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Support Effect in High Activity Gold Catalysts for CO Oxidation

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Abstract: In this work, we present a detailed study concerning the evaluation of the metal−support interaction in high activity gold catalysts for CO oxidation. Using the colloidal deposition method, model catalysts were prepared, which allow the isolation of the effect of the support on the catalytic activity. Prefabricated gold particles were thus deposited on different support materials. Since the deposition process did not change the particle sizes of the gold particles, only the influence of the support could be studied. TiO_2, Al_2O_3, ZrO_2, and ZnO were used as support materials. Catalytic tests and high resolution transmission electron microscopy clearly show that the support contributes to the activity. However, our results are not in line with the distinction between active and passive supports based on the semiconducting properties of the oxidic material. The most active catalysts were obtained with TiO_2 and Al_2O_3, while ZnO and ZrO_2 gave substantially less active catalysts. Furthermore, the effect of other important parameters on the catalytic activity (i.e., particles size distribution, calcination temperature, and aging time for a Au/TiO_2 catalyst) has also been studied. Using this preparation route, the catalysts show high-temperature stability, size dependent activity, and a very good long-term stability.