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Crystalline desiccation patterns and film break up from evaporating drops on hydrophobic oxide surfaces[1] SAMANTHA MCBRIDE, SUSMITA DASH, SAMI KHAN, KRIPA VARANASI, MIT — Solute-laden sessile drops evaporating on a substrate will often force crystallization of the solute at the triple phase contact line between the drop, substrate, and air in an effect similar to the "coffee-ring" deposition of particles from a particle-laden drop. We report new observations of ring-shaped desiccation patterns of gypsum crystals on hydrophobic oxide substrates; ceria, erbia, and silica. These surfaces have similar contact angles (˜105 degrees), and evaporation of sessile drops proceeds at the same rate and without contact angle hysteresis on all three substrates. However, despite the apparent similarity, the patterns of crystal deposits exhibit large differences across the substrates. The supersaturation and elapsed time at the onset of crystallization also varied across substrates, despite overall evaporation rates being identical. The differences in patterns can be explained in light of the position and morphology of the crystals just prior to completion of evaporation when the sessile drop has transitioned to a thin film spread over the deposit area. Break-up of this film occurs very differently on the different surfaces, and is simultaneously influenced by existing crystals while also influencing final crystalline patterns.

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