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_2H_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:
[1] Z. Liang, T. Li, M. Kim, A. Asthagiri, J.F. Weaver, Science **356**, 298 (2017).
[2] Y. Bian, M. Kim, T. Li, A. Asthagiri, J.F. Weaver, J. Am. Chem. Soc. **140**, 2665 (2018).