“Did you know…….?.” series for January-February 2022

Did you know…. that zeta potential measurements are more complex than many scientists and engineers realize? Zeta potential is a widely used measure of the colloidal stability of a latex particle. It is often thought to be the electrical charge at the surface of a polymer particle, which is not quite correct. A latex particle has a charged “double layer” of ions around its surface consisting of the charges on the particle surface (negative for anionically stabilized latexes) and then a layer of the oppositely charged counter ions. The ions close to the surface are tightly bound, while outer ions are not tightly bound and diffuse freely. The boundary between these two layers is called the “slipping plane”, and it is the charge at this boundary that is the zeta potential. Why does this distinction matter for those in the latex industry? Because the thickness of that charged double layer, and therefore the measured zeta potential, depend on ionic strength and often pH (if functional acids are used in your formulation). Higher ionic strength (from initiator, buffers and any other ionic species) compresses the double layer and reduces the zeta potential, making particles less stable. Ionizing acid groups (higher pH) increases zeta potential and improves stability, while lower pH has the opposite effect. An approximate rule of thumb is that stable latexes are obtained when the magnitude of the zeta potential is >+/-30 mV. Note however that nonionic stabilizers have no charge, and can help make a latex stable even at lower zeta potential values.

An important consideration when measuring zeta potential, if you want to obtain a measurement that is representative of conditions in your reactor, is how you prepare your sample. Most people just dilute the latex with water, but doing so considerably reduces ionic strength, brings the pH closer to 7 and may give a zeta potential quite different from the particles in your reactor. There are other important considerations related to understanding and interpreting zeta potential that we treat in detail in several of our STEPn workshops. As always, we invite your questions and comments via our website, www.epced.com.