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**Title:** ***Thermal Contact Conductance at Elevated Temperatures: Measurement System and Carbon Nanotube Thermal Interface Material Capabilities***

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In a review of thermal management for future, heat-generating electronics, panelists from Northrup Grumman, JPL, and Rockell Collins explored the challenges that thermal engineers face in designing innovative cooling solutions for systems subjected to harsh or extreme environments in military, automotive and space applications. As many of these electronics are assembled in a modular fashion that gives rise to a thermal contact resistance, the need to develop light weight thermal interface materials (TIMs) of higher thermal conductivity and lower thermal coefficients of expansions was highlighted as a critical issue, particularly in extreme temperature and pressure enviornments. In comparison to room temperature or sub-100°C applications, in which many different TIMs are available, high temperature applications are relegated to sparse options. While as-grown CNT TIMs, without any subsequent bonding technique or treatment, do not break performance barriers relative to current room-temperature, commercially available TIMs, their superior stability at elevated temperatures may render them more appropriate for high temperature applications. An equally important necessicity is the development of experimental systems that are capable of simulating the performance of TIMs and quantifying thermal properties of materials in extreme environments. Additionally, many materials, such as metals, exhibit strong temperature dependent thermal and mechanical properties at these temperatures. Commonly used data analysis techniques ignore both of these factors and as a result yield inaccurate results, rendering a need for measurement systems with such capabilities in high temperature environments. In this work, a custom thermal contact resistance measurement system based on the ASTM D470-06 standard was constructed and employed to measure the contact resistance of CNT TIMs under interfacial pressure (120 – 630 kPa) and temperature (150 - 450°C) ranges. The thermal performance of the CNT TIMs was evaluated as functions of both temperature and interfacial pressure. Additionally, the CNT TIMs were subjected to uniaxial compressive mechanical and thermal cycling.

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