

## Activated Carbon Fibers/Zinc Oxide Nanorods Fabrics for UV Protection

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**Abstract:** Organic–inorganic nanocomposite materials represent a creative platform to design new materials with improved or novel features that allow the development of innovative industrial applications. In this project, based on the fact that ZnO nanostructures are among the best and safest choices for ultraviolet (UV) protection materials for potential applications for UV preservation, Zinc oxide nanorods (ZnO-NRs) were grown on the surface of the activated carbon fibers (ACF) fabrics using a simple and cost-effective hydrothermal method to produce (ACF/ZnO-NR) nanocomposites. The experimental conditions (such as ZnO-NR density, lengths, and diameters) were optimized to obtain nanocomposites with best performance. The optical, microstructural properties of the nanocomposites were investigated using, SEM, XRD, UV-Vis, Contact angle test, and FTIR. The behavior of ZnO-NR, ACF, and ACF/ZnO-NR samples under UV-radiation exposure has been studied after different exposure times. The results obtained showed that the prepared ACF/ZnO-NR nanocomposites were somewhat transparent under the visible wavelength region and highly protective against UV radiation. Moreover, results revealed that the successful homogeneous immobilization of ZnO-NR on ACFs surface effectively enhances the UV-shielding performance. Particularly, the pristine ACF fabrics achieved a quite modest UV-blocking efficiency in the UVA (96%) and UVB (95%) regions. However, ACF/ZnO-NR fabrics showed a relatively high UV-blocking efficiency in the UVA (98%) and UVB (97%) regions. Additionally, fabrics with 1%wt ZnO-NR content demonstrate an enhanced hydrophobicity with a contact angle over 135° compared to pristine ACF. Moreover, ACF/ZnO-NR fabrics also displayed an outstanding thermal and UV stability and exhibit an excellent UV-protection factor of 50+. The experimental results suggest that the synthesized samples can be used as a UV-blocking material and find potential applications as a UV absorber in optical devices, cosmetics, smart packaging, textiles, and protective coatings.

**Keywords:** Hydrothermal process, ZnO nanorods, Activated carbon fabrics, Nanocomposite, UV protection.