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ABSTRACT

Carbon Fiber Composite Honeycomb Materials: Pioneering High-Stability and High-Precision Aerospace Structures

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Reducing structural weight, enhancing load-bearing efficiency, and ensuring surface accuracy are the design objectives for spacecraft exploration structures. In the space environment, as satellites continually pass through shaded and illuminated regions, the reflective surfaces of satellite antennas undergo significant thermal deformation, thereby reducing the satellite's detection capabilities. Carbon fiber honeycomb structures, characterized by their lightweight, high specific stiffness, high specific strength, and low thermal expansion coefficient, have important applications in advanced spacecraft components such as satellite antenna reflective surfaces, space telescopes, and high-precision optical support platforms. In this report, we will present some of the progress made by our research group in the field of carbon fiber composite honeycomb structures, including: (1) manufacturing techniques for carbon fiber honeycombs; (2) mechanical performance characterization and evaluation methods for carbon fiber honeycomb sandwich structures under typical loads; (3) design, mechanical performance evaluation, and reinforcement mechanism study of face-core reinforced carbon fiber honeycomb structures; (4) surface adaptability design and mechanical performance characterization of carbon fiber honeycomb structures.