

TITLE PREPARATION OF HIGH STRENGTH MULTIWALL CARBON NANOTUBES /
ULTRA HIGH MOLECULAR WEIGHT POLYETHYLENE COMPOSITE FIBERS.

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ABSTRACT High strength fiber from ultra-high molecular weight polyethylene (UHMWPE) has outstanding properties, especially, in regards to the very high strength to weight ratio. This leads to its uses in various applications, particularly in the use of personal and vehicle armors. However, fiber spinning from UHMWPE is very difficult and can not be carried out using normal melt spinning. It needs a solution for processing, and there are a limited number of studies on fiber spinning from UHMWPE. In this research, the preparation of high strength fiber from UHMWPE was studied by comparing three solvents; xylene, decalin and paraffin oil. Fiber characterization was carried out by measuring mechanical and thermal properties. It was found that the most suitable solvent in terms of both fiber production and cost was paraffin oil. The strength of fibers prepared from each solvent was not significantly different. When effect of concentration was studied, it was found that this concentration for fiber production was 3%wt. Fiber could be drawn up to 80 times its original length and gave fiber with strength and modulus of 2315 MPa and 115 GPa, respectively. The influence of MWCNTs content on mechanical properties of the composite fibers was investigated. Significant improvement in both tensile strength and modulus was clearly observed, especially composite fibers containing MWCNTs 5% by mass. The level of improvement at draw ratio 80 for both tensile strength and modulus are 24% and 10% for up to 2865 MPa and 126 GPa, respectively. Orientation of MWCNTs was investigated using polarized Raman spectroscopy. The results suggested that MWCNTs are aligned along the fiber axis in the draw fiber.