Molecular Fan for Radiative Cooling of Nanoelectronic Devices
By Dr. Chhiu-Tsu Lin

In this forum, the radiative cooling in relation to lattice quantization and surface emissivity in nanocoatings will be presented in details. Nanodiamond (NDP), carbon nanotube (MWCNT), and carbon black (CB) were dispersed separately in the nanosize acrylate emulsion (AC) to form a nanocoating on heat-sinks. The active phonons of the nanomaterials were designed to act as a molecular cooling fan, termed “molecular fan - MF”. The MF coating was shown to have an enhanced surface emissivity which is well-correlated to the lattice quantization with the order of MWCNT > CB > NDP, whereas thermal conductivity follows the order of NDP > MWCNT > CB. The equilibrium temperature lowering of the coated heat-sink was measured as 17 °C for MWCNT molecular fan, and can be attributed to the excited phonons that emit IR radiation to cool the heat-sinks.

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Research Interests
Molecular electronic spectroscopy; biophysical chemistry; lasers and their chemical applications for better materials science.