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Innovative functionalized carbon fibers from waste: how to enhance polymer composites properties.

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Abstract:

Carbon fibers (CF) were synthesized from waste clothes and treated with oxygen plasma at 100 W and 200 W for 5 minutes. Surface morphology and structure of the treated CF were studied via Field Emission Scanning Electron Microscopy (FESEM) and Raman spectroscopy. The functional groups on the surface of the plasma treated CF were studied through X-Ray Photoelectron Spectroscopy and Fourier Transform Infrared spectroscopy. BET analysis showed that surface area of the fibers increases after treatment. The plasma treated CF retained higher amount of the epoxy resin in the wettability test. Composites were fabricated from untreated and treated CF in 1% and 3% by weight with epoxy resin. Mechanical and tribology behavior of the composites showed that the plasma treated CF composites are superior to their untreated counterparts. Morphology of the mechanical and the tribology specimen were studied with FESEM.

Keywords: **A**. Polymer-matrix composites (PMCs), **A.** Recycling, **B.** Mechanical properties, **B.** Wear.

1.0. Introduction:

Carbon fibers and their composites are among the most employed materials in a number of applications ranging from super capacitors to sports goods, from airplane structural parts to wind turbine blades, thanks to their superior strength to weight ratio and electrical properties [1-6]. The carbon fiber composites industry is growing very fast and is expected to reach 140k tons production in the year 2020 [7, 8]. Currently Poly acrylonitrile (PAN) based carbon fibers represent more than 70% of the total carbon fiber (CF) production but the conversion process of PAN polymer to CF is complicated and has environmental impacts. Use of PAN precursor not only increases the cost of CFs based on nonrenewable energy but also the environmental pollution owing to the production of toxic gases such as hydrogen cyanide [9]. Furthermore, high temperature range of 1500^{o}C and above is required to produce carbon fibres with optimum properties. The waste management of carbon fibres composites itself is energy and resource