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REVOLUTIONIZING SPACECRAFT MANUFACTURING: 3D-PRINTABLE GRAPHENE-PLA COMPOSITE FOR ENHANCED CUBESAT STRUCTURES.

Abstract

This study introduces a pioneering composite material that combines graphene with Polylactic Acid (PLA) to enhance CubeSat structures, making strides toward more efficient, sustainable, and cost-effective space exploration. By integrating graphene's exceptional mechanical and thermal properties with PLA's biodegradability, we have developed a 3D-printable material that not only surpasses traditional CNC machining in manufacturing efficiency and environmental sustainability but also significantly improves the performance of space structures.

The graphene-PLA composite exhibits superior specs, enabling the production of CubeSat structures capable of withstanding the rigorous mechanical stresses of launch and the extreme thermal conditions of space. This advancement is crucial for both short and long-term space missions, ensuring structural integrity and reliability in the challenging space environment. Moreover, the material's 3D printability revolutionizes the manufacturing process, offering unprecedented design flexibility, reduced production times, and lower costs than conventional methods.

A key feature of this composite is its environmental friendliness; it is designed to burn off entirely upon deorbiting, leaving no harmful residues. This addresses the pressing issue of space debris and its impact on space operations and the Earth's atmosphere, offering a sustainable alternative to traditional space materials like aluminum.

In essence, the graphene-PLA composite represents a significant leap forward in space technology, promising to enhance the capabilities of CubeSats and other spaceborne platforms while prioritizing ecological considerations. This research paves the way for a new era in spacecraft manufacturing, where innovation meets sustainability, setting a new benchmark for future space exploration endeavors.