MATERIAL BEHAVIOUR UNDER ENVIRONMENTAL STRESSES
i) Mechanical Reliability of Electronic Components
ii) Tribo-chemistry of Copper Chemical Mechanical Planarization (CMP)

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Abstract
Components and their constituent materials change during interactions with their environment, sometimes in intended ways, and many times in unintended ways. Understanding the environmental stresses (for e.g. thermo-mechanical stresses, shock, friction, corrosive chemicals, electric potential) and the material response to these stresses (in form of fatigue, creep, fracture, wear, delamination, corrosion, electro-migration) is the key to prevent reliability disasters; and also to harness material change, particularly for precision manufacturing applications.

In this seminar, the speaker will talk about the reliability and design of electronics under different mechanical stresses; the focus will primarily be on solder joints that connect electronic components to motherboards. Different aspects of solder joint reliability will be explored through examples on: i) How consumers use their electronic devices (for e.g. smartphones/tablets) is an important consideration for thermo-mechanical design. ii) How knowledge of statistical behavior of failure and distribution of stresses within an electronic package can be used to create innovative and cost effective design for reliability solutions. iii) Understanding fundamentals of fatigue and catastrophic failure to create a unique shock testing and analysis method.

The seminar will also discuss Copper Chemical Mechanical Planarization (CMP), a key enabling process in semiconductor fabrication; a process where wear and corrosion phenomenon are synergized to produce nanometer level precise topography. The focus will be on innovative methods to understand fundamental mechanisms of this process: i) Cu CMP at nanoscale is simulated using an Atomic Force Microscope (AFM) to understand mechanical behavior of Cu passive films. ii) Passivation kinetics of Cu in CMP slurry constituents is studied using microelectrodes. These studies are used to build an integrated tribo-chemical model of Cu CMP.

About the speaker: Shantanu Tripathi is a Staff Engineer, in Quality & Reliability Research and Development at Intel Corp. in Portland, Oregon, USA. He leads R&D and certification of solder joint reliability of Intel component assembly, products that go into variety of markets such as smartphones, servers, wearables, industrial electronics etc. He is also a co-editor of Intel Assembly and Test Technology Journal. Before this he was a Sr. Process Technology Development Engineer working on R&D of next generation semiconductor processes at Intel. Shantanu got his MS and PhD from University of California at Berkeley, and B.Tech. from IIT-Madras, all in Mechanical Engineering.