Activity and relevant spectroscopic features of gold-ceria catalysts for the catalytic oxidation of carbon monoxide

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Gold/cerium oxide is one of the most active catalysts reported to date for the catalytic oxidation of carbon monoxide by various oxidants, such as oxygen in low-temperature dry CO oxidation [1], and the PROX reaction in the presence of large amount of hydrogen and water [2]; and water in low- temperature WGS reaction [2-5]. In this work, fundamental studies of the interactions of gold/ cerium oxide with CO are reported to shed light on the activity/stability of various structures in oxygen and water.

An FTIR study of CO adsorption from 120 K up to r.t. on high- and low- content Au/CeO_2 samples identified some special features, unique to the gold-ceria system. . In particular, a broad absorption in the 2130-2140 cm^{-1} range, more resistant to oxidation than the usual band of CO on the Au^0 sites, assigned to CO interacting with cationic gold clusters, has been observed. These species show lower reactivity to oxygen than CO adsorbed on the Au^0 particles, beginning to produce CO_2 at ~310 K, while CO adsorbed on metallic gold forms CO_2 below room temperature. On both the high- and low-content gold-ceria samples, a broad CO absorption band in the range 2000-2100 cm^{-1} was observed following a reduction treatment at 473 K. This is assigned to negatively charged gold species. Upon oxidation, these species are again transformed to positively charged clusters. XPS and cyclic CO- and H_2-TPR data corroborate the catalysis and the FTIR results.

References

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