Abstract
Dielectric Analysis of Polypropylene-Based Composites Filled with Pyrolytically Stripped Pyrograf® III Carbon Nanofibers †

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Abstract: In this study, pyrolytically stripped (PS) Pyrograf® III carbon nanofiber (CNF)/polypropylene (PP) composite films produced by a scalable melt-mixing method are used to investigate the effects of CNFs' weight concentrations on their dielectric properties. Unexpectedly, the electrical conductivity of PP/CNF composite films showed only a slight improvement with respect to pure PP, with values in the order of $10^{-8}$ S/m for PP/CNF composite films containing 5 wt.% CNFs. This increase corresponded to an improvement in the dielectric constant up to a maximum of approximately 9 at 1 MHz. This change was attributed to the polarization effect at the interface between the CNF agglomerates and the PP matrix. Moreover, the Cole–Cole model was employed to analyze the effects of CNF concentrations on the dielectric relaxation of PP/CNF composite films, revealing that the incorporation of carbon nanofibers (CNFs) not only increased the dielectric strength of the composites but also extended their relaxation times. These discoveries provide valuable insights into the mechanisms responsible for the dielectric properties of polymer composites produced with commercial carbon nanofibers (CNFs), thereby providing information for potential applications in the electronics arena. Additionally, understanding these mechanisms can pave the way for optimizing composite materials for diverse electronic applications. The results of this presentation have been published and can be consulted in previous work [1].

Keywords: polypropylene; carbon nanofibers; polymer composites; electrical conductivity; electrical modeling

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