

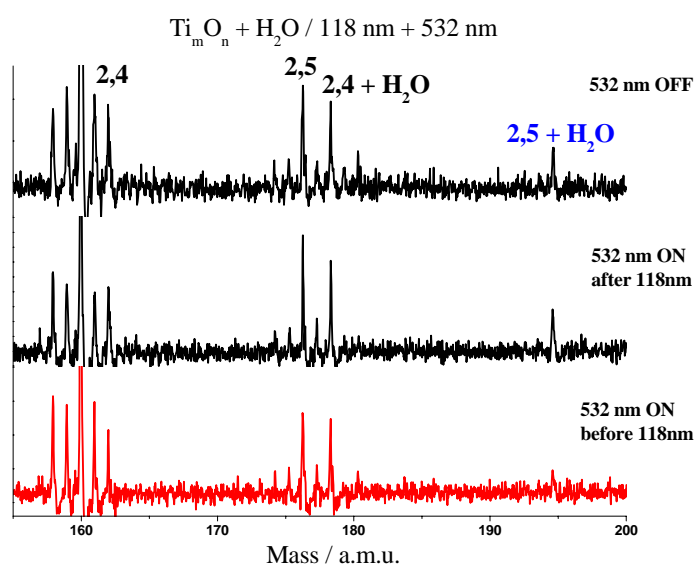
WATER DECOMPOSITION ON NEUTRAL Ti_2O_5 CLUSTERS WITH 532 nm LASER EXCITATION

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Reactions of neutral, gas phase Ti_mO_n clusters with H_2O are investigated through 118 nm (10.5 eV) single photon ionization coupled with a time of flight mass spectrometer. Titanium oxide clusters are generated by the reaction of laser ablated titanium metal foil with 1% O_2 seeded in a helium carrier gas, and react with water in a fast flow reactor after supersonic expansion. Ions are deflected from the molecular beam by an electric field, and neutral species are skimmed and ionized by 118 nm laser radiation. A slightly focused 532 nm laser pulse crosses the molecular beam and the 118 nm laser radiation perpendicularly and the timing delay between the 532 and 118 nm lasers is set as, a. 532 nm excitation laser pulse is after the 118 nm ionization laser pulse by 50 ns, and b. 532 nm laser pulse is before the 118 nm laser pulse by 50 ns. The results are presented in the following Figure.

Ti_2O_4 , Ti_2O_5 , $\text{Ti}_2\text{O}_4\text{H}_2\text{O}$ and $\text{Ti}_2\text{O}_5\text{H}_2\text{O}$ are observed when the 532 nm laser is blocked in the top pattern of the Figure. The association product $\text{Ti}_2\text{O}_5\text{H}_2\text{O}$ almost disappears while the $\text{Ti}_2\text{O}_4\text{H}_2\text{O}$ mass peak is still present when the 532 nm laser pulse is introduced before 118 nm ionization laser pulse, as shown in the bottom pattern of the Figure. When 532 nm laser pulse arrives after the 118 nm ionization laser pulse, both $\text{Ti}_2\text{O}_4\text{H}_2\text{O}$ and $\text{Ti}_2\text{O}_5\text{H}_2\text{O}$ are observed (middle pattern of the Figure). The experimental results suggest that H_2O molecules decompose only on neutral Ti_2O_5 clusters. Further experimental and theoretical work to interpret the detailed reaction mechanisms for the water decomposition reaction on the neutral Ti_2O_5 cluster surface is in progress.



Reference

[1]. Y. Matsuda, E. Bernstein, *J. Phys. Chem. A*, **109**, 314, 2005.