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Pressure-dependent encapsulation kinetics of Pt nanoparticles on reducible oxides

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Pt catalyst particles 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 synchrotron-based near-ambient pressure X-ray photoelectron spectroscopy (NAP-XPS) to study the effect of O_2 and H_2 on the SMSI-state of well-defined oxide-supported Pt catalysts at pressures from UHV up to 0.1 mbar. On a TiO_2(110) support, we can either selectively oxidize the support or both the support and the Pt particles by tuning the O_2 pressure. 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.

if "Other", please specify:

I apply for a travel grant

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