Redispersibility of ceramic ink characterized with SMLS

PAINT & INKS

Introduction

Printing inks used in ceramics are constituted of inorganic pigments dispersed in a serigraphic liquid. This liquid gives to the ink some rheological properties necessary for the printing process. A good stability of ink, at rest or in use, is essential because pigments tend to settle and to aggregate. This instability leads to evolutions of the rheological properties of the product, which can make the application difficult or even impossible, and provoke defects in the printing.
For a given pigment, it is necessary to study the stability of the ink as a function of the different serigraphic liquids as the aggregation can be reversible or not due to chemical interactions between the pigment and the liquid. Depending on the stability behaviour, the ink redispersibility can be different.
This note will show, on the example of three inks from the market, how SMLS technology permits to characterize pigment stability and redispersibility.

KEY **BENEFITS**

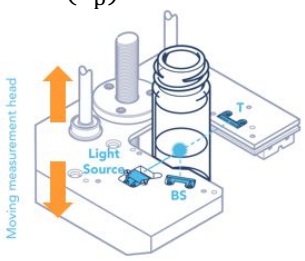
VERSATILE

OBJECTIVE 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 inks samples were analyzed with the Turbiscan®. They are composed of the same pigment in three different serigraphic liquids. The experiments were conducted at 25 °C. Only the backscattering variations (%, ordinate axis) along the tube height (mm, abscises axis) as a function of time (last curved displayed in red) were analyzed.

Results

Raw data

Raw backscattering (BS) data is acquired over a 10-hours period in order to monitor the changes in the sample (Figure 1).

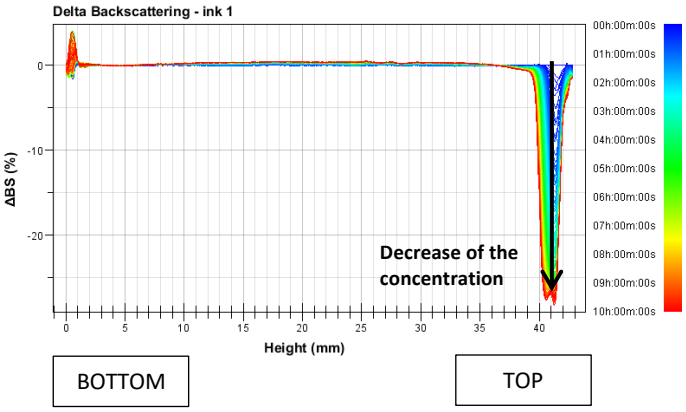


Figure1: Backscattering data for ink 1

A significant decrease of the backscattering signal is observed at the top of the sample over time. This is representative of a clarification occurring at the top of the product. This clarification is due to sedimentation of the pigment in the ink.

Sample stability as a function of viscosity

Monitoring the clarification layer formation allows to calculate the kinetics of sedimentation for each of the three inks. The figure 2 shows the migration rate as a function of viscosity of the sample.