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Coatings for thermal management and their radiation property

Thermal management is a major challenge in the electronics and optical industries. With miniaturization and integration, it is important to manipulate heat dissipation efficiently. A thin coating (molecular fan 'MF') is proposed to improve heat dissipation from hot body to surroundings. The coatings include an organic matrix (acrylate) and carbon nanomaterials (carbon nanotube (CNT), nanodiamond powder (NDP), carbon black (CB)). In spite of the superior thermal conductivity of NDP, it is observed that CNT exhibits better cooling performance. A radiative monitoring system has been constructed to estimate the emissivity of the MF coatings. Temperature of the hot body and radiation temperature; as measured by an IR thermometer, are recorded until steady state is reached. The emissivity value of the surface is estimated by comparison of the radiation temperature with the actual surface temperature; as measured by a temperature sensor. Preliminary data suggests that CNT composite has the highest emissivity value, approaching that of a black body and better than that of NDP composite. IR imaging showed strong emission from CNT filled composite. It is concluded that radiative heat transfer could be an important factor in thermal management.