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QCM Studies of Alcohols as Vapor Phase Lubricants for MEMS
HEATHER NEMETZ, JON JONES, TONYA COFFEY, Appalachian State University, DEPT. OF PHYSICS AND ASTRONOMY TEAM — The future of nanotechnology depends in part upon the development of successful lubrication for micromachines (MEMS). Atomic Force Microscopy (AFM) research at Pennsylvania State University* has suggested alcohols such as propanol, ethanol, butanol, and pentanol to be potential vapor phase lubricants for MEMS; propanol at its vapor pressure can greatly reduce the friction on silicon dioxide surfaces. Due to the relatively high vapor pressure of these alcohols, all surfaces of a MEMS, including buried interfaces not easily reached by solid coatings, should become coated in thin layers of the alcohol upon exposure. We are testing the ability of the alcohols to migrate to buried interfaces in the MEMS. The mass uptake of the alcohols will be measured using the quartz crystal microbalance (QCM) in a vacuum chamber. The resonant frequency of the QCM drops as alcohols adsorb on its face. The uptake of the alcohols is measured as the pressure increases using different geometries of the cans, allowing us to simulate a buried interface. The aforementioned alcohols are first thermally distilled, then leaked into the chamber until vapor pressure of the alcohol is reached. We see significant mass uptake even in extreme geometries, where the entire QCM face is only accessible through a tiny hole in the can encasing the QCM, 0.0006" in diameter. *K. Strawhecker et al., Trib. Lett. 19, 17 (2005).

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