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The Impact of Water on CO Oxidation with Au/TiO_2 Catalysts: Poison or Promotor? A Study with an $Au–TiO_2$/MCM-48 Model Catalyst

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Abstract CO oxidation was studied with a model catalyst containing Au and TiO_x nanoaggregates confined in a siliceous MCM-48 host. With this material, which has a particular small ratio between the TiO_x and Au components, activities well comparable to those of unconfined Au/TiO_2 catalysts were obtained in particular when a thermal activation in inert gas at temperatures between 523 and 673 K was applied. When the subsequent catalytic tests were performed in a feed containing ca. 20 ppm H_2O, strong deactivation phenomena were observed which could be reverted by repeated thermal treatment and are most likely caused by carbonate deposition. This deactivation was strongly attenuated when the water content of the feed was decreased to ca. 6 ppm, which suggests that water plays an important role in the formation of the poisoning species. With unconfined Au/TiO_2 catalysts, a promoting role of water on the formation of catalyst poison was observed as well, but to a much lower extent. The effect may therefore have escaped undetected so far as a contribution to the well-known catalyst deactivation by carbonate species.

Keywords Gold · Titania · MCM-48 · CO oxidation · Water · Host–guest systems · Poisoning

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