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Title:

Numerical Methods for Assessing the Thermal Conductivity Performance of Aerogel Using the Boltzmann Transport Equation

Abstract: Space is a domain of temperature and radiation extremes, and to this end multi-layer insulation applications (MLI) are crucial for protecting vital components on satellites. Aerogel has emerged as an ideal material for insulation design due to its low thermal conductivity, therefore the effective modeling of aerogel conduction has been a key area of research. Aerogel is a nonporous structure that does not adhere to Fourier’s Law of heat transfer. Instead, the Boltzmann transport equation (BTE) is essential to effectively model heat transfer. This project focused on developing a numerical method of solving the BTE to model the effects of aerogel in different MLI configurations. The Gaussian quadrature method was implemented to solve the BTE in different directions to account for the change in phonon energy density (Hamian, Yamada, Faghri, & Park, 2015).

References

Hamian, S., Yamada, T., Faghri, M., & Park, K. (2015). Finite element analysis of transient ballistic–diffusive phonon heat transport in two-dimensional domains. International Journal of Heat and Mass Transfer, 80, 781-788. <https://doi.org/10.1016/j.ijheatmasstransfer.2014.09.073>

**[Submission Response]**

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