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Melting of Two-Dimensional Colloidal Crystals A.D. DINSMORE, J.R. SAVAGE, D. BLAIR, A.J. LEVINE, J. MACHTA, Univ. of Massachusetts Amherst Physics Dept. — The process by which crystals melt into a fluid is an interesting topic that, despite being very common, has proved difficult to study experimentally because of the high speed and small size of atoms. Using colloidal spheres as model 'atoms,' however, we have monitored the kinetics of the melting of crystallites formed in the presence of a short-ranged depletion attraction, whose strength was adjusted by means of the temperature. We followed the motions of hundreds of individual particles with high resolution. We found that large crystallites melted at a steady rate that was limited by bond-breaking. The melting kinetics, however, drastically sped up when the size reached 20-30, below which the melting was approximately diffusion-limited. The results are robust and are observed at different temperatures above the melting point. Computer simulations of a similar system show similar behavior while providing additional insight into the effective elastic constants inside the small crystallites. Implications for melting in a broader range of examples will be discussed.

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