

Characterization of cerium oxide nanoparticles using Vasco Kin

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This application note presents the size characterization of cerium oxide (CeO₂) nanoparticle in suspension in water using the “Vasco Kin” instrument.

Material and protocol

The sample examined here is a colloidal suspension of cerium oxide particles at a concentration of 30 g/L in water. This suspension is filtered at 0.2µm with a PES filter.

Prior to the DLS measurement, these particles are observed by transmission electron microscopy (LVEM5, Delong Instrument) after drying 5µL of the suspension on a TEM grid. A representative micrograph is shown in Figure 1. We can see that these CeO₂ particles are not spherical as they are composed of small crystallites. However we can estimate their average TEM diameter to be **6.6 nm ± 2.0 nm**. Note that some aggregates of about 20-50 nm are also spotted on the grid.

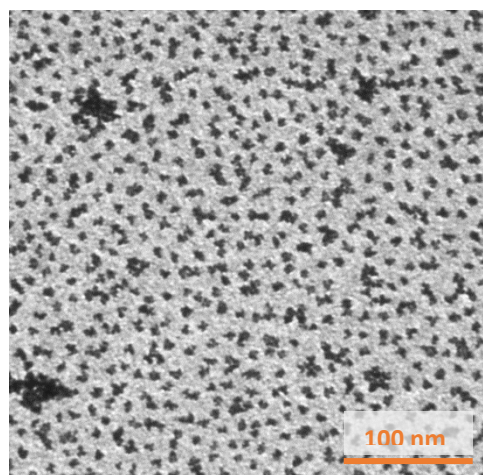


Figure 1: Electron micrograph of the CeO₂ particles.

The DLS measurement is performed in a quartz cuvette at room temperature using the “Vasco Kin” with its *in-situ* optical head. The correlograms are processed using the SBL (for Sparse Bayesian Learning) inversion algorithm, which provides size distributions for monomodal or multimodal samples with a high resolution.

Results

A reliable DLS measurement of this sample is achieved in less than 10 seconds of acquisition using the Vasco Kin.

The corresponding size distribution in intensity is reported in Figure 2. It shows a main population with a hydrodynamic diameter of **6.4 nm ± 0.2 nm** (mode/peak value), which is very consistent with the TEM size of the CeO₂ particles.

We also observe a secondary population with diameters between 20 and 80 nm which also corresponds to the aggregates detected by TEM.

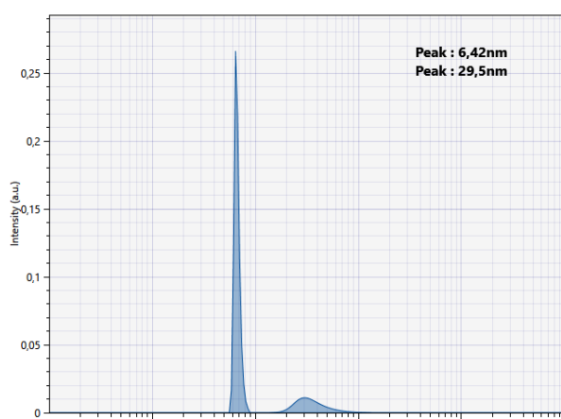


Figure 2: Size distribution in intensity of the CeO₂ suspension at 30g/L in water, after filtration, and calculated by the SBL inversion algorithm.

This result demonstrates the very good accuracy of the Vasco Kin measurement of very small cerium oxide nanoparticles, as well as its ability to discriminate populations from a multimodal distribution.