New approaches for preparing new solid photocatalysts with enhanced properties

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Despite the recent advances in photocatalysis, the efficiency of the suggested systems is still moderated and much work is required for this technology to be more involved in our real life. The emerging understanding of the reaction mechanism, as well as new materials can bring the promise held by this process to fulfillment in the near future. In this context, developing new approaches for designing new materials with high performance, and new methods and strategies for studying the photocatalysts under real conditions (operando), would allow a faster development of photocatalysis and extend its field of application to new horizons.

In general, heterogeneous photocatalysts (semiconductors) have a low specific surface area with high particles size. Thus, increasing the specific surface area of the photocatalyst and/or decreasing their particle size can improve their activity, by increasing the molecules/surface contact, and enhancing the charge diffusion, respectively. Several works demonstrated that the dispersion of the photocatalyst particles, such as TiO_2, onto porous materials, such as zeolites, significantly enhance their efficiency.

In this talk, new approaches for preparing highly dispersed photocatalysts clusters in the pore system and on the surface of zeolite-type materials will be presented. Contrariwise to the traditional methods, the new procedures consist in the incorporation of atomic scale of the photoactive species in zeolite channels. It is based on a local and selective photoreduction of the metal ions or on a direct-decomposition of the photocatalyst's precursors. The new photocatalysts, then obtained, demonstrate high photocatalytic activities and good selectivity with respect to a conventional photocatalyst used as reference.

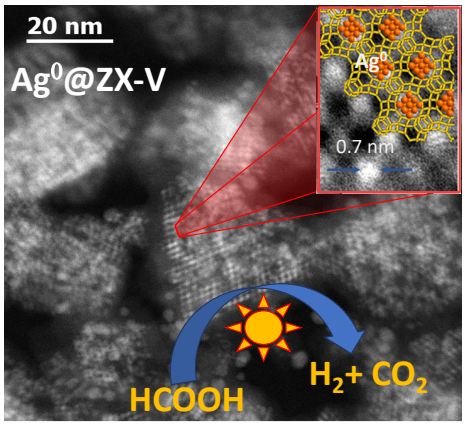

Fig. 1. TEM image of sub-nanometer silver particles in the zeolite channels. The materials are prepared with a new photochemical method and demonstrate a high efficiency and selectivity in the photocatalytic dehydrogenation of formic acid under visible light.