Multifunctional Mesostructured Oxides: controlling porosity and surface function in the nanoscale

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The synthesis of nanostructured metals, oxides or sulfides through chemical routes in mild conditions (i.e. molecular precursors, low temperatures) permits materials processing in the shape of powders, films or monoliths. These soft processes are the route of choice for the combination of organic and inorganic components, which lead to complex materials with multiple chemical functionalities.

In this presentation, we will focus in the combination of ***sol-gel chemistry***, and ***self-assembly of amphiphilic molecules*** (surfactants or polymers) to synthesize oxide powders or thin films presenting ordered mesopores (diameter between 2-20 nm). These mesoporous matrices can be chemically functionalised by incorporating a variety of organic functions, from metal scavengers to biomolecules. Such complex hybrid inorganic-organic networks are an example of a multifunctional material: a relatively simple synthesis route can afford control over several tunable characteristics such as: pore size, shape, spatial distribution and accessibility, inorganic wall nature (thickness, composition, microporosity, crystallite structure and size), pore surface acidity and functionality... The pore systems can also accommodate nano-objects with novel magnetic or optical properties within the matrix. Examples of these systems in selective sensing, molecular filters, decontamination or optoelectronics will be presented.