Au-Cu/SBA(Ti) based catalysts for photocatalytic applications

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Since the discovery in 1972, by Fujishima and Honda, of water splitting by using TiO_2 under UV irradiation, photocatalysis has gained interest in energy and environment fields worldwide. Nowadays, photocatalysis is an extensively studied field for pollutants degradation as well as for environmental remediation, inasmuch as these reactions can be accomplished at mild operating conditions and can be solar driven. Titania, specially anatase phase, is regarded as one of the most promising photocatalysts thanks to its high stability, optical properties, availability and non-toxicity. Nonetheless, the use of this semiconductor as a photocatalyst is limited by its wide band gap, as it requires wavelengths close to UV. Considering that approximately 5% of solar light consists in UV, one of the greatest challenges for photocatalysis hints at the development of catalysts active in the visible light scope, which stands for 43% of the incident solar spectrum. Nanoparticles of noble metals such as Au, Pd or Pt have arisen as excellent means to enhance photocatalytic activity thanks to their high optical absorption in a wide range of solar light, together with their reactivity at low temperatures. Besides, these noble metals can form alloys with a second more widely diffused metal like Cu, showing a synergistic effect in photocatalytic reactions.

Regarding to titania photocatalytic activity, it has been demonstrated that not only it depends on the crystalline structure, but also on particle size distribution, as a high specific surface area must be provided for the photoactive species. One of the most studied strategies comprised the use of mesoporous supports for obtaining TiO_2 species with high specific surface area which improve the pollutant molecules adsorption and their degradation. In this issue, the synthesis method is a determining step for obtaining highly active and stable photocatalysts, since it is crucial that these photoactive TiO_2 species remain confined in the internal surface of the mesoporous support and not in the pore channels nor the external surface, causing pore blockage.

In this work, it has been synthesized several Au and Au-Cu alloy photocatalysts supported on two different mesoporous supports: a non-commercial SBA-15 and a post-synthesis TiO_2 modified SBA-15 (TiSBA-15), with which a high dispersion of TiO_2 species have been achieved maintaining the SBA-15 structure. In addition, it has also been obtained highly dispersed Au nanoparticles confined in SBA-15 pore channels, as can be observed in Figure 1. The photocatalysts have been preliminary tested in the preferential CO oxidation in a H_2-rich stream (CO-PROX) at room temperature and atmospheric pressure under simulated solar light irradiation. In spite of the very low gold and copper loading (1.5 wt% and 0.5wt% respectively), the catalysts resulted active and selective in the low temperature photo-CO-PROX.

a **b**

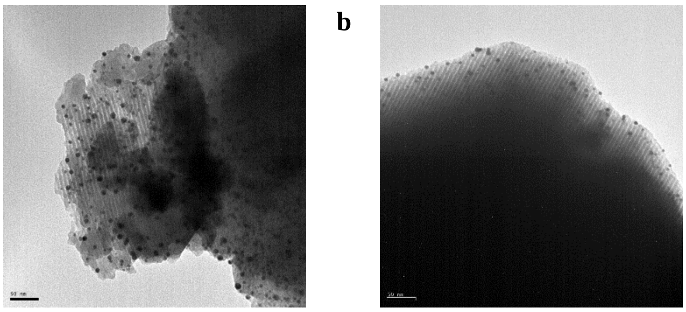

Figure 1: TEM images of (a) Au/SBA-15 and (b) Au/TiSBA-15

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