Contribution ID: **4** Type: **not specified**

Dynamic Nanocatalysts: Environmental Effects

Thursday, 9 September 2021 12:00 (30 minutes)

In order to comprehend the catalytic performance of metal nanostructures, their dynamic nature and response to the environment must be taken into consideration. The working state of a nanocatalyst might not be the state in which the catalyst was prepared, but a structural and/or chemical isomer that adapted to the particular reaction conditions. Furthermore, deactivation phenomena taking place under reaction conditions can only be understood, and ultimately prevented, if sufficient information is available on the catalyst morphology, structure, chemical state, and surface composition while at work.
I will first describe novel approaches for the synthesis of size- and shape-controlled nanoparticle catalysts (Cu2O, Cu, Cu-M (M=Zn, Ni, Ga), NiGa and FeOx NPs). Subsequently, I will illustrate how to follow the evolution of their morphology and surface composition under different gaseous and liquid environments in the course of a catalytic reaction. Examples will be given regarding the dynamic transformations of the former nanocatalysts during the hydrogenation and the electrochemical reduction of CO2 via NAP-XPS and other complementary techniques such as XAS, or NAP-STM. Emphasis will be given to elucidating the role of the nanoparticle size, shape, composition, chemical state and support of the catalysts in their activity, selectivity and durability.

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