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Femtosecond laser doped and nanostructured TiO_2 for photocatalysis KATHERINE PHILLIPS, ELIZABETH LANDIS, CYNTHIA FRIEND, ERIC MAZUR, Harvard University — We present a novel method for femtosecond-laser doping of titanium dioxide (TiO_2) for above bandgap absorptance by irradiating titanium metal in the presence of oxygen and dopants. With a bandgap of 3.2 eV for the anatase crystalline phase, TiO_2 most strongly absorbs in the UV range ($\lambda < 387$ nm). However, doping with metals and nitrogen has been shown to create intermediate states in the bandgap. Using femtosecond laser doping techniques on titanium in a gaseous environment, we produce laser-induced periodic surface structures. Altering the gas composition and pressure does not change the surface morphology, but it does impact the chemical composition of the surface. We present compositional data from x-ray photoelectron and Raman spectroscopy and structural data from scanning electron microscopy. Our research presents an innovative approach using laser scanning techniques to alter the structure of TiO_2 and generate a new material for visible-light photocatalysis that has the potential for watersplitting.

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