TIM Design for Optimized Mechanical and Thermal Properties

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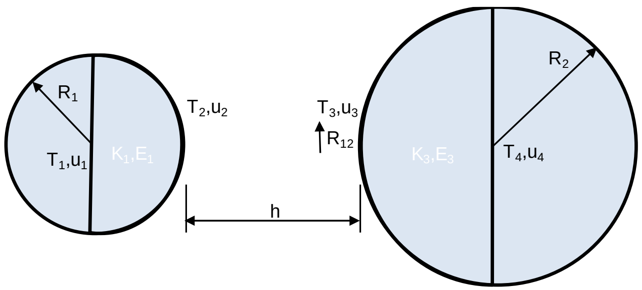
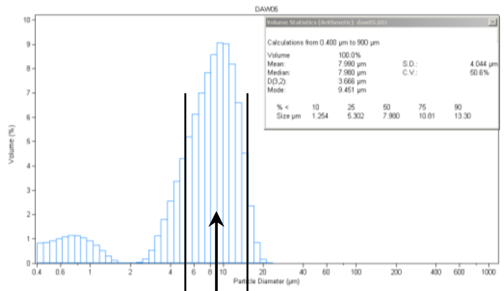
Objective

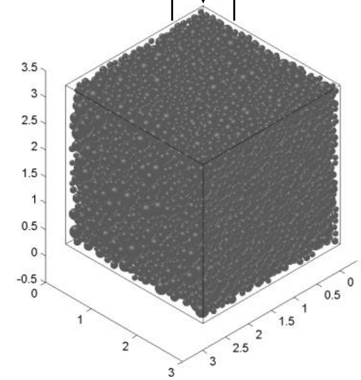
Develop models to estimate the effective elastic modulus and thermal conductivity of particulate thermal interface materials (TIMs), and to determine the optimal configurations for maximum conductivity and minimum stiffness.

Approach

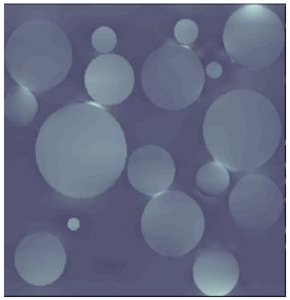
- Energy and momentum transfer from chip to sink occur primarily through filler particles
- Inter-particle transport restricted to a small zone of interaction







Microstructures of given particle size distribution simulated



Heat flux dominant in neighborhood of point of contact between particles

Impact

Optimized TIM performance leads to greater heat removal and allows design of faster and more reliable semiconductor devices

Selected Publications

- Kanuparthi, S., Rayasam, M., et al. (2009) *CMAME,* 198 (5), pp. 657-668
- Kanuparthi, S., Subbarayan, G., et al. (2008), *IEEE CPT,* 31 (3), pp. 611-621
- Dan, Bo et al. (2009), *Proc. of the ASME InterPACK Conference*, 2, pp. 69-81
- Batchelor, G.K., and O'Brien, R.W., (1977) *Proc. Roy. Soc. Lond. A, Mathematical and Physical Sciences,* 355 (1682), pp.313-333
- Zhang, X. and Subbarayan, G., (2004), *Comp. Aided Design and Applications*, 1, pp. 171-178

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