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Cracks, Meltdowns and Crossover Sizes: An abrupt change in sublimation kinetics associated with the thermally-activated introduction of disclination charge in crystallites. ALEX J. LEVINE, MOUMITA DAS, Department of Chemistry and Biochemistry, University of California, Los Angeles., DON BLAIR, Department of Physics, University of Massachusetts, Amherst. — Recent experiments and numerical studies of the sublimation kinetics of 2d colloidal crystals show an abrupt increase in the sublimation rate at a particular crystallite size [J. R. Savage *et. al.* Science **314**, 795(2006)]. Motivated by this observation, we propose that the abrupt change in the sublimation kinetics is due to the thermally activated introduction of a disclination charge leading to large internal stresses. These stresses are then relaxed by a fission event precipitating the break-up of the remaining crystallite. We use our numerical simulations to show that the average disclination charge indeed increases to one at the 'crossover size' corresponding to the observed change in sublimation rate. Using the Griffith criterion for the spontaneous propagation of microscopic cracks, we see that the effect should depend sensitively upon the range of the attractive interparticle potential. We test this prediction using numerical simulations of the sublimating system. Where that potential is short-ranged, the crystal is brittle allowing for the proposed mechanism. For longer-ranged potentials, however, the material is more ductile preventing this abrupt fission event.

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