

A Novel Microwave Treatment to Augment the Mechanical Properties of Polymeric Materials †

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Abstract: The present study portrays a novel post-processing treatment by using microwave radiations for enhancing the mechanical properties of five commonly used engineering polymers, Poly-amide (PA), Poly-butylene-terephthalate (PBT), Poly-propylene (PP), Poly-carbonate (PC), Acrylonitrile-butadiene-styrene (ABS). The analysis revealed that the crystal structures of the polymers improved after the treatment due to a more favorable rearrangement of crystalline segments within the polymers. Furthermore, tensile properties and tribological performance of microwave treated polymers were found to be significantly better when compared to those of untreated counterparts. The tensile strength, elongation, and wear performance of PA increased by 51%, 286%, and 45%, respectively, only after a treatment of 20 seconds. A similar response was also exhibited by other polymers as well. It was noted that the optimum time for microwave treatment could vary depending on the different crystalline nature of the polymers. The degree of randomness in the molecular chains of semi-crystalline polymers is less; thus, it requires less treatment time. However, for amorphous polymers, as randomness increases, more time is needed. As such, post-processing microwave treatment of polymers has proven beneficial as a cost-effective, time-saving, and environment-friendly technique for enhancing material properties significantly.

Keywords: post-processing treatment; microwave; polymers; structural rearrangement; tensile properties; tribological performance.

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Conflicts of Interest

The authors declare no conflict of interest.