Holm Conference 2008 Abstract

A nanoindenter based method for studying MEMS contact switch microcontacts

Authors: Kevin W. Gilbert, Shankar Mall, Kevin D. Leedy, Bryan Crawford

Physical and electrical processes involved in lifecycle failure of metal contacts in MEMS RF cantilever beam contact switches are of great interest to switch designers, as the main failure mechanisms of MEMS contact switches occur at the metal contacts. This paper describes the novel use of a nanoindenter and an experimental setup specially designed for characterizing the physics and mechanics of MEMS scale electrical contacts as they are being cycled.

The setup uses silicon cantilevers fabricated with contact bumps cycled mechanically to simulate the action of a MEMS contact switch. The cantilevers were sputter deposited with 300 nm of gold. Gold was investigated as the initial material of interest, as many MEMS contact switches employ gold as a contact metal. The setup allows the physical evolution of the contact to be visually tracked and provides data on resistance, material property (e.g. strain hardening), and other changes in contact behavior. Test data collected includes contact adhesion force, contact stiffness changes, resistance vs. cycles, and resistance vs. contact force relationships as a function of applied contact cycles. This paper will provide details of this unique set-up and test results.