# How does nanosize pigment influence CPVC?

Particles dispersed in a resin solution get coated with a dispersing/stabilizing monolayer. This increases the effective volume of the particle and proportionately reduces the free volume of the available resin. As the particle size goes down from micron scale to nanoscale, the contribution of the volume of the adsorbed layer to the effective volume increases substantially as given by the following equation:

$$\Phi eff = \Phi (1+ 6\Delta/d)$$

Where Φeff: Effective volume of the dispersed phase including the stabilizer layer

- Φ: Original volume of the dispersed particles
- Δ: Thickness of the stabilizer layer
- d: Particle diameter

Thus at nanoscale, the effective pigment concentration (or effective PVC) is much higher than the volume occupied by the bare pigment particles. Inclusion of very low percentage of nanoparticles (~1 %) results into the same effective PVC as attained with the high loading of micron size fillers. Following Figure illustrates the relationship between the increase in effective PVC and the particle size of the pigment. High increase in the effective PVC below 100 nm is quite noticeable compared to the conventional microscale region of 400~ 1000 nm (0.4 ~ 1.0 micron). For pigments with particle size of 1000 nm (1.0microns) the effective PVC is higher by about 4~5% of the PVC value. When particle size is below 100 nm the effective PVC goes up by 40~60% of the PVC value.

This leads to significant suppression of CPVC value when nanosize pigments are used.

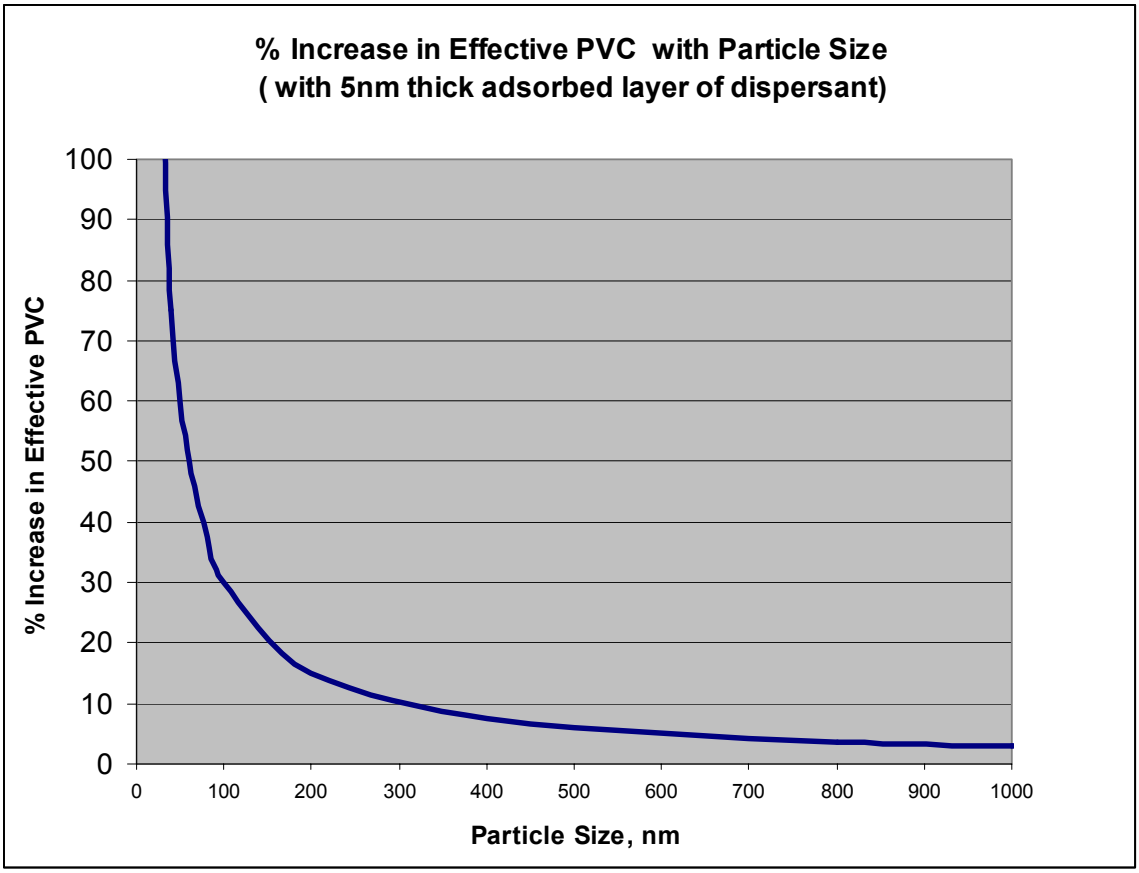


Figure: Increase in Effective PVC with Particle Size