 **Bonding Technology for Hybrid Integration**

Dr. Guilian Gao,

Principal Engineer, Invensas;

The MEMs market is currently a $10B market and is growing rapidly, as a result of the Internet of Things (IOT), mobile and automotive markets. The drivers in the consumer based (mobile and IOT) markets include enhanced and multiple functionality, die size shrink and average sales price (ASP) reduction. In contrast, the automotive market demands highly accurate, low temperature drift and vibration but cost effective sensors. Meeting such demands with wafer bonding and sensor packaging technologies currently in use is very challenging. Theoretically there are multiple ways to integrate CMOS controllers, sensors and actuators. However, the most practical approach is hybrid integration.

The Invensas dielectric bonding technology (ZiBond) and hybrid bonding technology [Direct Bonding Interconnect (DBI)] are platform technologies that offer increased manufacturing throughput with lower cost of ownership, both important in the electronics industry. The technology is fully compatible with BEOL wafer fabrication process and hence lowest cost of ownership. For MEMS products currently on the market, the ZiBond and DBI technologies offer a simplified bonding process and superior bond energy compare to anodic, eutectic and grass frit bonding. More importantly, this bonding platform will enable future product development of multi-functional integration with the DBI 3D hybrid integration.

This talk will include an analysis of the MEMS market trend and requirements, a brief introduction of the hybrid bonding technology in wafer to wafer and die to wafer applications. The challenges and advantages of ZiBond and DBI technology are compared to the conventional bond techniques in MEMs. The performance of bond energy and bond force of ZiBond are shared along with the electrical performance and assembly yield improvements for our D2W development.

**Dr. Guilian Gao** received her Ph.D. in Materials Science from University of Cambridge, U.K, her M.S. in Corrosion and Protection from University of Manchester, U.K and her B.S. in Materials Science and Engineering from Beihang University, China. Dr. Gao has 26 years of experience in electronics packaging technology development, materials, processes and reliability engineering. She is currently a Principal Engineer in 3D Technology at Invensas Corp. in San Jose, CA. Prior to her Invensas assignment, she was a Staff Engineer and Program Manager at Tessera Inc. Before joining Tessera, she was a Senior Technical Specialist at Ford Motor Co. and was awarded the Henry Ford Technology Award. Dr. Gao holds 23 US patents and more than 30 publications.