A Electronic and Structureal Study of Growth Iridium Oxide on Ir(100)

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Abstract

A recent study shows that Ir(100) surface oxidized in ambient pressure oxygen is active toward C-H bond cleavage which is different from the one grow in UHV condition. However, the structural information between two different growth condition remain unknown. Therefore, the present study aims to figure out the structural evolution of growth of iridium oxide. We study the growth of iridium (Ir) oxides on Ir(100) substrate, with varied surface probe techniques including reflective high energy electron diffraction (RHEED), Ambient pressure X-ray photoelectron spectroscopy (XPS) and scanning tunneling microscopy (STM). The RHEED results shows the surface grow 2×1 structure when the dosage is smaller than 2×10^8 L. When the dosage larger than 2×10^8 L but smaller than 6×10^9 L, the surface start to form 3D structure. In both of the condition, Ir 4f bulk state dominates the XPS spectrum and little of Ir 4f (IV) state presents in the high binding energy side. As the dosage increase, the blurred line and dot, which represent the 3D cluster on the surface, coexist in RHEED pattern. In XPS spectrum, the peak intensity of Ir 4f (IV) state increase until it's identical to Ir 4f bulk state intensity. However, the Ir 4f bulk state disappear and Ir 4f (IV) and (III) state dominate the spectrum if the iridium oxide grows in ambient pressure condition (Pressure larger than 1torr). The RHEED pattern emerge more evident line feature which means the organized structure form on the surface. The unintuitive result indicates different oxygen pressure during the growth of iridium oxide plays an important role in determine the surface structure and valance electron property. On the other hand, it might be the key the understand the growth mechanism of the iridium oxide.

Keywords – Iridium, Oxide, XPS, RHEED, STM