OXIDE CHARACTERISATION USING SCANNING TUNNELLING MICROSCOPY: $RuO_2(110)$ + O, CO

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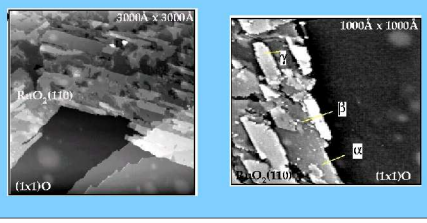
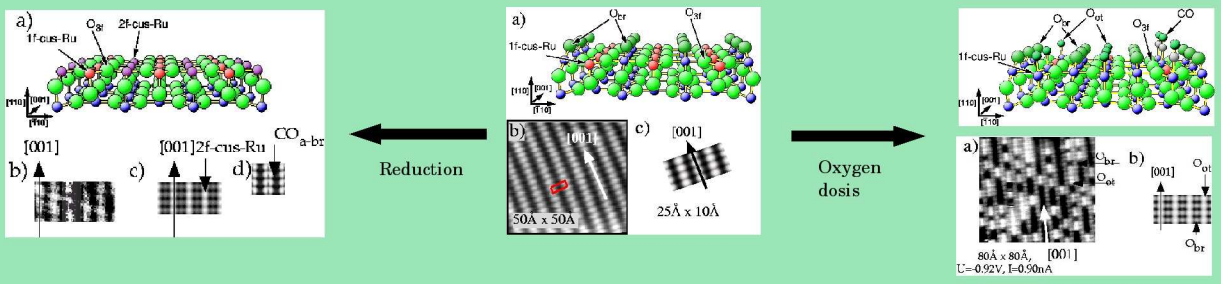
- Catalytic CO oxidation at transition metal surface:
  - Initially Ru metal a bad catalyst
  - After oxygen dosis an excellent catalyst
- Explanation: Ruthenium di-oxide formed Over *et al, Science (2000)*
- The oxide already characterised with
  - LEED – structure
  - Surface core level spectroscopy – active sites
  - TDS – reactivity, adsorbed species
  - STM – structure in real space, adsorbates, ...
  - DFT – all of the above

Upon oxygen dosis on Ru(0001) first chemisorbed layers up to (1x1) overlayer are formed, later the oxidation of the surface begins forming domains of $RuO_2(110)$ thin layers

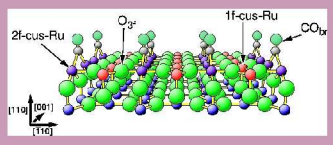


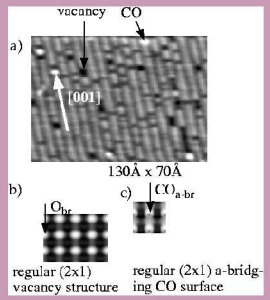
Three surface phases/terminations of $RuO_2(110)$:



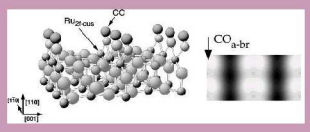
Adsorbed CO on $RuO_2(110)$:

At low CO coverage:

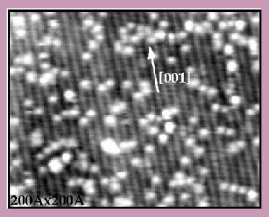




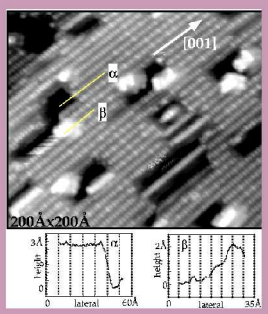
At CO coverage 1:



After mild reduction, CO coverage > 1:



After mild reduction and annealing at 600 K:



References:

- H Over, A P Seitsonen, E Lundgren, M Schmid & P Varga
  Journal of the American Chemical Society **123** (2001) 11807-11808
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  Surface Science **515** (2002) 143-156