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Kinetics of Narrowly dispersed Latex Formation in a Surfactant-free Emulsion Polymerization of Styrene in Acetone-Water Mixture[1] HE CHENG, ZHIYONG LI, CHARLES HAN, Intitute of Chemistry Chinese Academy of Sciences — The kinetics of narrowly dispersed latex formation in a surfactant-free emulsion polymerization of styrene in acetone-water was studied by a combination of transmission electron microscopy and light scattering. The critical nuclei were experimentally observed and the formation of narrowly dispersed PS latex is proved to be originated from competitive growth kinetics. Spherical nuclei were regenerated via a microphase inversion of PS oligomer in 50% volume fraction acetone-water mixture at 70°C. They follow a polydispersed log-normal distribution and the smallest nucleus with Rs 1.1nm is similar to critical nuclei. Note the spherical nuclei are not necessarily narrowly dispersed. Competitive growth kinetics makes smaller nuclei grow much faster than large nuclei in the subsequent polymerization process, resulting in narrowly dispersed PS latex. Two kinds of PS seed particles were added, separately, into two parallel surfactant-free emulsion polymerization batches of styrene in acetone-water mixture at 70°C. It was found that the size of seed particles almost does not change, but the small size PS latex grows rapidly. Our fitting results proves competitive growth kinetics proposed by Vanderhoff and coworkers.

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