CO oxidation on h-BN/Rh(111)- supported Pt nanoclusters

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The stability and CO oxidation on mass selected Pt_7 nanoclusters supported on hexagonal boron nitride (h-BN) grown on a Rh(111) surface was experimentally investigated. In a first case, the idea of our experiments is to reduce the size of catalytic particles to their ultimate limit in order to make car exhaust catalysts that contain less Pt. In a second case, the inert h-BN layer is expected to minimize the effect of the support on the catalytic reaction. Recent studies show that h-BN presents a great potential as future catalysts support[1]. The misfit of h-BN with the underlying Rh(111) surface leads to a strongly corrugated Moiré pattern that can be used as an ordered array to stabilize the small Pt nanoclusters. In this work, the stability of Pt supported on h-BN is investigated in-situ by means of Scanning Tunneling Microscopy (STM), operated at 80 K. We find that the Pt clusters are stable up to 700 K, above, intercalation of Pt under h-BN takes place. The stability is strongly reduced under reaction conditions, a phenomenon which has also been observed for other systems such as Co/h-BN/Rh(111)[2] and $Pt/TiO_2(110)$[3]. Then, CO oxidation is measured in situ in a custom made UHV reactor using alternating $^{13}C^{16}O$ and $^{18}O_2$ pulses, (at a frequency of 0.2 Hz) on the Pt/h-BN/Rh(111) catalyst as a function of temperature (300-700 K). We find that, the onset temperature of the CO oxidation is at 500 K and thereby higher than on Pt supported on titania[4]. However, the Pt that undergo partial intercalation under h-BN exhibit a by 100 K lower onset temperature thus improving the cold start behavior of the Pt catalyst.

References

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