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Polygonal crack patterns by drying thin films under quasi-two-dimensional confinement XIAOLEI MA, JANNA LOWENSOHN, JUSTIN BURTON, Department of Physics, Emory University — Cracks patterns such as T/Y junction cracks in dried mud are ubiquitous in nature. Although the conditions for cracking in solids is well-known, cracks in colloidal and granular systems are more complex. Here we report the formations of polygonal cracks by drying thin films of corn starch ($\sim$ 10 μm in diameter) under quasi-2D confinement. We find there are two drying stages before the films are completely dried. Initially, a compaction front invades throughout the film. Then, a second drying stage "percolates" throughout the film with a characteristic branching pattern, leading to a dense packing of particles connected by liquid capillary bridges. Finally, polygonal cracks appear as the remaining liquid dries. The same drying kinetics occur for films with different thickness, h, except that fractal-like fracture patterns form in thin films, where the thickness is comparable to the particle size, while polygons form in thick films with many layers of particles. We also find that the average area of the polygons, A, in fully dried films scales with the thickness, $A \propto h^{\beta}$, where $\beta \approx 1.5$, and the prefactor depends on the initial packing fraction of the suspension. This form is consistent with a simple energy balance criterion for crack formation.

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