PREPARATION OF GOLD NANOPARTICLES ON SEVERAL SUPPORTS AND THEIR USE FOR THE OXIDATION OF CARBON MONOXIDE

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The oxidation of carbon monoxide is a simple reaction that although intensively studied in the literature is still poorly understood, as the mechanistic pathways are still uncertain. It is however a reaction of outstanding importance in pollution control (CO removal), fuel cells, and gas sensing [1].

Gold catalysts, in particular, have advantages in this reaction which arise from their improved activity at low temperatures and stability in the presence of water [2,3]. However, for gold to be active as a catalyst, use of a careful preparation procedure is crucial in order to obtain it as nanoparticles well dispersed on the support. The most common methods are Deposition Precipitation (gold precursor is precipitated onto a suspension of the preformed support by raising the pH either by the addition of alkali or urea) Co-Precipitation (support and gold precursors are brought out of solution, perhaps most likely as hydroxides, by adding a base such as sodium carbonate), and the use of colloids (prepared by reduction of chloroauric acid by citric acid and other reducing agents) [1].

In the present work, several gold catalysts were prepared by less usual methods, namely incipient wetness impregnation (variation of the traditional impregnation method in which the pores of the support are filled with a solution of $HAuCl_4$, using ultrasonication), double impregnation (similar to the previous one but with a second step of impregnation of Na_2CO_3) [4] and liquid phase reductive deposition (the gold precursor $HAuCl_4$ is mixed with NaOH and aged for 24h in the dark before it is impregnated onto the support) [5]. The main advantage of the latter two methods is that chloride is removed from the catalyst sample, which is well known to cause sintering of Au nanoparticles, thus turning them inactive [1].

Different supports were also tested, such as functionalised activated carbons, carbon xerogels and multi-walled carbon nanotubes [6], as well as oxides such as TiO_2, ZnO, among others. Samples were characterised by TEM and XRD. Catalysts were used as prepared or subjected to different surface pre-treatments. Activities for CO oxidation are compared and results are discussed.

References:

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