“Gas Electrostatic Discharge in Capacitive RF-MEMS and Its Role in Degradation and Failure”

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Friday, April 9, 2010  
3:00 pm, Birck 1001

Abstract: Broad evidence for a unified mechanism of slow degradation and catastrophic failure of capacitive RF-MEMS switches is examined. The experimental results reported by various groups from parametric studies of effects of pressure, temperature, gas composition, metallic material, hold-down bias and others suggest that gas discharges at voltages significantly lower than the classical DC Paschen breakdown affect reliability under a wide range of conditions. Analysis of dynamics of a MEMS switch with a measured lifetime shows that the breakdown may be accelerated by injection of metallic and solid dielectric material in the gas gap due to repeated low-current discharges during contacting events. Strategies for avoiding this failure mechanism and achieving highly reliable capacitive switching for high-power applications are discussed.

Bio: Alina Alexeenko received her Ph.D. in Aerospace Engineering in 2003 from the Pennsylvania State University and B.S. and M.S. degrees in Applied Mathematics from Novosibirsk State University, in 1997 and 1999. She was a Women in Science and Engineering Fellow at the University of Southern California from 2004 to 2006. A. Alexeenko is currently an assistant professor in the School of Aeronautics and Astronautics at Purdue University and is an affiliate of NNSA Center for Prediction of Reliability, Integrity and Survivability of Microsystems (PRISM). Her research interests are in computational rarefied gas dynamics and its applications in high-altitude aerothermodynamics, physics of microscale devices and vacuum gas dynamics.