## Particle encapsulation on rutile TiO<sub>2</sub>(110) under near-ambient pressures: Substrate and environment effects

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Catalysts on reducible oxide supports often change their activity significantly at elevated temperatures due to the strong metal-support interaction (SMSI), which induces the formation of an encapsulation layer around the noble metal particles. However, the impact of oxidizing and reducing treatments at elevated pressures on this encapsulation layer remains controversial, partly due to the 'pressure gap' between surface science studies and applied catalysis.

In the present work, we employ near-ambient pressure X-ray photoelectron spectroscopy (NAP-XPS) and scanning tunneling microscopy (NAP-STM) to study the effect of reducing and oxidizing atmospheres on the SMSI-state of well-defined Pt catalysts on rutile  $TiO_2(110)$  at pressures from UHV up to 1 mbar. On near-stoichiometric samples, we can either selectively oxidize the support or both the support and the Pt particles by tuning the  $O_2$  pressure [1]. We find that the growth of the encapsulating oxide overlayer is inhibited when Pt is in an oxidic state. Our experiments show that the Pt particles remain embedded in the support once encapsulation has occurred. Finally, we systematically explore how the rate of encapsulation and the stoichiometry of the encapsulating layer depend on the initial reduction state of the  $TiO_2$  support.

[1] P. Petzoldt et al., J. Phys. Chem. C, **126**, 16127 (2022)