

## What is the significance of 'Pigment surface concentration (PSC)' in nanoscale dispersions?

The word 'pigment' includes pigments, fillers and extenders. The coating films can be looked upon as nanocomposites in which the pigments are dispersed as reinforcements in a polymer matrix. Conventionally, the contribution made by the micron scale pigments is understood in terms of pigment volume concentration or (PVC). The properties of the coatings are also correlated to PVC. However, as the particle size of the pigment decreases down to nanoscale, the interfacial or surface effects become dominant in governing various properties. PVC is no more an adequate descriptor of pigment – binder geometry. The contribution of surface area is captured by the expression 'Pigment surface concentration' (PSC).

It may be defined as the surface area of the pigment per unit volume of the dispersion. PSC has dimensions of  $L^{-1}$  or inverse length.

There are two variants of PSC as follows:

- For liquid or fluid dispersion:

$$\text{PSC (f)} = \frac{\text{Surface area of the pigment}}{\text{Volume of the fluid dispersion}}$$

Here the denominator includes the volume of the solvent.

- For dry film:

$$\text{PSC} = \frac{\text{Surface area of the pigment}}{\text{Volume of the dry film}}$$

Convenient unit to express PSC is Sq. meters of pigment surface in a 100 micron thick film (wet or dry) of 1 meter X 1 meter area.

The following Figure shows how PSC varies with the particle size at constant PVC of 5%. Sharp increase in the PSC in the nanoscale range below 100 nm is very significant in deciding the properties of nano dispersions.

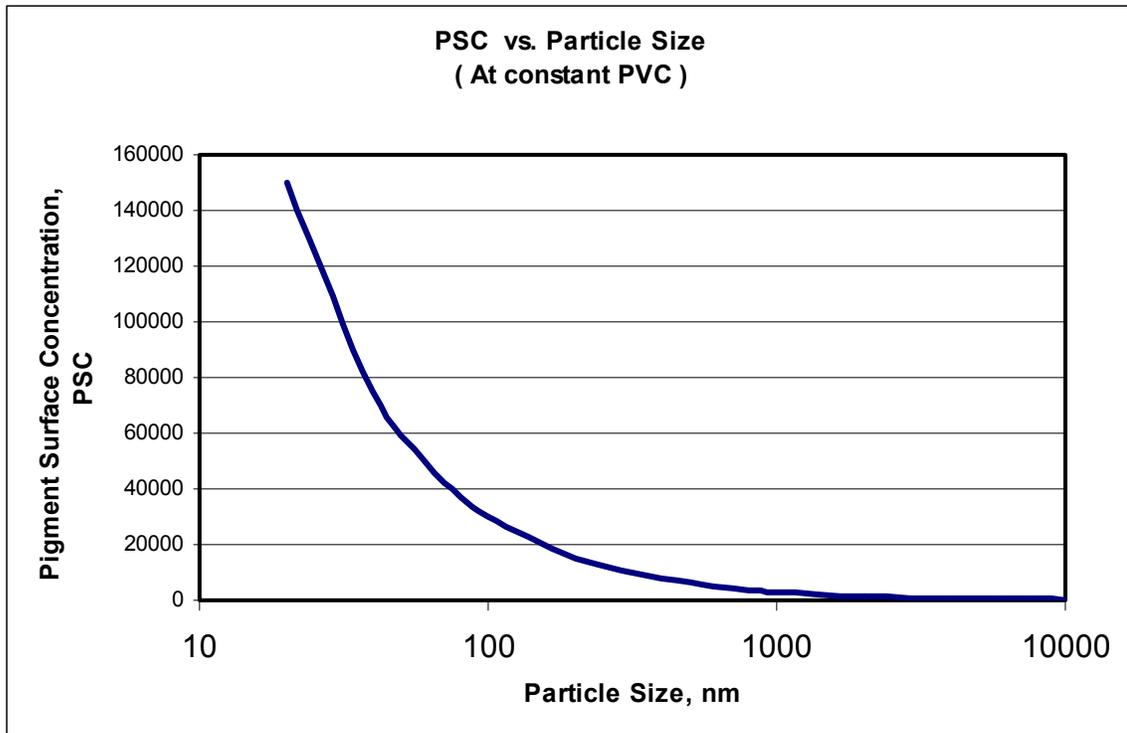


Figure: Particle Surface Concentration (PSC) variation with the Particle Size

Since the optical, photocatalytic, mechanical and barrier properties of coatings depend upon the area of pigment binder interface, the concept of PSC is very useful in understanding coatings with nanoscale pigments.

While PSC is conceptually very important in designing of the nanoscale coatings, its practical determination is not easy. There are two ways by which one can estimate PSC:

- BET surface area of the pigments is a good indicator of the interfacial area or PSC of the coating when the pigment is fully dispersed.
- Transmission Electron Micrograph (TEM) of the coating film will offer a fair estimate of the particle size from which surface area can be approximated.

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