VALIDATION OF INVERSE BOUNDARY CONDITION DESIGN IN A THERMOMETRY TEST BED

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ABSTRACT. This study presents validation of an inverse boundary condition design analysis used in the design of an axisymmetric vacuum chamber with characteristics of a semiconductor Rapid Thermal Processing (RTP) furnace. The vacuum chamber with heater is a thermometry test bed and is equipped with thermocouples and an instrumented silicon wafer to map the temperature field in the system. In order to model the physical system accurately, precise characterization of the system is essential. In the absence of any medium, radiative heat transfer is the dominant heat transfer mode. The radiative properties of the system's important components are measured and a numerical sensitivity study is conducted to understand the effects of property and model based uncertainty introduced to the solution. The required power input for the heaters is estimated directly using inverse design so that specified thermal conditions across the silicon wafer are achieved at steady state. Through application of the estimated power distribution in the system, the design is validated by comparing the design goal and measured temperature distribution along the silicon wafer accounting for the uncertainties of the solution.