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Observation of Heat Exchange between Different Gas Molecules and Suspended Carbon Nanotubes with Raman Spectroscopy I-KAI HSU, MICHAEL T. PETTES, MEHMET AYKOL, LI SHI, STEPHEN CRONIN — We observe different heat dissipation behavior of individual, suspended carbon nanotubes (CNTs) in different gas environments based on their temperature profiles as measured by micro-Raman spectroscopy under various electrical heating powers. The heat transfer coefficient between gas molecules and CNTs is determined by comparing the temperature profiles along each individual CNT measured in vacuum and in different ambient gas environments. Our results show that heat taken away by gas molecules from the hot CNT surface is approximately 3 times larger than the heat transported though the CNT itself, indicating the significant influence of gas molecules in the thermal transport of CNTs. This result is encouraging for thermal management solutions for future CNT-based electronic applications. Moreover, the heat transfer coefficient is found to be inversely proportional to the temperature of the CNT, which implies that the heat removal rate from the CNT by gas molecules might also be limited by the decreased thermal conductivity of the CNT at higher temperatures.

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