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## Analysis of thermal conductivity in mica-epoxy pellets as a thermal paste for thermal management applications

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In electronic and electrical applications, the removal of excess heat is crucial. A thermal paste with electrical insulating properties is essential. This study investigates the thermal conductivity characteristics of epoxy-mica composites with varying mica content, ranging from 9:10 to 2:10 ratios, and compares them with pure epoxy and soldering lead as reference materials. The objective is to develop a cement-like material with improved thermal conductivity and electrical insulating properties, and to assess the potential of these composites for thermal management applications. Mica powder was mixed with epoxy resin and hardener in precise ratios, stirred for uniform dispersion, and poured into custom moulds. The samples underwent vacuum treatment to eliminate air bubbles and ensure a dense, defect-free structure. The pellets were trimmed and polished to reduce thermal contact resistance. Thermal conductivity measurements were performed using a custom-designed steady-state thermal conductivity meter. This setup employed a nichrome wire heating element, nylon insulation, and temperature probes to measure the temperature gradient across the samples. Thermal conductivity was measured across a range of temperatures using the steady-state heat flow method for each sample. At an initial temperature of 37°C, the 4:10 mica:epoxy ratio exhibited the highest thermal conductivity at 8.06 W/m·K, whereas pure epoxy had a thermal conductivity of 6.38 W/m·K. The results further show that the thermal conductivity of the epoxy-mica mixture decreases with temperature, and epoxy loses thermal conductivity much faster when not mixed with mica. Therefore, it can be concluded that mixing mica powder with epoxy can create a versatile material suitable for thermal and electronic applications, where heat must be removed while maintaining electrical insulation.

**Keywords:** Epoxy-mica composites, Thermal conductivity, Thermal management