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Drop Impingement on Highly Wetting Porous Thin Films: Theoretical Justification for the Washburn-Reynolds Number CULLEN BUIE, YOUNG SOO JOUNG, Massachusetts Institute of Technology — Recently we've introduced a dimensionless parameter named the Washburn-Reynolds number (Re_w). The Washburn-Reynolds number predicts drop impingement modes on highly wetting porous thin films. Physically, the Washburn-Reynolds number (Re_w) can be interpreted as the ratio between the inertia of the impinging droplet and capillary transport in the porous thin film. In this talk we outline the theoretical considerations that lead to the Washburn-Reynolds number. To estimate droplet spreading after impact, we've devised an energy conservation expression employing a capillary potential energy term. This term leads to another dimensionless parameter denoted the capillary Weber number (We_c), which is the ratio of the kinetic energy of the droplet to the capillary energy of the surface. The energy equation can be simplified as a function of the Weber number (We) and the dimensionless spreading speed constant (C^*_{cap}) in high and low We_c limits, respectively. Re_w is obtained from the log scale geometric average of We and C^*_{cap}. Our theoretical analysis and experimental results verify that Re_w is useful to predict impingement modes on highly wetting porous films for a wide range of impact velocities and fluid properties.

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