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(57) Abstract :

This study presents a comparative analysis of the damping properties of epoxy nanocomposite beams reinforced with carbon nanotubes (CNTs) and graphene nanoplatelets (GNPs). The investigation focuses on exploring the effects of these nanofillers on the damping behavior of polymer matrices, particularly under dynamic conditions. The study utilized dynamic mechanical analysis (DMA) and free vibration tests to evaluate the composite specimens, which were fabricated with varying weight ratios of CNTs and GNPs. Scanning electron microscopy (SEM) was employed to examine the dispersion of nanofillers within the epoxy matrix. The results demonstrate significant enhancements in the first-order loss factor of the composite beams, with GNP-reinforced specimens showing a 128.9% increase compared to pure epoxy at 0.025 wt% GNP content. In contrast, CNT-reinforced specimens exhibited a 41.1% increase at 0.4 wt% CNT content. The study found that GNPs provided a more substantial improvement in damping properties than CNTs, with the maximum damping ratio being 62.2% higher in GNP-reinforced beams. The analysis suggests that the superior performance of GNPs is due to better dispersion and stronger interfacial bonding with the epoxy matrix. Overall, this research highlights the potential of CNT and GNP reinforcements in enhancing the damping capabilities of polymer nanocomposites. The findings have significant implications for the development of advanced materials with improved mechanical properties for applications in noise reduction and vibration control in various engineering fields.

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