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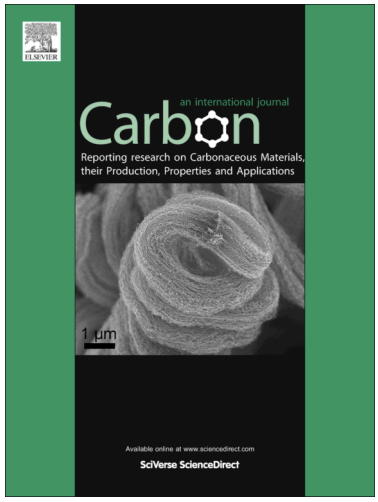

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Thermal and electrical conduction in the compaction direction of exfoliated graphite and their relation to the structure

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Abstract

The effects of the compaction and graphite layer preferred orientation on the thermal and electrical conductions in the compaction direction of graphite-flake-based exfoliated graphite have been decoupled. The compact's electrical and thermal conductivities decrease with increasing compaction (density increasing from 0.047 to 0.67 g/cm^3, solid content increasing from 2.1 to 30 vol.%) and preferred orientation. The essentially linear correlation between electrical and thermal conductivities (Wiedemann-Franz Law) is because both conductions are governed by the preferred orientation. With increasing compaction, the fraction (*f*) of conduction path that is the graphite *a*-axis decreases from 0.997 to 0.937 and from 0.994 to 0.798 for thermal and electrical conductions respectively. For the solid-part thermal and electrical conductivities to exceed 140 W/(m.K) and 60 kS/m respectively, *f* must exceed 0.95; the highest solid-part conductivities are 550 W/(m.K) and 230 kS/m. The compaction-related variation in the solid-part conductivities is large [21-550 W/(m.K) and 10-230 kS/m], due to the preferred orientation variation. The through-thickness Lorentz number (7.3 x 10^{-6} W.Ω/K^2) is similar to the in-plane value, being independent of the preferred orientation. At 2-7 vol.% solid,

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