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The Formation and Reactivity of Anion Radicals on Metal Oxides*

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Electronegative gas molecules react with many metal oxide surfaces, forming negative anion radicals which have been identified by electron paramagnetic resonance (EPR) spectroscopy. The metal oxide may either be an *n*-type semiconductor or an insulator with trapped electrons at the surface. A partial list of the ions which have been studied includes O^-, O_2^-, O_3^-, SO_2^-, SO_3^-, SO_4^-, CO_2^-, COS^-, CS_2^- and NO_2^{2-}. Some of these ions, such as O_3^-, are formed by secondary reactions at the surface. The thermal stability and chemical reactivity of these ions varies widely from one type of metal oxide to another, and from one ion radical to another. The O^- ion, for example, is unstable at room temperature on ZnO, but it is reasonably stable at 300°C on the surface of molybdenum oxide supported on silica gel. The elusive N_2O^- has never been detected on a surface; yet its dissociation product, O^-, is readily formed. Current research efforts are shifting from the formation and identification of these anions to studies of their reactivity with other molecules. Recent evidence indicates that ion–molecule reactions similar to those observed in gas phase kinetics may be important in surface reactions as well.

* Invited paper.