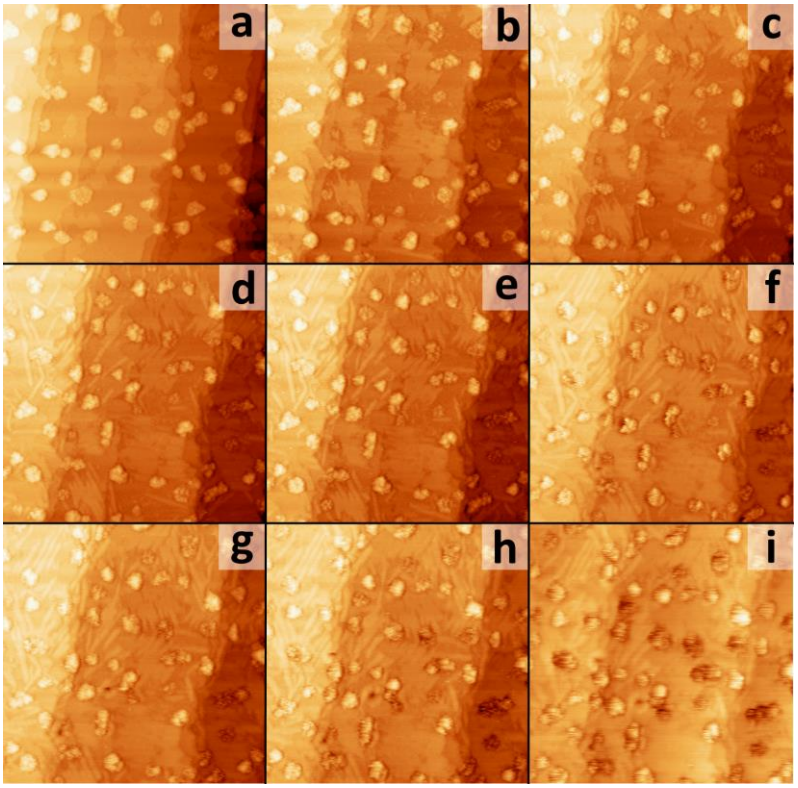
Gold oxide formation in the presence of Ti under CO oxidation conditions

D. Boden[1]*, M.K. Prabhu[1], I.M.N. Groot[1]

[1]*Leiden University, Gorlaeus Laboratories, Einsteinweg 55*
2333 CC Leiden, The Netherlands
*d.boden@lic.leidenuniv.nl

Gold is historically regarded as a bad catalyst material because it is typically very inert, however, gold nanoparticles on reducible metal oxides are found to be excellent catalysts [1] and have prompted the development of the field of gold catalysis over the last three decades. [2] Au/TiO_2 is of particular interest because it facilitates CO oxidation with high selectivity and activity at low temperatures. Recently, studies on inverse TiO_2/Au catalysts show that metal-support interactions play a large role. [3] A TiO_2/Au(111) model catalyst is observed with STM while flowing 1 bar of reaction mixture containing oxygen and CO. In these reaction conditions needle-like islands form on the Au(111) surface. The presence of fully formed TiO_2 crystallites is not required for the formation of these islands, as their formation is also observed on an Au(111) surface containing trace amounts of Ti in the form of a surface alloy. This suggests a new type of catalyst-support interaction that is not typically considered might be at play during CO oxidation by TiO_2/Au catalysts.



TiO2 nanoparticles on Au(111) in **a**: 40 mbar rough vacuum**,** **b - i**: In O2 : CO = 4 : 1 reaction mixture with a pressure of 1.00 Bar. 6 minutes between images. Tunneling current: 100 pA. Bias voltage: 2.0 V. Image sizes: 160 x 160 nm^2.

References:

[1] M. Haruta, T. Kobayashi, H. Sano, N. Yamada, Chemistry Letters **16**, 405-408 (1987).
[2] R. Meyer, C. Lemire, S. K. Shaikhutdinov, H. J. Freund, Gold Bulletin, **37**, 72-124 (2004).
[3] R. M. Palomino, R. A. Gutiérrez, Z. Liu, S. Tenney, D. C. Grinter, E. Crumlin, I. Waluyo, P. J. Ramírez, J. A. Rodriguez, S. D. Senanayake, ACS Sus. Chem. & Eng. **5**, 10783-10791 (2017).