Growth and Surface Chemistry of Rutile IrO$_2$(110)

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Interest in the surface chemistry of late transition-metal oxides has been stimulated by observations that the formation of metal oxide layers tends to dramatically alter the catalytic performance of transition metals in applications of oxidation catalysis. In this talk, I will discuss our recent investigations of the growth and chemical properties of rutile IrO$_2$ surfaces, focusing particularly on the activation and chemistry of small alkanes. I will discuss our studies of the oxidation of metallic Ir surfaces by O-atom beams as well as O$_2$ at pressures above 1 Torr. We find that stoichiometrically-terminated IrO$_2$(110) layers could only be formed by oxidizing Ir(111) and Ir(100) at sufficiently high temperature and O$_2$ pressure. I will discuss our recent discovery of highly facile CH$_4$ and C$_2$H$_6$ activation on the IrO$_2$(110) surface at temperatures as low as 150 K and the subsequent oxidation chemistry.$^{1,2}$ Lastly, I will present results showing that the controlled deactivation of bridging oxygen atoms of IrO$_2$(110) provides a way to enhance the selective conversion of ethane to ethylene.

References: