# Microstructure Engineering via Throttled Nucleation

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We consider the crystallization of a thin film via interface-limited growth and throttled nucleation, a transient nucleation schedule in which nucleation is suppressed before a sample is fully transformed. This schedule can be readily realized by two stages of isothermal anneals where the throttling time is parameterized by the area fraction transformed when throttling occurs. The limits of throttling are simultaneous and continuous nucleation, which produce, respectively, site-saturation and Johnson-Mehl structures.

We use an efficient level set method to generate microstructures, which are subsequently used to study geometric and topological properties of grains. We find that throttling produces significant differences in the distributions of grain area, grain perimeter, and number of grain edges. Our results suggest a possible way to easily engineer certain types of microstructures via isothermal annealing stages.

**Keywords:** microstructure; microstructure engineering; nucleation and growth; nucleation control.