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Evaluation of the cross-plane thermal conductivity of double-layer materials

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Abstract

Double-layer cladding materials were fabricated by roll bonding using stainless steel (STS439) and aluminum (Al1050) sheets to investigate the thermal conduction of multi-layer composites. The measured thermal conductivities were compared to values calculated from cross-plane models that are widely used for resistor connections in electrical circuits. The measured thermal conductivity was 88.3 W/m•K for the sample containing 76 vol% of Al1050. Unexpectedly, the measured cross-plane thermal conductivities were always higher than the values calculated from the series model. The high cross-plane thermal conductivities were attributed to the contribution of phonons to thermal transfer. A deviation index of the thermal conductivity, $F_{m(S)}$, is proposed, which effectively describes the cross-plane thermal conductivity characteristics of double-layer materials.

Keywords: A. Layered structures, B. Thermal properties, C. Thermal analysis, D. Joints

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