BEOL Reliability

Moderators:

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Background

Since the introduction of dual-damascene Cu and low-k dielectric materials, there has been continuous device scaling from 130nm down to 7nm (and beyond) during the last two decades. Numerous innovations in materials, processes, and models have enabled the new technology node successful and reliable, thanks to the efforts of our fellow scientists and engineers. In this year's IRPS, more innovations are happening, as we have seen papers on Ru interconnects and 7nm EUV Co-liner Cu interconnects.

Today, BEOL reliability evaluation includes electromigration (EM), stress-induced voiding (SV/SIV/SM) and time-dependent dielectric breakdown (TDDB). Looking forward, we must also include environmental factors and more extreme use cases of current and thermally induced inelastic behavior of interconnects under various loadings. How do we incorporate these into an accelerated test framework, in both modeling and verification?

Regarding materials, it is key to understand intrinsic and extrinsic size effects – e.g. linewidths, networks, grain boundaries, twins, and texture - and how these relate to stress and the inelastic response. How do we measure and understand these effects and what technological impact do they have? What are the impacts of mechanical response of next generation materials - Ru, Co, alloys, and barrier integrations, etc. – on the reliability, and how do we measure these?

Attendants are invited to discuss their experiences and experiments in metallization, as well as diagnostic and physical/electrical failure analysis techniques that have helped develop their understanding. Additionally, we would like to discuss the pros and cons of fast test methods available, like wafer-level EM, TVS, isothermal EM, and others for rapid learning cycles in development.

Discussion Topics

- Ru Interconnect / 7nm EUV Co-liner Cu interconnects.
- BEOL challenges for 5nm and beyond (Roadmap for RC delay)
- EM Short Length effect (Blech) in 7nm and below.
- Model selection for BEOL TDDB.
- BEOL reliability of power devices, and heterogeneously integrated solutions
- Metal fatigue in microelectronics
- Physical and electrical evaluations
- Reliability methodology & test