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Macroscopic and microscopic friction at low temperatures: heat transfer at an AFM tip and the effect of superconductivity on friction CHRIS DUNCKLE, MATT AGGLETON, PETER TABOREK, University of California, Irvine — Temperature is an important parameter in both macroscopic and microscopic (single-asperity) friction. Temperature dependent measurements can help discriminate between phononic and electronic friction mechanisms. At cryogenic temperatures, phonons freeze out, and electronic states change dramatically in the vicinity of phase transitions such as superconductivity. Models of single asperity friction focus on thermally activated hopping processes. We report measurements using a variable temperature AFM and a macroscopic tribometer to study friction at low temperatures. Preliminary results on macroscopic sliding block tribometer with a niobium track show no change in friction through the superconducting transition near 9K. Our analysis of the thermal environment of a variable temperature AFM shows that the temperature difference between the tip and the substrate can be several hundred Kelvin, which severely complicates comparison between theory and experiment. Current work on an isothermal AFM that avoids these problems will also be discussed.

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