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Quenching of oxygen photodesorption from TiO₂(110) through co-adsorption NIKOLAY PETRIK, GREG KIMMEL, MINGMIN SHEN¹, MICHAEL HENDERSON, Pacific Northwest National Laboratory — Fundamental understanding of photochemical reactions on TiO₂ surfaces is important for many practical applications. We used temperature programmed desorption and photon stimulated desorption (PSD) to show that coadsorbates of varying binding energies (Ar, Kr, Xe, N₂, CO, CO₂, CH₄, N₂O, acetone, methanol or water) on the rutile TiO₂(110) surface suppress the hole-mediated photodesorption of adsorbed O₂. The extent of suppression correlates with the coadsorbates gas phase basicity, which in turn determines the strength of the coadsorbate-Ti⁴⁺ bond. Coadsorbed rare gases inhibited the photodesorption of O₂ by 10-25%, whereas strongly bound species (water, methanol and acetone) nearly completely inhibited O₂ PSD. We suggest that coadsorption of these molecules inhibit the arrival probability of holes to the surface. Band bending effects, which vary with the extent of charge transfer between the coadsorbate and the TiO₂(110) surface, are not expected to be significant in the cases of the rare gases and physisorbed species. These results indicate that neutral coadsorbates can influence significantly the charge transfer events by altering the interfacial dipole in the vicinity of the target molecule.

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