Catalytic oxidation of CO by step and kink sites of curved Au crystal

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Curved crystalline surfaces allow to compare chemical reactions across a sequence of vicinal crystal planes with increasing density of steps, all exposed to the very same reacting conditions. This provides essential clues to understand catalytic processes, and, in particular, to reveal the role of low-coordination active sites. Within the present study, we have explored the formation of oxidic species across different crystallographic planes of the Au curved crystal and their further behaviour for CO oxidation reaction by means of UHV- and NAP-XPS. In order to oxidise gold we have followed three approaches: use of atomic oxygen, ozone and activating molecular oxygen by intense X-ray beam of the synchrotron. We have observed the formation of oxide at all the studied crystallographic planes, both at room and elevated temperatures, upon all applied approaches. Reduction of atomic oxygen chemisorbed on gold was revealed already at partial CO pressure of 6×10^{-9} mbar for all the studied surfaces. Our analysis of photoemission intensities of O 1s species implies lower efficiency of the CO oxidation reaction at the flat (111) surface compared to the stepped surfaces.

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