

# **Understanding properties and catalytic performances of enhanced ceria-based catalyst by means of advanced transmission electron microscopy**

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The potentials of advanced transmission and scanning transmission electron microscopy in nanostructural studies of ceria mixed oxides are overviewed.

In this talk, a first part will be focused on ceria–zirconia mixed oxides that are key materials both as catalysts and catalyst supports of noble metal nanoparticles, for a variety of chemical processes related to Environmental Catalysis but also, more recently, to the production of hydrogen for fuel cells or even the production of other chemicals. Particular attention will be made on the relationship between nanostructural properties and redox response of these materials is complex. A wide range of electron microscopy studies including both imaging mode (HREM, HAADF-STEM) and spectroscopy mode (XEDS, EELS) will be presented. Special emphasis will be made to the implementation of the three-dimensional characterization by HAADF-STEM tomography. These findings allow deeper understanding of the influence of different thermal ageing pretreatments on the redox behavior of this family of mixed oxides.

The second part of this talk will be focused on the characterization of ceria-based monolith catalyst. As it is well known, the characterization of some key parameters for the overall performance of these monolithic devices are routinely determined by several methods based on SEM. However, other features related with the complexity in the structure of the device (e.g., size and dispersion of the catalytically active particles or the exact spatial distribution of the different components and their specific interactions in the washcoat), which also have a remarkable influence on its catalytic behavior, necessarily require analysis at the sub-nanometer scale. A success approach combining focused ion beam (FIB)-STEM to monitor the eventual influence of the preparation steps on the actual surface of catalytic monolithic devices will be presented.

Link to the web pages of Nanomaterials and Catalysis Lab of the University of Cadiz, The Hernandez-Garrido Group:

[http://www2.uca.es/dept/cmat\\_qinor/nanomat/people/NanoLabCat/jchg.html](http://www2.uca.es/dept/cmat_qinor/nanomat/people/NanoLabCat/jchg.html)