Enhanced Thermal Conductivity in Polyimide/Inorganic Composite Films based on Controlled Phase Separation Morphology and Anisotropic-Shaped Particles

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Enhancement of thermal conductivity along the out-of-plane direction in polyimide (PI) blend films containing ZnO, MgO, and h-BN particles having different sizes and anisotropic shapes has been extensively investigated. Microphase-separated structures with “vertical double percolation (VDP)” morphology were spontaneously formed in the PI films composed of sulfur- and fluorine-containing PIs, in which two phases were separately aligned along the out-of-plane direction, and ZnO and MgO particles were preferentially precipitated in the fluorine-containing PI phase. In particular, the PI blend films containing needle-shaped ZnO particles exhibited significant enhancement of thermal conductivity even at lower filler contents, which indicate that the VDP structure with selective incorporation of anisotropic shaped inorganic particles functions as highly efficient thermal conductive pathways.

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