The Effect of Voltage and Temperature Level on Dielectric Properties of PUR/MgO Nanocomposites

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Abstract. Polyurethanes (PURs) are a group of materials that have gained significant attention in recent years due to their unique properties and wide range of applications. PURs are known for their excellent mechanical properties, chemical resistance, and durability, making them highly desirable in many fields, including automotive, construction, and biomedical industries. This work aims to provide a comprehensive analysis of the changes in dielectric properties that occur when magnesium oxide (MgO) nanoparticles were incorporated into PURs at different weight ratios (1, 3 and 5 wt.%) via direct dispersion method. Specifically, it concerns the dielectric parameters such as relative permittivity, dissipation factor, or volume resistivity at different voltage (0.5–2 kV) and temperature (30–120 °C) ranges. The results of this study have important implications for the use of PURs in the electrical industry. The following facts result from the conducted investigation. The addition of magnesium oxide has a significant effect on the thermal stabilization of the resulting material, particularly with regard to the dielectric losses (decrease within one order of magnitude), relative permittivity (decrease up to 12 %), and volume resistivity (increase within the order of magnitude). The effect of the applied field intensity is negligible within the monitored voltage ranges. The conducted research has demonstrated that the incorporation of MgO nanoparticles into composites can enhance their electrical and thermal properties, thus making them highly desirable for diverse applications.