Metal reliability for advanced interconnects

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Abstract:

With the continuous transistor scaling, there is a need to reduce the interconnects size, so that the signals, power and ground can be distributed in the circuit. Scaling of Cu interconnect dimensions is becoming increasingly difficult due to the increase in the resistance-capacitance (RC) delay which will cause a degradation in the chip performance. Currently there are two trends that are being researched: One proposal is to replace Cu by other materials (i.e., Co, Ru...) and the second route is to increase the Cu area by scaling the barrier and liner (B/L). The common aspect from both trends is that they need to meet all the reliability requirements. Therefore, metal reliability has become an essential area of research for the semiconductor technology.

This tutorial will begin with the physical and statistical fundamentals of electromigration and stress migration on Al and Cu interconnects. Different test methods, test structures and models will be used for illustrating recent findings on EM and SIV for Cu scaling which include B/L scaling, via prefill schemes and metal capping. Following, reliability aspects of different alternative metals like Co and Ru will be introduced as alternative for Cu. To conclude, new advances on novel integration schemes and their reliability challenges will be discussed.

Biography:

Olalla Varela Pedreira received the M.Sc. degree in telecommunication engineering from the University of Vigo, Vigo, Spain. In 2007, she joined imec as a Research Engineer, where she worked on the optical characterization of microelectromechanical system (MEMS) devices in the Microsystems Reliability team. Her activities expanded from 2012 towards the field of 3D technologies, for which she was driving activities in optical profilometry as well as involved in electrical characterization of 3D stacks and TSV interconnects.

Since 2017, she is focusing on the reliability of back end of line to assess the TDDB and Electromigration challenges for advanced interconnects. Currently she leads the metal

reliability experimental research for the nano-Interconnect program where she looks into different reliability aspects, including EM, SIV, Thermal shock/Thermocycling testing and Self-Heating and their impact of the new technologies.