

Assessing bimodal size distributions at the nanoscale: issues and solutions in colloidal systems

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Differently sized and shaped nanoparticles (NPs) are very interesting for many industrial applications, among which automotive catalysis or fuel cells^[1]. They often expose different facets and the surface to bulk ratio varies with size^[2], thus providing the access to exciting proprieties at the nanoscale.

The synthesis of Pt and Pd NPs with different size and shape was achieved in this study through the use of a patented Pt precursor^[3] and in some cases the coexistence of two differently sized NPs populations was obtained.^[4]

The characterization of these metallic NPs in suspension is a challenging task that is addressed with the state of the art of the available analytical techniques. It is now possible to cross reference many direct or visible analytical outputs with indirect or calculated results from other techniques. In the present work, the results obtained by Dynamic Light Scattering (DLS), X-Ray Diffraction (XRD), Small-Angle X-ray Scattering (SAXS), Transmission Electron Microscopy (TEM) and High Resolution-TEM (HRTEM) were compared with the aim to single out the *pro* and the *cons* of each single technique, thus providing overall a reliable analytical methodology for the study of such systems. There is not a single method that can be selected that is the “best”, but there is rather a balance of requirements with regard to the type of sample, the needed information, time constraints and the cost of the analysis.

This contribution outlines advantages and drawbacks of different analytical techniques, their comparability among each other as well as detailed application examples in the field of colloidal suspensions, particularly in the case of very small nanoparticles. In addition, a focus on samples with bimodal size distributions with two close but distinct populations is presented.

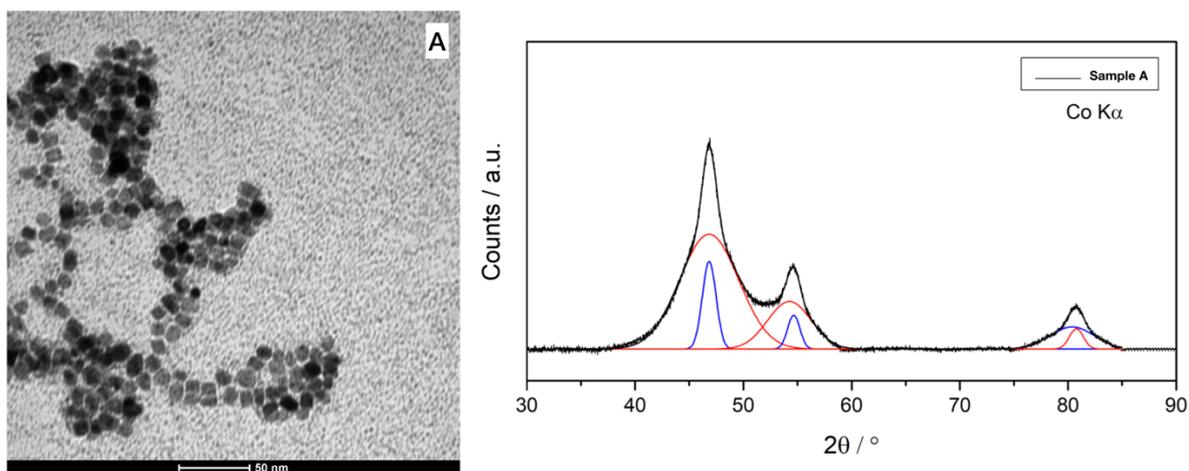


Figure 1: TEM and XRD of a Pt colloidal sample characterized by a bimodal particle size distribution.

References:

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