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Dynamic Scaling of Ramified Clusters Formed on Liquid Surfaces

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Abstract: A comprehensive simulation model --- deposition, diffusion, rotation, reaction and aggregation model is presented to simulate the formation processes of ramified clusters on liquid surfaces, where clusters can diffuse and rotate easily. The mobility (including diffusion and rotation) of clusters is related to its mass, which is given by $D_m=D_0 s^{-\gamma_D}$ and $\theta_m=\theta_0 s^{-\gamma_\theta}$, respectively. The influence of the reaction probability on the kinetics and structure formation is included in the simulation model. We concentrate on revealing dynamic scaling during ramified cluster formation. For this purpose, the time evolution of the cluster density and the weight-average cluster size as well as the cluster-size distribution scaling function at different time are determined for various conditions. The dependence of the cluster density on the deposition flux and time-dependence of fractal dimension are also investigated. The obtained results are helpful in understanding the formation of clusters or thin film growth on liquid surfaces.

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Key words: dynamic scaling, liquid surface, ramified cluster, kinetic Monte-Carlo simulation

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