PhD Dissertation Defense Announcement
Mechanical and Aerospace Engineering Department
University of Texas at Arlington

THERMO-MECHANICAL ANALYSIS OF HETEROGENOUS INTEGRATED PACKAGES AND IMMERSION COOLING OF DATA CENTER SERVERS

By
KRISHNA BHAVANA SIVARAJU

Thesis Advisor: Prof. Dereje Agonafer
2 PM, Tuesday, 14th November 2023
Woolf Hall, 413

Abstract

With the saturation of Moore's Law being evident, semiconductor researchers and industries are looking at heterogenous integration to pack more functionalities into the electronic packages. For growing higher data transfer demands, 3D integration, silicon photonic integration and interposers play a pivotal role in highspeed transceiver chips. Silicon photonics packages enable optical co-packaging technologies for high data transmission speeds while interposers enable system in package configurations bringing together different functionalities in proximity. Four different interconnect designs, namely annular, semi annular, flat pads solder balls in silicon photonics package configurations are evaluated for their thermo-mechanical performance under different reliability tests. A through package via based glass interposer package is evaluated for different aspect ratios of the vias to understand their effects on the glass interposer, solder interconnects and overall package. Submerging a cluster of servers inside a large tank is the customary way of employing single-phase immersion cooling. But this approach requires a complete renovation of existing air-cooled infrastructure. A practical approach to convert an air-cooled data center to immersion cooled data center can be retaining the rack and server arrangements and supplying each server with immersion liquid in sled configuration, retaining the horizontal position. Thermal performance of a 2-socket server in sled and tank configurations are evaluated under the forced convection of EC110 dielectric fluid and EC110/Al2O3 nanofluid.