Growth rate of nuclei

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Lagragian approach to growth rate of nuclei considers growth of isolated clusters formed by collisions of monomers (molecules, atoms or growth units) with cluster surface. Growth rate is derived from attachment and detachment frequencies on cluster surface, respectively from volume changes of clusters [1]. Eulerian approach instead of observing the growth of specific cluster is based on the study of fluxes between two adjacent clusters [1]. We introduce new alternatively approach based on the growth of the largest nuclei within the standard nucleation theory.

The kinetic equations for formation of nuclei are solved numerically to determine the number of clusters, F_i, formed by i monomers. The maximum size of nuclei, i_{max}, in considered volume V, is determined from the condition $F_i V = 1$. Growth rate of nuclei is determined as time derivative of radius of the largest nucleus within system. It is shown that at low supercooling (or supersaturation) growth rate of nuclei in sufficiently large volume reaches the values, which are very close to Lagragian model. As system volume decreases, the supercooling needed to form nuclei is higher [2]. At low supersaturation the growth of nuclei will be stopped and only certain maximum nucleus size is reached. It is necessary to have sufficiently high supersaturation to enable growth of supercritical nuclei.

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