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Interfacial melting of ice under a high-speed slider: real-time visualization and friction modeling HYUNG-SEOK KIM, CHANG-HO YUN, DONG-JO KIM, HO-YOUNG KIM, Seoul National University — When a solid plate slides on ice, frictional heat melts asperities on the ice surface causing the real contact area to increase. Previous studies indicate the significance of contact area growth for ice friction, yet its quantitative understanding is far from clear mainly because the direct observation of the melting process at the interface has been extremely difficult. Here we describe a novel experimental setup that visualizes the interface of a rapidly rotating ice disc (up to the linear velocity of 10 m/s) and a transparent quartz surface in real time using the total internal reflection. We find that the melted area of the ice surface is a sensitive function of both sliding speed and temperature. We rationalize such quantitative measurements numerically and analytically, which allows us to predict the friction coefficient of ice as a function of relative velocity and temperature. This work can be used to develop friction-controlling mechanisms on ice surface, which are important in traffic safety as well as winter sports.

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