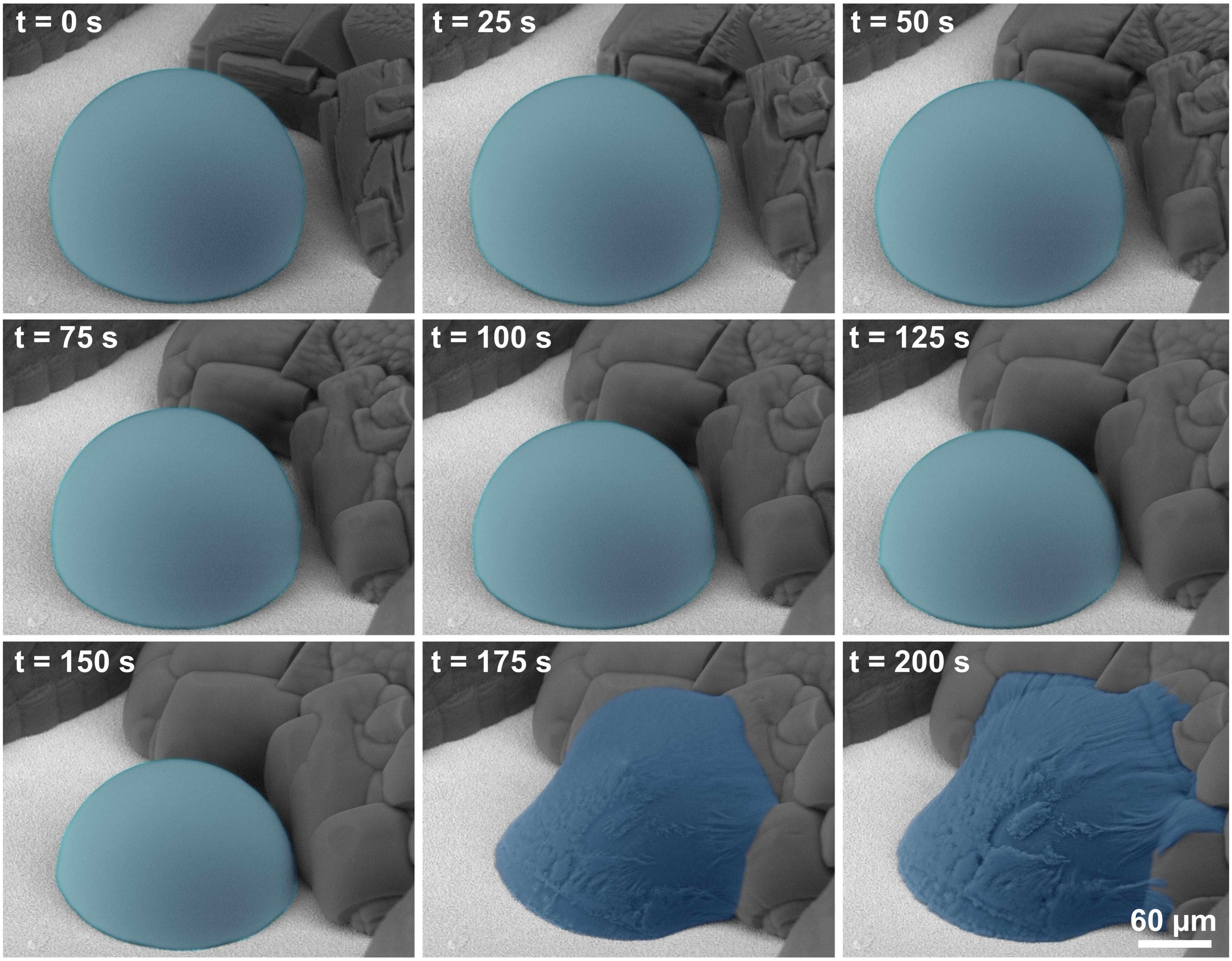
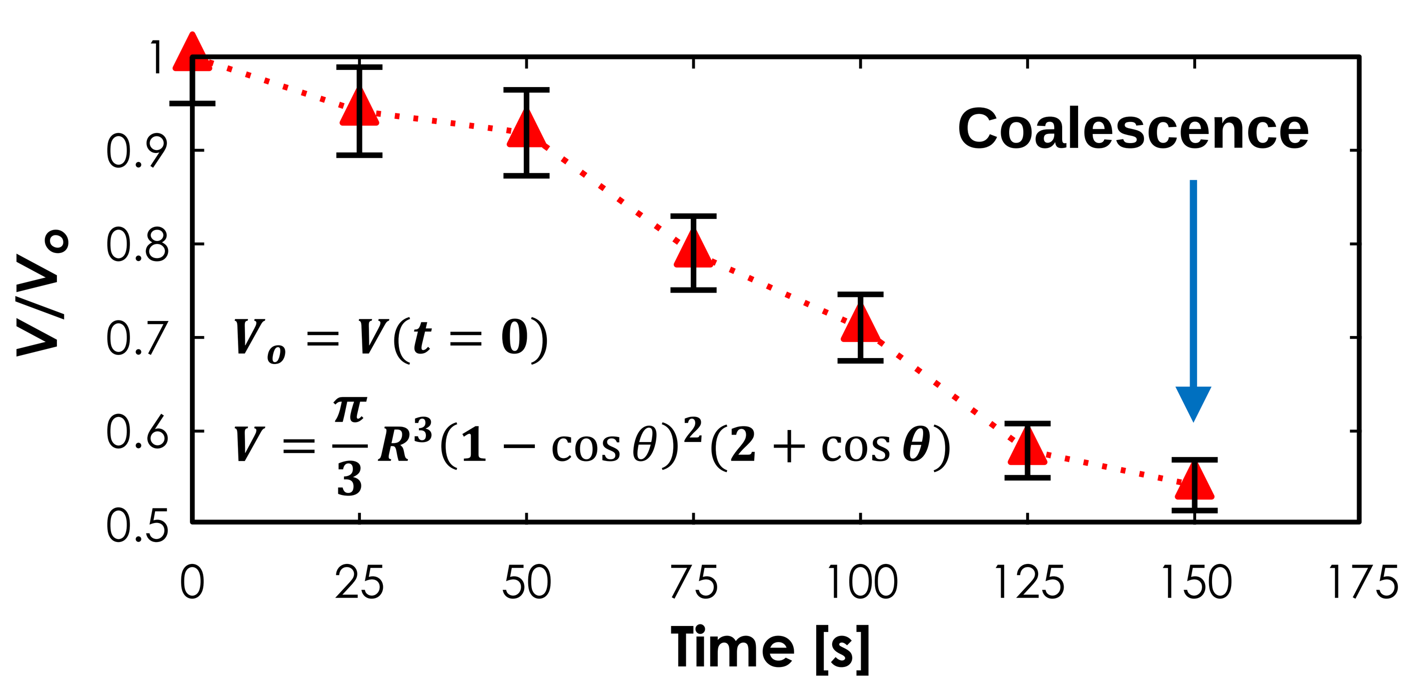
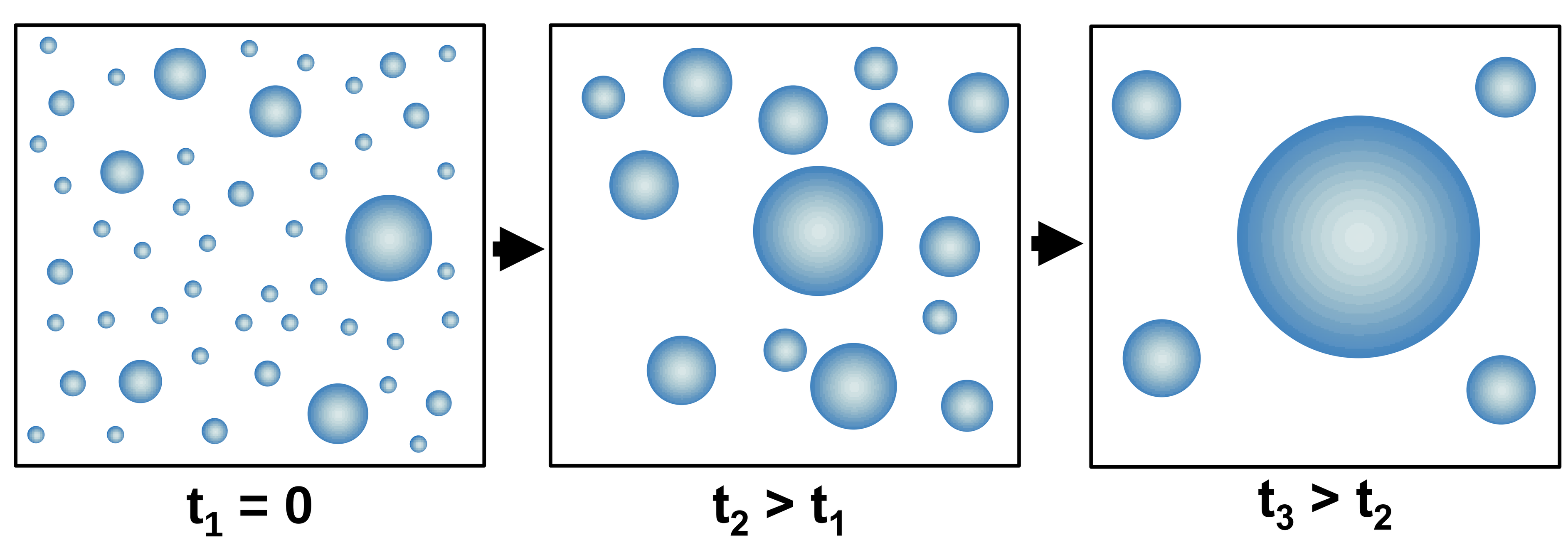


(a) False color time-lapse images captured *via* environmental scanning electron microscopy of subcooled water droplet freezing.



(b) Normalized water droplet volume (V/V_o) vs. time.



(c) Schematic of Ostwald ripening during freezing - analogous to (a).

Ostwald Ripening During Freezing on Scalable Superhydrophobic Surfaces

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False color environmental scanning electron microscope (ESEM) images of subcooled water droplet freezing on a superhydrophobic copper oxide (CuO) surface are presented (a). Nanostructured CuO films were formed by immersing copper sheets into a hot (≈96°C) alkaline solution composed of $NaClO_2$, NaOH, $Na_3PO_4 \cdot 12H_2O$, and DI water (3.75:5:10:100 wt.%). Hydrophobicity was obtained by depositing a fluorinated silane from a vapor phase. Droplets formed on the surface *via* condensation prior to the sample temperature being reduced, resulting in ice nucleation and growth (gray material) concurrent with subcooled droplet formation (light blue droplet). Interestingly, simultaneous droplet evaporation and ice nucleation/growth occurred. As the subcooled liquid droplet continued to evaporate (b), vapor deposited on the adjacent ice until coalescence between the two phases occurred with instantaneous freezing of the subcooled water droplet and continuous growth in the ice phase (blue color in $t \geq 175$ seconds). The observed behavior can be understood in terms of Ostwald ripening, which is the transfer of water molecules from smaller sized (subcooled) droplets to larger ice crystals *via* diffusion through the bulk vapor phase due to the chemical potential difference between the small droplet and large ice crystal (c). An everyday example of the observed phenomena is the recrystallization of water in aged ice cream, giving it a crunchy texture. The visualizations shown here provide insight into these complex phase change interactions, which are important for the development of anti-icing surfaces.