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TURBISCAN

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Electronic

STABILITY OF SUSPENSIONS FOR ELECTRONIC APPLICATIONS

Abstract
Many processes in the fabrication of electronic devices use suspensions at one point or another. Wafers are polished using CMP slurries, carbon nanotubes are incorporated in various materials to enhance their thermal, electrical or mechanical properties, fuel cells and flat panel displays comprise coated surfaces with nanoparticles, etc. All of these suspensions show typical colloidal instabilities (sedimentation, flocculation). Therefore, it is important to test their stability in the shortest possible time in order to improve the delay from development to production in a very competitive market. All these destabilizations can be monitored and quantified using the optical device Turbiscan®. Analyses are done on the real product, without dilution and can be automated and accelerated through temperature increase.

Keywords: CNT, CMP, FDP, dispersion, suspension, stability, Turbiscan®.

Introduction

Semi-conductors, flat panel displays, multilayer capacitors, and most electronic devices which surround everyone of us in our everyday life are fabricated *via* a process where a suspension is involved. Even if these dispersions are not end-products but are used in a process, their stability is crucial for the good quality of these very high tech systems. Sedimentation and flocculation phenomena need to be tracked and quantified in order to minimize their intensity, hence getting reproducible and high quality processes.
In this paper we present various examples of stability studies using the Turbiscan® optical device.

Experimental procedure

1. Principle of the measurement

The heart of the optical scanning analyser, Turbiscan®, is a detection head, which moves up and down along a flat-bottom cylindrical glass cell (Figure 1)[1-2]. The detection head is composed of a pulsed near infrared light source (λ = 880 nm) and two synchronous detectors. The transmission detector (at 180°) receives the light, which goes through the sample, while the backscattering detector (at 45°) receives the light scattered backward by the sample. The detection head scans the entire height of the sample, acquiring transmission and backscattering data every 40 µm. The Turbiscan LAB can be thermo-regulated from 4 to 60°C and linked to a fully automated ageing station (Turbiscan ags) for long-term stability analyses. Increasing temperature is the ideal parameter to accelerate destabilisation processes, while maintaining realistic testing conditions.

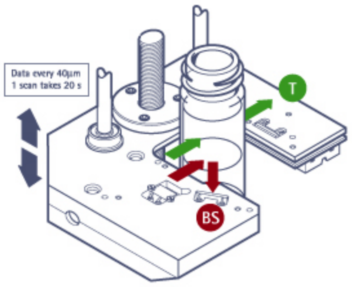

Figure 1. Principle of Turbiscan® measurement

The Turbiscan® makes scans at various pre-programmed times and overlays the profiles on one graph in order to show the destabilisation. Graphs are usually displayed in reference mode, whereby the first profile is subtracted to all other profiles, in order to enhance variations. A stable product has all the profiles overlaid on one curve (Figure 2), as an unstable formulation shows variations of the profiles (Figure 3). Backscattering and/or transmission fluxes are shown in ordinate and the height of the cell in abscissa (Figure 2 and 3). The first profile is displayed in pink, the last one in red.