The Effect of ZnO and Al₂O₃ Nanofillers on the Volume Resistance of New Cold-Curing Polyurethane

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Abstract. This study examines the effects of nanoparticle incorporation on the volume resistivity of insulation materials, specifically focusing on comercial polyurethane Vukol N22. Nanocomposites containing zinc oxide (ZnO) and aluminum oxide (Al₂O₃) nanoparticles with diameter of 20 nm and with weight fractions ranging from 0.5% to 2%, were synthesized using the direct dispersion method. The volume resistivities of these composites were subsequently measured and analyzed. The findings indicate that optimal nanoparticle concentrations can enhance the insulating properties of the materials, with 0.5% ZnO and 1% Al₂O₃ showing the most significant increase in resistivity. Measurement showed that 2 wt. % of concentrations of used nanoparticles were found to yield resistivity values comparable to those of the unenhanced VUKOL N22. The study highlights the pivotal role of nanoparticle concentration in modifying the electrical properties of polymer-based insulators, underscoring its potential to improve the reliability and safety of electrical systems.

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