

Abstract Submitted
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Effect of trace moisture on friction¹ YUN LIU, IZABELA SZLUFARSKA, University of Wisconsin - Madison — Although the effects of humidity on friction have been widely studied, much less is known about friction behavior when only trace level moisture is present on a surface. Trace moisture is particularly important for hydrophilic surfaces because such surfaces will be often terminated with dissociated water even if they are transferred to nominally dry conditions. Here we demonstrate that friction of hydrophilic surfaces increases in the presence of trace moisture due to formation of hydrogen bonds across the interface. Using first principle calculations we discover that frictional instability during sliding is related to rotation of hydroxyl groups, which are bonded across the interface via hydrogen bonding. Using theoretical analysis based on Prandtl-Tomlinson's model we quantify free energy released during such instabilities and we predict that velocity dependence of trace moisture friction follows the same trend as dry friction.

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