Impedance-Based Visualization of Voids in Thermal Interface Materials

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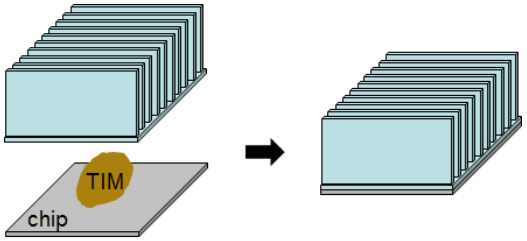
Objective

Flaws in thermal interface material (TIM) distribution reduce performance of heat dissipation devices.



This project seeks to develop a method of impedance-based visualization to detect flaws in the TIM distribution on small surfaces.

Potential benefits include:

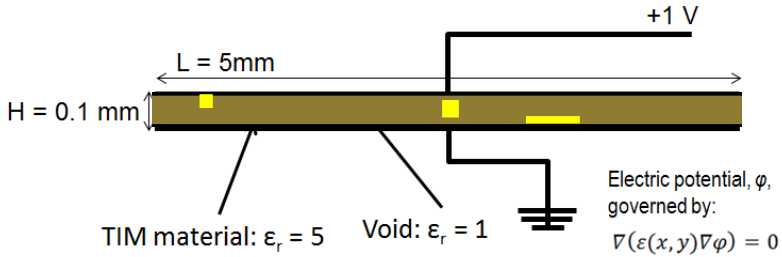
- Non-destructive comparison of distribution of different TIMs
- Non-destructive comparison of TIM application methods
- Prediction of hot spots for imperfectly distributed TIMs

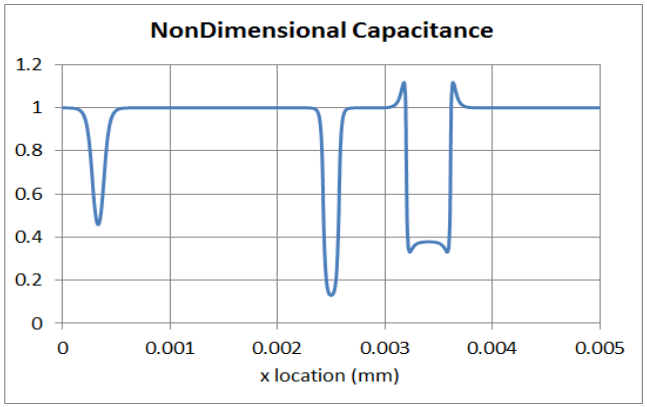
Method

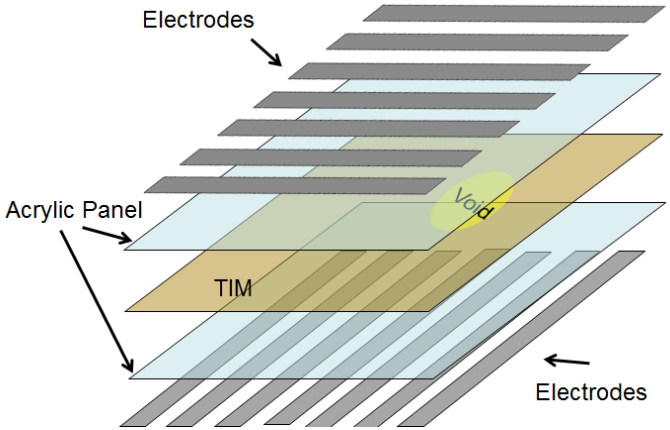
Right: Voids in the distribution of the TIM will cause changes in electrical capacitance across the gap. Thus, the presence of voids may be detected through anomalies in electrical capacitance.

Right: Simulated capacitance per unit length along a thermal interface region with three square voids of various shapes.

Below: Voids will be detected by taking an array of N^2 capacitance measurements with two N by N sets of electrodes.







Impact

- In-situ characterization of voids distribution as a function of TIM type, application method.
- Method for characterization of void development as a function of time throughout thermal cycling.

Reference: Paranjape, S. et al., 2012, Electrical Impedance-Based Void Fraction Measurement and Flow Regime Identification in Microchannel Flows Under Adiabatic Conditions, IJMF, 42, 175-183.