MAE Praxair Seminar

Nanoscale Heat Transfer in Thermoelectric Materials

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ABSTRACT:
Heat transfer in nanostructures differ significantly from that in the bulk materials since the characteristic length scales associated with heat carriers, i.e., the mean free path and the wavelength, are comparable to the characteristic length of the nanostructures. Nanostructure materials hold the promise of novel phenomena, properties, and functions, which are not attainable using bulk materials. Thermoelectric properties are among the properties that may drastically change at nanoscale. The efficiency of thermoelectric energy conversion in a material is measured by a non-dimensional figure of merit (ZT) defined as, $ZT = sS^2T/k$ where s is the electrical conductivity, S is the Seebeck coefficient, T is the temperature, and k is the thermal conductivity. During the last decade, advances have been made in increasing ZT using nanostructures. In this talk, we present the simulation results for thermal transport in 2-D and 3-D nanocomposites. The Boltzmann Transport Equation (BTE) for the phonon intensity is solved in conjunction with suitable boundary and interface treatment. The treatment of interfaces between the two materials significantly affects the thermal characteristics of the nanocomposites. Unlike in bulk composites, the results show a strong dependence of thermal conductivity, temperature, and heat flux on the wire size, wire atomic ratio, and interface specularity parameter.

BIO :
Arvind Pattamatta is currently a Doctoral student in Aerospace Engineering at the CFD Laboratory of the State University of New York at Buffalo. He received his Bachelor and Master's degrees in Aerospace Engineering from the University of Madras in 2001 and the Indian Institute of Science in 2003, respectively. For the next two years he was employed as a Design Engineer in the Combustion Center of Excellence at GE India Technology Center in Bangalore, India where he was using Computational Fluid Dynamics based tools for the analysis of fluid flow and heat transfer in GE Aircraft engine Diffusers and Combustion chambers. Since 2005 he has been enrolled in the MAE department as a Graduate student with research focus in the field of nanoscale energy transport in thermoelectric materials.

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