

Hard Settle Study of Toners

- Quantified kinetics of sediment packing -



Introduction

The primary destabilization kinetic in paint and ink formulations is the sedimentation of the suspended particles to the bottom of the sample. In most, if not all, cases, this is unavoidable and redispersion will be required. The main concern is that the redispersion technique (stirring, shaking, etc.) will not be energetic enough to render the suspension back to its initial, homogeneous state. When this is the case, the sediment settles and packs on the bottom of the storage container and the formulation loses its properties and quality. Since packing takes months to complete a fast, quantitative method needs to be developed in order to complete the product development process with confidence that the formula will remain stable and the prediction of this effect is critical.

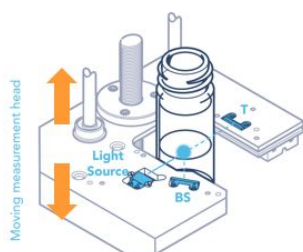
KEY BENEFITS

VERSATILE
PREDICTIVE RESULTS
ACCURATE

Reminder on the technique

Turbiscan® technology, based on Static Multiple Light Scattering (SMLS), consists on sending a light source (880nm) on a sample and acquiring backscattered (BS) and transmitted (T) signal over the whole sample height. By repeating this measurement over time with adapted frequency, the instrument enables to monitor physical stability.

The signal is directly linked to the particle concentration (φ) and size (d) by the Mie theory knowing refractive index of continuous (n_f) and dispersed phase (n_p):



$$BS = f(\varphi, d, n_p, n_f)$$

Materials & Method

Three toner samples were analyzed with the Turbiscan®. The experiments were conducted at 50 °C in order to accelerate any destabilization conditions that would cause the formulation to fail and have the particles settle and hard pack. Each sample was then scanned every 60 minutes for 5 days in order to produce the destabilization profiles.

Results

Raw data

Raw backscattering (BS) data is acquired over a 5-day period in order to monitor the changes in the sample and predict the ability of a toner formulation to settle and pack (coalesce). A typical plot is shown in Figure 1.

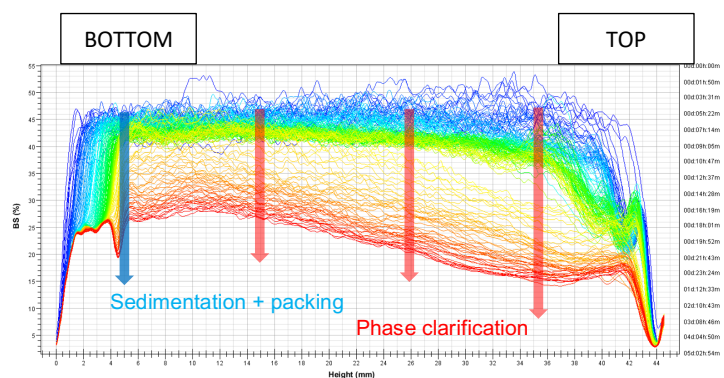


Figure1: Backscattering data from a hard-settling toner

It is seen that an overall phase clarification is occurring at the top and middle of the samples as indicated by the red arrows in Figure 1. This shows that the BS is gradually decreasing over time as the particles are settling.

Left side of the graph (the bottom of the sample vial) is the one to be analyzed for key indicators: particle size and concentration changes. It shows a decrease in BS as well, which is a sign that the particles are coalescing in this zone (blue arrow).