ULTRAFAST EXCITED STATE DYNAMICS OF NEUTRAL ALUMINUM OXIDE CLUSTERS

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Aluminum oxides are an affordable, abundant, and commonly utilized material for many applications such as magnetic devices, gas sensing, and catalysis. To maximize catalytic activity, a modern frontier of material science is aimed at creating ever-decreasing sizes of materials which drives new demands to understand the electronic properties and geometric structures down to the molecular (cluster) scale. I will present recent measurements investigating the excited state dynamics of neutral aluminum clusters collected with femtosecond pump-probe spectroscopy coupled with time-of-flight mass spectrometry. Neutral clusters are excellent mimics of bulk material properties and show tunable ultrafast dynamics and excited state lifetimes with the addition and subtraction of each atom in their composition. Our preliminary results on the ultrafast dynamics of aluminum oxide clusters reveals a trend where sequential addition of oxygen atoms decreases the measured excited state lifetimes. For example, in the Al_4O_y series (y = 0-2), the measured excited state lifetimes decrease by 37% with the addition of 2 oxygen atoms, which is consistent across our measurements for other aluminum oxide series. By understanding the electron dynamics and charge carrier separation in aluminum oxide clusters, bulk material defects and vacancies can be capitalized upon to increase the efficiency of aluminum containing species.