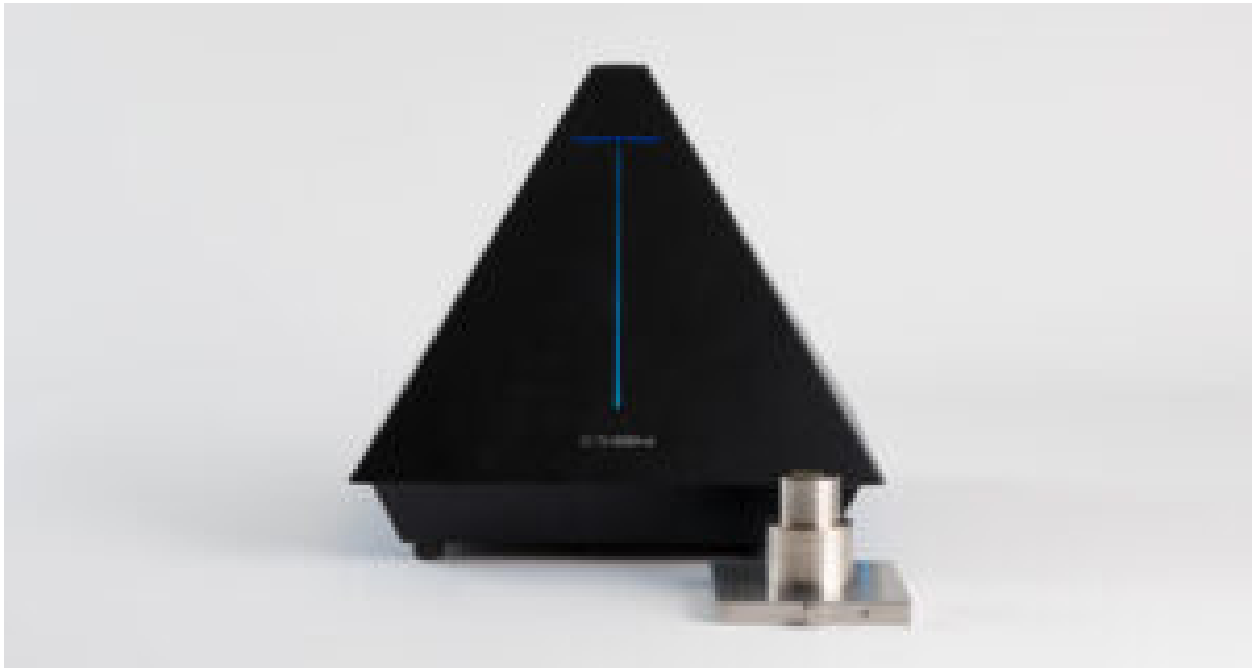
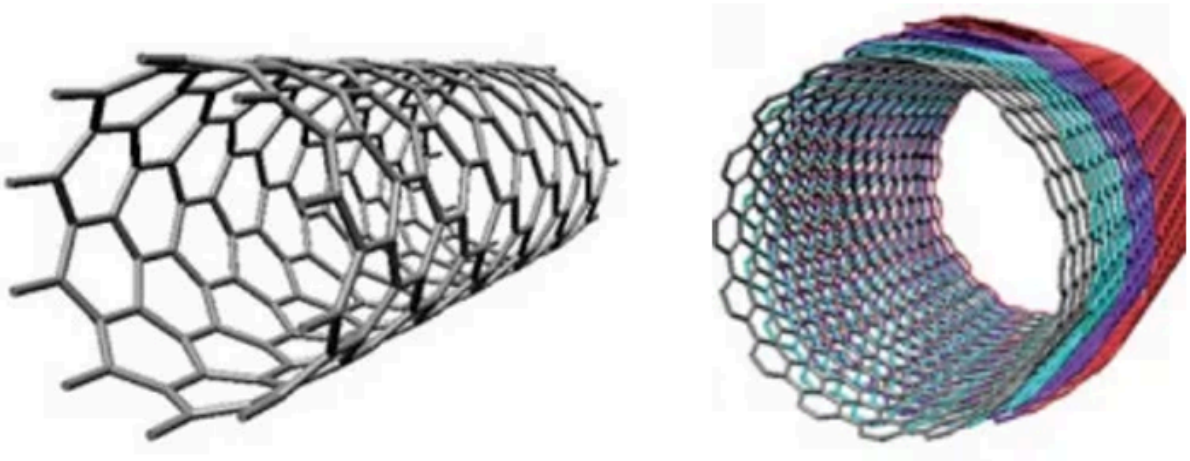
Measuring the Thermal Conductivity of Nanomaterials

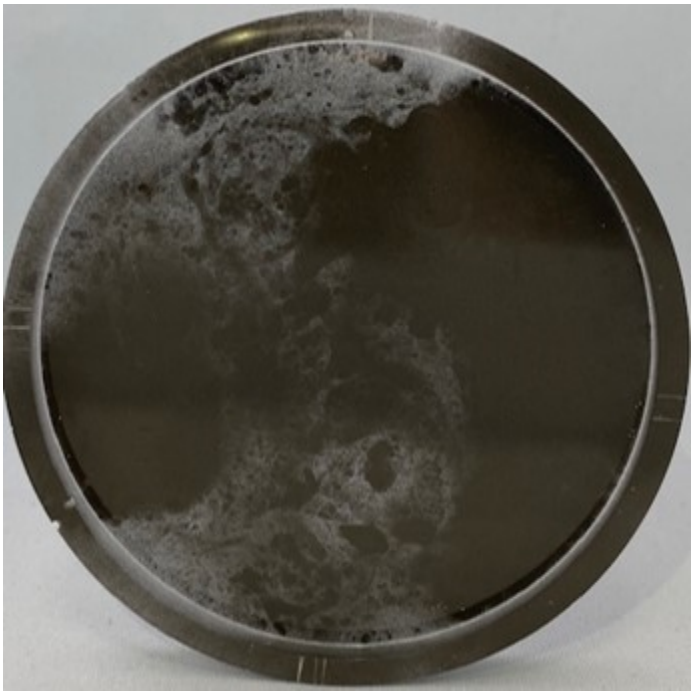


Trident Thermal Conductivity Instrument, equipped with the MTPS sensor, ideal for measuring nanomaterials and the thermal mapping of composites.

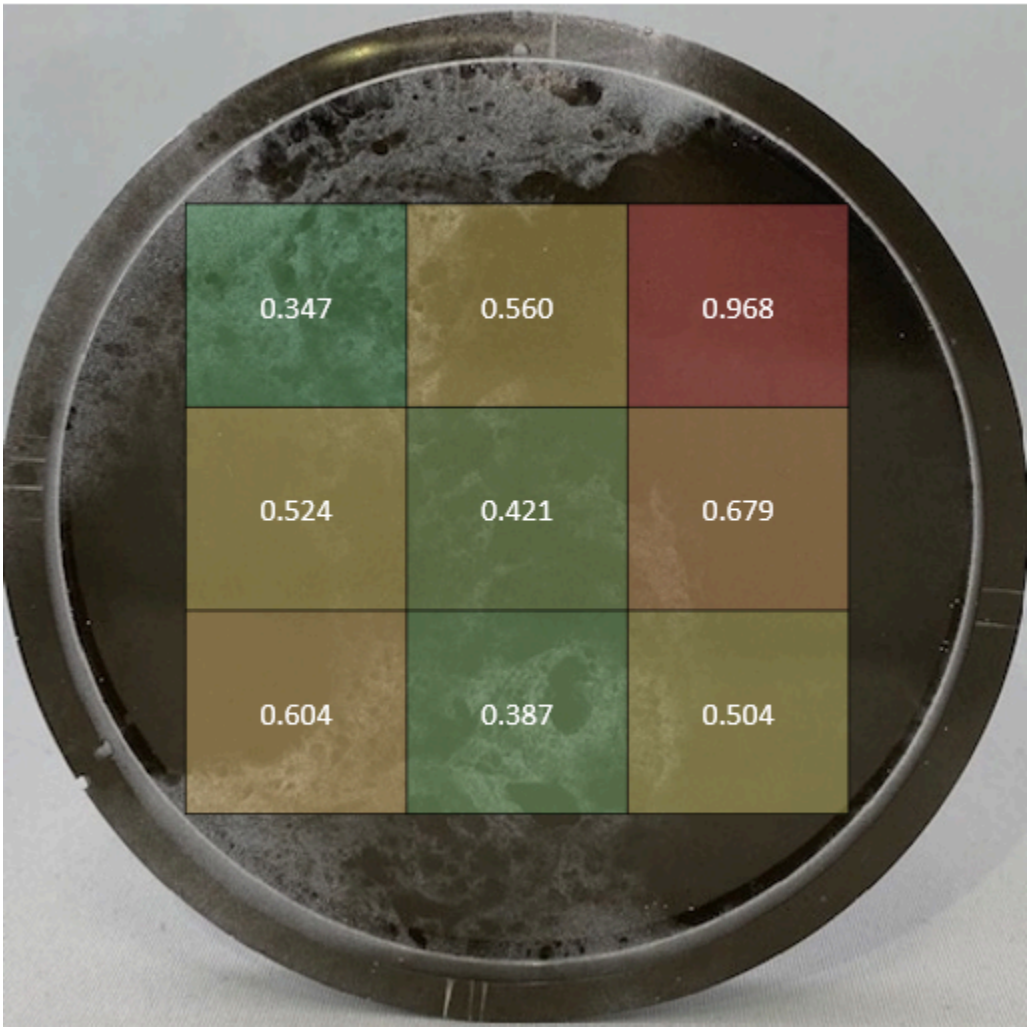
The Modified Transient Plane Source (MTPS) method developed by C-Therm provides the optimal choice for researchers in characterization the thermal conductivity of nanomaterials. Such materials are expensive and time-consuming to produce in the development phase. The MTPS has a small volume requirement of 1.5 mL, which is convenient for quick measurements, especially given the cost of large volumes of nanoparticles. The method's simplicity allows researchers to quickly and easily characterize their samples, with no need for regression analysis. Additionally, the single-sided sensor is the only method that allows for the thermal mapping of a sample's performance to better understand the dispersion of nanomaterials in a polymer matrix.



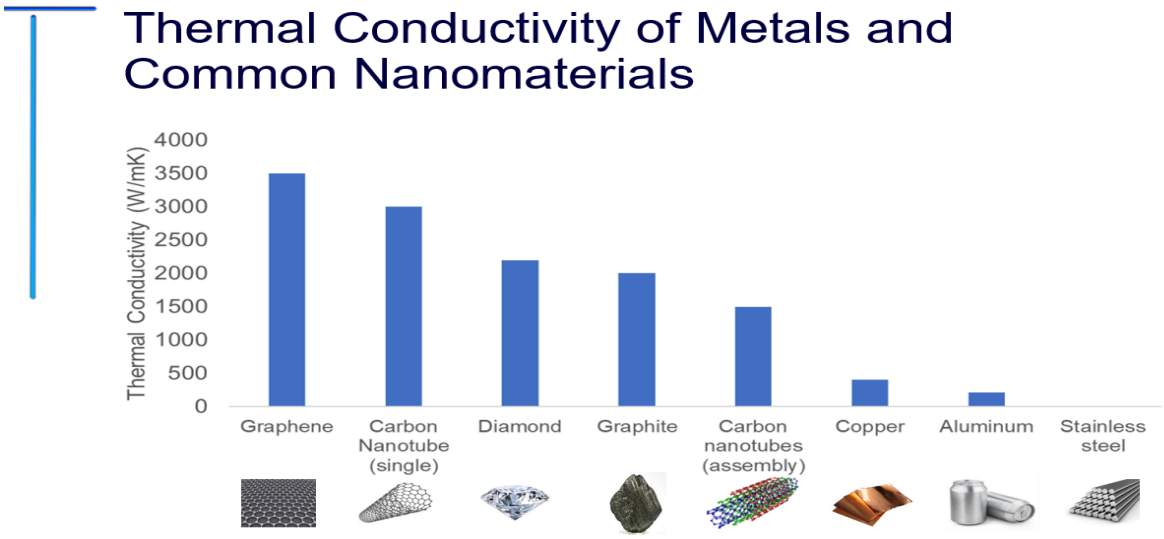
Single-walled (left) and multi-walled (right) carbon nanotubes (CNT) which are often used as a filler material to increase thermal conductivity.



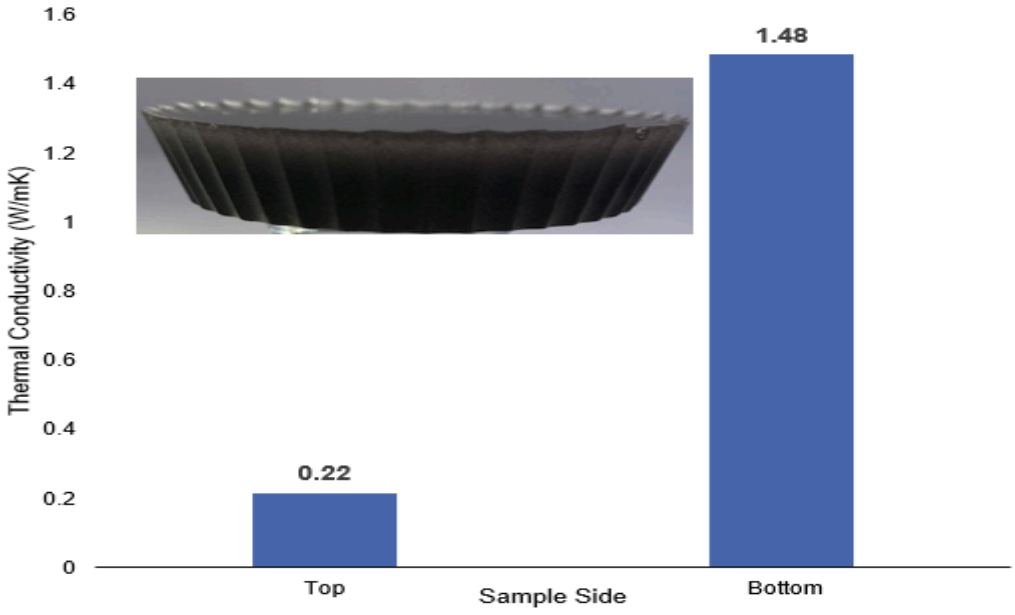
An epoxy resin that has been filled with conductive metal nanoparticles to increase thermal conductivity. This was done unevenly for the purpose of creating a thermal map.



A thermal map of the nanoparticle-filled epoxy resin. The high thermal conductivity correlates to a high concentration of nanoparticles. This map demonstrates the uneven nature of the filler. This is only possible with the MTPS.



The thermal conductivities of common nanomaterials and metals. Nanomaterials are often used as filler materials to improve the heat transfer of composites.



An example of settling detection; the top of the composite has a visibly lower particle concentration that the bottom, and this can be detected using thermal conductivity measurements possible with the single-sided MTPS.

How Nanomaterials Influence Thermal Conductivity

Nanomaterials offer unique electrical properties, extraordinary strength and great efficiency in heat conduction. Application areas for nanomaterials include electronics, optics, medicine and architecture – offering tremendous potential for ground-breaking discovery. The effective thermal conductivity is often considered a critical performance attribute of the material.