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The study of interaction dynamics of the adsorbed oxygen with Pt (111) surface

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Pt and Pt-transition metal alloys are the most widely investigated catalyst for oxygen reduction reaction (ORR) in the fuel cell study. We re-visited this old system and discovered new details of surface electronic structures between adsorbed oxygen and Pt (111) surface, which can provide a better understanding for the development of improved fuel cell catalyst.

In this presentation, we will report the changes of the electronic structures and chemical states of oxygen adsorbed on Pt (111) at various temperatures with x-ray photoemission spectroscopy (XPS). From O *1s* core-level XPS measurement, both physisorbed and chemisorbed oxygen molecules are present on the surfaces at T=30K. Both adsorption states show strong temperature dependence in the range of T=30~150K, indicating thermally activated absorption process. From angle-resolved XPS, strong interactions of chemisorbed oxygen with Pt *d* -bands is found with the constant energy map at Fermi energy level and valence band, indicating most of the *d* -band of Pt contribute to the charge transfer interaction. The correlation between the recent electrochemical reactivity (ORR) and surface electronic structures on Pt (111) will be discussed.