

Thermal Anisotropy in Chopped Cf Reinforced SiC Composites by Laser Printing and Polymer Infiltration-Pyrolysis Techniques

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Directional thermal transport materials enable anisotropic heat flow, thereby enhancing the efficiency of thermal management systems. These materials have found broad applications in aerospace, electronics, and automotive industries. Silicon carbide (SiC) based composites, with their exceptional properties including high modulus, thermal stability, and superior thermal conductivity, serve as an ideal structural material. Strategic manipulation over microstructure and composition enables directional thermal management, expanding applicability in thermal management and achieving structural-functional integration. By combining selective laser printing with precursor impregnation and pyrolysis (PIP), this work presents an innovative approach to fabricating thermally anisotropic Cf/SiC composites that integrate both structural and functional properties. The optimized composite (20% (in volume) chopped Cf) exhibited high fiber alignment ($f_p = 0.7677$) and pronounced thermal anisotropy, with thermal conductivities of $70.14 \text{ W/(m}\cdot\text{K)}$ perpendicular and $38.87 \text{ W/(m}\cdot\text{K)}$ parallel to the printing plane (anisotropy ratio: 1.8). This directional heat transport, enabled by fiber orientation and phonon scattering control, is critical for advanced thermal management. The composite also maintained good mechanical strength, exhibiting a flexural strength of $(150.4 \pm 9.8) \text{ MPa}$ parallel to the printing plane, finalizing in a structural and functional integration.

Professional Status of the Speaker

Doctoral or Master Student

Interest in submitting a paper in a special issue of

No interest

Invitation letter for visa

Yes

Author: TIAN, Huisheng (Shanghai Institute of Ceramics, Chinese Academy of Sciences)

Presenter: TIAN, Huisheng (Shanghai Institute of Ceramics, Chinese Academy of Sciences)

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