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Development of Thermally Conductive Thermoplastic Polyurethane Composite Foams via CO₂ Foaming-Assisted Filler Networking

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Abstract: In this work, thermoplastic polyurethane (TPU)-hexagonal boron nitride (hBN) composite foams have been fabricated by physical foaming processes using carbon dioxide (CO₂) as the blowing agent. Parametric studies were conducted to investigate the effects of saturation pressure, foaming temperature, and post-foaming elastic recovery on the composite foam's morphology and effective thermal conductivity. It was found that foaming-induced filler alignment and post-foaming elastic recovery of TPU synergistically facilitated the formation of interconnected thermally conductive filler network in TPU matrices. This represents a novel processing technique to fabricate TPU-hBN composite foams with enhanced effective thermal conductivity.

Keywords: A. Foams; Polymer-matrix composites (PMCs); C. Thermoplastic resin; Effective thermal conductivity

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