FEMTOSECOND PUMP PROBE SPECTROSCOPY OF NEUTRAL Ti, Fe, AND Ni OXIDE CLUSTERS

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The dissociative electron dynamics of transition metal oxide clusters provide information about the stability and reactivity of their bulk material counterparts. Ti, Fe, and Ni oxides are widely used catalytic materials which may be improved with the detailed atomic precision of their stable conformations and low energy electron properties. In our experiments, neutral Ti_nO_m, Fe_nO_m, and Ni_nO_m oxide clusters are produced with small amounts of oxygen and their mass spectra show a primary stable stoichiometry of m = n for Fe clusters, m = n - 1 for Ni clusters, and m = 2n - 1 for Ti clusters. I will present our ultrafast pump-probe spectroscopy measurements on the direct ionization, dissociation, formation, and excitation-relaxation properties for these metal cluster systems extending up to n = 10. The femtosecond dynamics observed for these clusters depend strongly on their metal composition, size, and oxidation state. Understanding the energy and time-resolved fragmentation patterns of large molecules may prove to produce more targeted catalysts of increased reactivity, leading to decreased cost and waste.