Abstract Submitted
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Narrowing of band gap in thin films and linear arrays of ordered TiO_2 nanoparticles[1] YU LIU, Department of Physics and Astronomy, University of California, Irvine, JAMES TAING, Department of Chemistry, University of California, Irvine, CHENG-CHIEN CHEN, Advanced Photon Source, Argonne National Laboratory, ADAM SORINI, Lawrence Livermore National Laboratory, MING H. CHENG, ALEXANDRIA MARGARELLA, Department of Chemistry, University of California, Irvine, HENDRIK BLUHM, ZHI LIU, Lawrence Berkeley National Laboratory, THOMAS DEVEREAUX, Stanford Institute for Materials and Energy Science, SLAC National Accelerator Laboratory, JOHN HEMMINGER, Department of Chemistry, University of California, Irvine — Utilizing ambient pressure synchrotron x-ray spectroscopies, we report the properties of thin films and linear arrays of ordered TiO_2 nanoparticles under in situ water vapor exposure and heating. Our nondestructive depth profiles indicates an enhancement of the density of states (DOS) near the Fermi level due to surface Ti^{3+} states and oxygen vacancies caused by heating isolated TiO_2 nanoparticles. In contrast, introducing water on the TiO_2 interface eliminates oxygen vacancies and increase Ti^{4+} configurations, thereby suppressing the DOS enhancement. Our results suggest that the TiO_2 band gap can be tuned reversibly under water exposure and heating, and isolated TiO_2 nanoparticles can potentially enhance solar absorption efficiency and the life time of electron-hole pairs for photocatalysis.

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