Strong metal-support interaction: A case study on TiO_x/Pt(111) for CO oxidation

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Since the strong metal-support interaction (SMSI) effect was first described in 1978 by Tauster, a great deal of effort has been carried on for preparing efficient catalysts and understanding its mechanism. For the metal / titanium oxide system, most of the spectral and morphological evidences showed that the presence of Ti^{3+} plays a key role in SMSI. Encapsulation of TiO_x on metal nanoparticle has been evidenced. Moreover, well-ordered TiO_x thin films have been reported to be prepared on single crystal surfaces. In this presentation, an improved method for measuring the turnover frequency (TOF) for a catalytic reaction on a single crystal surface is proposed. Different types of TiO_x thin films with various coverages are prepared on the Pt(111) surfaces to mimic the SMSI interface. The fully cover of the Pt(111) surface by TiO_x films at 1 ML is confirmed by home-built wide spectral range infrared reflection absorption spectroscopy (IRAS) using CO adsorption as a probe, in which only very weak CO adsorption peak is observed. CO catalytic oxidation is tested on these model surfaces. Significant enhancement is observed at submonolayer region. The high catalytic activity can be maintained for many cycles. And the stability of these model SMSI surfaces is confirmed by *in-situ* IRAS as shown in Figure 1.

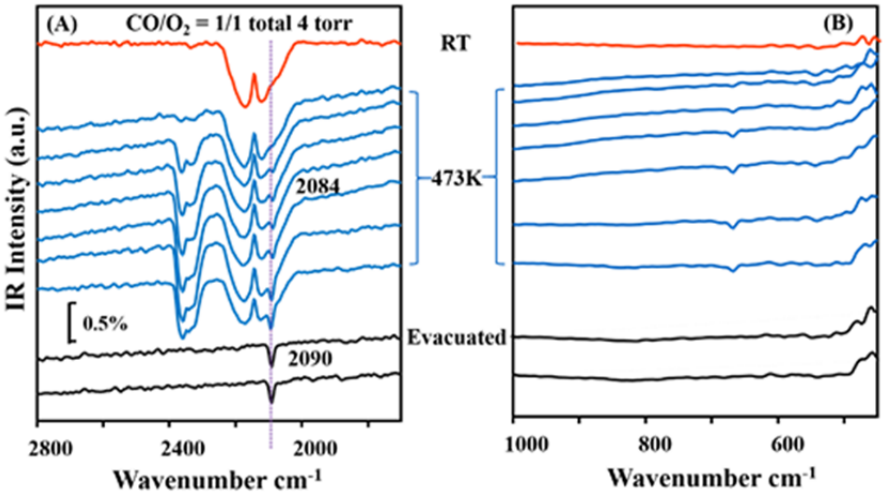

Figure 1. (A) and (B) In-situ IRAS spectra for CO oxidation on the 1 ML TiO_x/Pt(111) surface.

References:
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