

Reliability challenges for advanced Ru-AG BEOL systems

Dr. Kristof Croes, imec

Time: Friday, November 19th, 2024, 12:00 PM – 1:00 PM (EST)

Location: Online (via Zoom, joining link will be emailed to registrants)

Sponsors: IEEE Central Indiana EPS Chapter



(Scan here to register)

Ru is a candidate to replace Cu in the lower metal layers of future scaled BEOL interconnects. Because Ru is compatible with the direct metal etch integration approach, putting air (further referred to as air gap or AG) between metal lines could become the preferred approach to isolate adjacent metal lines. Although such advanced Ru-AG nano-interconnect schemes are awesome from a performance point-of-view, their reliability is challenged. In this presentation, the main reliability challenges for advanced Ru-AG BEOL systems will be discussed and future reliability research opportunities will be proposed.

First, metal-reliability challenges will be addressed, where it will be argued that the determination of J_{max} -values is difficult because very high currents are needed to make the lines fail and thus Joule heating needs to be properly considered. Also, the fact that Ru is a p-type metal makes data interpretation and failure analysis challenging (but interesting).

Second, TDDB is discussed. Although lifetime predictions using standard TDDB tests look good, the non-existence of a consensus about a) the TDDB lifetime model, b) the conduction mechanism and the related conduction paths and c) the preferred failure locations, are worrisome and will require significant research efforts.

Finally, experimental and modeling work related to potential mechanical issues with the Ru-AG system will be discussed. Where the mechanically weaker places and their mitigation approaches are more-or-less known for Cu-low-k systems, the integration and design knobs to mitigate potential CPI-issues in such systems require future research attention.

Dr. Kristof Croes received an MSc in physics and biostatistics. He obtained a PhD concerning the development of statistical techniques for planning reliability experiments. For seven years, he was product and application manager of the package level reliability products of the Singaporean based company Chiron holdings. Beginning 2007, he went back to research, where he is currently scientific director working on the reliability of advanced interconnects, packages and silicon photonics devices. Kristof was an (invited/tutorial) speaker at several leading-edge semi-conductor conferences [IRPS, IEDM, IITC, IPFA, ADMETA, ...]. He also (co)authored more than 100 articles in the field of reliability.



LEARN MORE AND PLEASE REGISTER HERE:

<https://r4.ieee.org/cis-eps/>