

### **Is high-shear sufficient to deflocculate nanoparticles?**

The term flocculation is used to describe particle-particle interactions that are large compared to  $kT$  so that the particles stick together, but not much higher energy. The key question is whether the contacts between particles have coalesced. If they have, then the energy to disperse them is high and a high-shear dispersed is not good enough.

I have worked on this problem some and have two observations:

1. Generally nanoparticles are made by precipitation from solution. In order to make sure the particles remain small in the medium in which they are being formed, some chemistry has to be set to stabilize newly created surface quickly. Otherwise the particles would "sinter". As long as this surface coating remains on the particles, then even if they flocculate, they can generally be redispersed if the solvent conditions are correct.
2. But, many people are trying to move nanoparticles from one solvent to another and this is a real challenge. It is often quite difficult to find a dispersant that is sufficient in both solvents and exchanging dispersants is not easy. In any case, the problem is chemical not engineering.