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Using Ice Nucleating Particles to Enable Desublimation on Chilled Substrates JULIA O'BRIEN, KEVIN FAILOR, CAITLIN BISBANO, MEGAN MULROE, SAURABH NATH, BORIS VINATZER, JONATHAN BOREYKO, Virginia Tech — On a subfreezing surface, nucleating embryos usually form as supercooled condensate that later freeze into ice, as opposed to desublimation. Ice nucleating particles (INPs) have been widely used to freeze existing water; however, nobody has studied how they might affect the initial mode of nucleation. Here, we show that INPs deposited on a substrate can switch the mode of embryo nucleation to desublimation, rather than supercooled condensation. Deposition was achieved by evaporating a water droplet containing INPs on a hydrophobic silicon wafer. A Peltier stage was used to cool the wafer down inside of a controlled humidity chamber, such that the desired set point temperature correlated with the dew point and onset of nucleation. Beneath a critical surface temperature, microscopy indicated that desublimation occurred on the circular patch of deposited INPs, compared to supercooled condensation outside the circle. The hydrophobic surface was then patterned with hydrophilic stripe arrays, which facilitated the deposition of stripes of INPs via the same evaporation method. The resulting array of desublimating ice stripes created dry zones free of condensation or frost in the intermediate areas, as the hygroscopic ice stripes served as overlapping humidity sinks.

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