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Contact voltage-induced softening transition of gold-on-gold contacts at cryogenic temperatures DIANA BERMAN, MATTHEW WALKER, JACQUELINE KRIM — A series of experiments were performed in vacuum environments to investigate the impact of contact voltage on the surface softening transition for gold-on-gold contacts at cryogenic temperatures [1]. The purpose of this work was twofold: (1) To examine whether asperity heating models already validated for high temperature contacts were also applicable at cryogenic temperatures, and (2) to explore the implications and validity of prior suggestions that contact temperatures between 338 and 373 K are high enough to dissociate adsorbed film and/or push them aside, but low enough to prevent asperities from becoming soft and adherent. Measurements on two distinct RF MEMS switch types were performed in the temperature range 79 - 293K and for contact voltages ranging from 0.01 to 0.13 V. Contact resistance values at all temperatures were observed to be lower for higher contact voltages associated with increased heating and softening effects. In-situ removal of adsorbed species by oxygen plasma cleaning resulted in switch adhesive failure. Switches that had not been cleaned meanwhile exhibited distinct reductions in resistance at contact temperatures close to 338 K, consistent with suggestions that films begin to desorb, disassociate, and/or be pushed aside at that temperature. Funding agencies: AFOSR, DARPA, and NSF DMR. [1] D. Berman, M. Walker, J. Krim, J. Appl. Phys., 108, 044307 (2010).

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