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When a water drop freezes before it solidifies PIROUZ KAVEHPOUR, University of California, Los Angeles, STEPHEN DAVIS, Northwestern University, FARYAR TAVAKOLI, University of California, Los Angeles — When a drop of liquid is placed on a substrate which temperature is below the melting point of the liquid, one would expect the drop to solidify instantaneously. However, many liquids, such as water, must be subcooled to solidify below its melting temperature due to homogeneous nucleation's high activation energy. Most of the drop solidification research, particularly for water, phase change is assumed to occur at equilibrium freezing temperature; however, this is not the case. We found that after a certain degree of supercooling, a kinetic based nucleation begins and latent heat of fusion is suddenly liberated, causing an increase in liquid temperature. At the end of this stage, approximately 20% of the drop is crystallized. This phenomenon is known among metallurgists as recalescence. This is followed by a slow solidification process at the melting point. As a water droplet spreads on a cold substrate, its contact line stops just prior to freezing inception from the liquid-solid interface. In this study, we assert that recalescence prior to solidification may be the cause of water's sudden immobility, which results in a fixed contact angle and droplet diameter. In our experiments, the nucleation front initiates from the trijunction point and propagates to the drop volume.

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