerance, near-zero thermal expansion coefficient and other characteristics are very attractive in many structural applications. Carbon fiber reinforced structures could be used to reduce the mass of passenger automobiles by about 50%, with an attendant 30% decrease in fuel demand. Studies have also shown that using carbon fiber reinforced structures in deep water offshore oil production may reduce the capital cost of some floating platforms by up to 50% (due principally to decreased platform loading and size). Hence carbon fiber is a technically enabling material for the Department of Energy missions in both Energy Efficiency and Fossil Energy production. Unfortunately carbon fiber is expensive limiting its broad application. The cost for commercial grade carbon fiber is in the range of \$6-8 per pound, when purchased in large lots. The high material cost is a barrier to full realization of the material's benefits for energy efficiency and energy production. Therefore technological advancements are needed to reduce carbon fiber cost. Oak Ridge National Laboratory (ORNL) is actively working in pursuing the development of new technologies in this area. Microwave assisted plasma (MAP) processing for the manufacturing of carbon fibers is an example for these new technologies. In this process, substantially oxidized polyacrylonitrile (PAN) fibers are converted to commercial grade carbon fiber in a compact MAP processing system.

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