# Mechanical and Structural Characterization of Novel Polyesterimide Nanocomposites

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**Abstract.** This study is part of a broad research to develop advanced composite material through the incorporation of nanofillers. Focusing in this article on dynamic mechanical and thermal properties, alongside charge density measurements. Evaluating a composite comprising of polyesterimide resin matrix filled with 1 wt.% silicon dioxide ($SiO_2$) nanoparticles, supplemented with polyamide nonwoven nanofabric and polyamide film. Dynamic Mechanical Analysis (DMA) is employed to assess the viscoelastic behavior, stiffness, and damping properties of the composite under various mechanical stresses and temperatures. Simultaneous Thermal Analysis (STA) is conducted to evaluate the thermal stability and decomposition characteristics, which are essential for applications exposed to high temperatures. Charge density within the composite is measured using the Pulsed Electroacoustic (PEA) method, essential for analyzing the electrical charge distribution under electrical stress. Results indicate notable enhancements in mechanical damping and thermal stability. The use of an environmentally friendly, low-viscosity polyesterimide resin not only facilitates the manufacturing process but also improves the performance of the composite, positioning it as a viable alternative to traditional materials in demanding mechanical, thermal, and electrical applications. The synergistic effects of the nanoparticle and nanofabric reinforcement on the overall properties of the composite are highlighted, showcasing its potential for future use in high-performance engineering applications.

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