On the logarithmic-normal distribution in nucleation and growth processes

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The logarithmic-normal (lognormal) distribution is one of the most frequently observed distributions in nature and describes a large number of physical, biological and even sociological phenomena. However, a derivation of this distribution from first principles is lacking. We propose a differential equation governing the time development of grain size distribution in random nucleation and growth processes. The solution of this equation provides an analytical derivation of size distributions that has a form of the lognormal type. The resulting expression is used to discuss the grain size distribution of solid phase crystallized Si-films.