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Time-Evolution of the Grain Size Distribution in Random Nucleation and Growth Crystallization Processes[1] ANDREAS BILL, ANTHONY V. TERAN, Department of Physics & Astronomy, California State University Long Beach, RALF B. BERGMANN, Bremen Institute for Applied Beam Technology (BIAS), 28359 Bremen, Germany — The micromorphology of solids impacts in an essential way their mechanical, electronic, optical or magnetic properties. Hence, it is an important task to characterize properly the granularity of materials. One central quantity providing such information is the grain size distribution. We propose an analytical derivation of this distribution during the random nucleation and growth crystallization process of a $d-$dimensional solid ($d = 1, 2, 3$). We describe how the grain size distribution evolves from early stages of crystallization to its final form when complete crystallization is achieved. We also discuss the remarkable result that for certain classes of nucleation and growth rates the asymptotic limit of large times is a logarithmic-normal (lognormal) type distribution. Finally, we apply the theory to the time-evolution of the grain size distribution during solid-phase crystallization of Si-films.

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