

# KL 01

## **SYNTHESIS OF MONODISPERSE MICROSPHERES BY DISPERSION AND SEEDED DISPERSION POLYMERIZATION**

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Dispersion polymerization has been widely adopted as a process for preparing micron-size polymer particles having narrow particle size distributions primarily owing to the fact that this is accomplished in a single polymerization step. However, polymerization recipes must generally be developed empirically and often the reproducibility of achieving a targeted particle size can be difficult. Seeded dispersion polymerization has been applied with limited success to grow large particles even larger and also particles have been prepared with various morphological features.

Seeded dispersion polymerization using submicron PMMA seed particles was initially applied to gain a deeper understanding of the nucleation process in the dispersion polymerization of MMA. Surprisingly, it was discovered that under certain conditions, large particles with narrow particle sizes could be prepared using a relatively small amount of these seed particles (even mixtures of seed sizes) and the number of final particles ( $N_f$ ) was found to be about the same as the initial seed number ( $N_i$ ). Further studies showed that this is not always the case (e.g., when  $N_i$  is less than the number of particles made in the *ab initio* process, then  $N_f = N_{ab\ initio}$ ) and in fact, rarely seems to be the case. It was found that  $N_f \propto k \times N_i$  and that  $k \leq 1$  and increases with increasing seed size in the range of 152 nm to 285 nm. This implies that a certain number of seed particles ends up in each final particle and this ratio is not a function of the number of seed particles in the recipe. Using a polystyrene seed resulted in a lower value of  $k$  compared to the same size PMMA seed, while a crosslinked PMMA seed gave a value of  $k$  approaching zero. The actual fate of the seed particles is not clear and efforts are underway to determine this. The effects of other polymerization variables are also being explored including the medium composition (methanol/water), and the monomer (MMA), initiator (AIBN), and stabilizer (PVP K30) concentrations.