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Simulated Crystallite Melting Kinetics in Two Dimensions D. W. BLAIR, J. R. SAVAGE, A. D. DINSMORE, J. MACHTA, R. A. GUYER, University of Massachusetts at Amherst, A. J. LEVINE, University of California, Los Angeles — We report on results of numerical simulations of the melting of two-dimensional crystallites. Recent experiments in colloidal systems demonstrate that colloidal crystallites undergo a two-stage melting process. Initially large crystallites melt at a constant rate until reaching a critical size at which there is a dramatic increase in the melting rate. Throughout the initial melting stage the crystallite interior maintains bond orientational order; this order is abruptly lost at the critical size. Using Brownian dynamics simulations of particles interacting via a variety of short-range central potentials, we find that in two dimensions small crystallites generically melt in two-stages characterized by a sudden increase in melting rate that coincides with an abrupt loss of bond orientational order. The critical size, particle number $\mathcal{O}(20)$, is in agreement with experimental data and appears insensitive to details of the short-range interparticle potential. We discuss a possible mechanism for this change in melting dynamics at a critical crystallite size. This work is supported in part by NSF (DMR-0242402) and NASA (NAG8-1659).

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