CHEMICAL-MECHANICAL POLISHING SLURRY STABILITY

Electronics

Effect of polymer molecular weight

INTRODUCTION

Chemical-mechanical polishing (CMP) is a technique used in semiconductor fabrication for planarizing a wafer or other substrates. This removes material and tends to even out any irregular topography, making the wafer flat or planar at the Angstrom level.

Cerium(IV) oxide, also known as ceria, is an oxide of the rare earth metal cerium. It is known to have a high polishing efficiency for oxide film, but it also has an unfavourable reputation for problems linked to its quick sedimentation and agglomeration of particles, which can significantly alter the CMP process, leaving unwanted defects. Therefore it is necessary to tailor the ceria slurry in order to reach the right stability requirements for CMP applications.

Polymeric dispersants are typically used to stabilise ceria particles, *via* steric stabilisation. Hence, the molecular weight of the dispersant plays a key role in the stability efficiency.

METHOD

3 suspensions of ceria were analysed using the Turbiscan LAB at 35°C for 12 hours. Formulation A contains high, formulation B intermediate and formulation C low molecular weight of dispersant.

RESULTS

Identification of instability mechanism

All three formulations display a similar behaviour (Figure 1) with:

- A decrease of the backscattering signal at the top as the particles deplete from this region due to a sedimentation process.
- Simultaneously backscattering increases at the bottom of the vial, where the particles settle.
- Transmission increases at the top when clarification is large enough for light to cross the suspension. This would be eventually visible to naked eye observation.

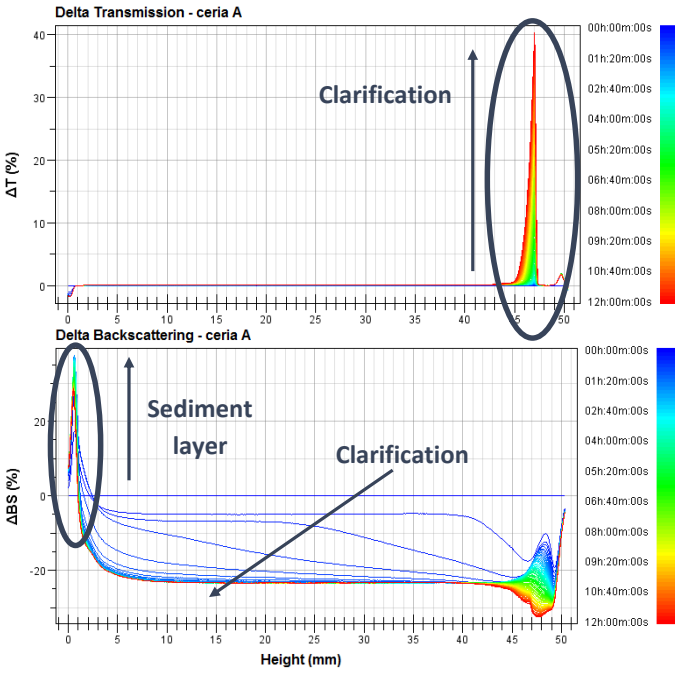

Figure 1: Delta transmission (top) and delta backscattering (bottom) for ceria suspension A at 35°C.