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# $^{121}$Sb Mössbauer spectroscopic insight into the puzzling persistence of photocatalytic activity exhibited by Sb-doped anatase $TiO_2$

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Routine X-Ray Diffraction (XRD) measurements were performed on a powder sample ARL X'TRA Thermo Scientific diffractometer using Cu $K_\alpha$ radiation (wavelength $\lambda$ = 1.5418 Å). All the XRD patterns of the examined photocatalysts revealed the formation of single anatase phase (space group $I4_1/amd$). An XRD pattern of argon-annealed photocatalyst 0.1 at% $Sb^{III}/a$-$TiO_2$ is depicted in Figure S1.

$^{121}$Sb Mössbauer spectroscopic measurements were carried out on a MS-1104 spectrometer in standard transmission geometry and analyzed by a least-square fitting program. The velocity scale was calibrated with the standard spectrum of an $\alpha$ Fe absorber using a $^{57}$Co(Rh) source. To carry out the $^{121}$Sb resonant absorption measurements the 8.5 keV escape peak, produced by Mössbauer gamma rays ($E_\gamma$ = 37.15 keV) in a thin NaI(Tl) scintillator, was used. During the measurements both the $Ca^{121m}SnO_3$ source and studied photocatalyst (absorber) were introduced into the hole of a copper bar immersed in a Dewar flask filled with liquid nitrogen. Under these conditions, the temperature of absorber was close to 100 K and thus allowed to consider the spectral contribution of a chemically different antimony species as an acceptable estimate of its abundance.

Conventional photocatalytic measurements were carried out using an appropriate LED (white light, color temperature $T_c$ = 6500 K, $P$ = 3W). Optical density was determined at $\lambda$ = 460 nm in a cuvette used for irradiation [4 ml-polypropylen cuvette, containing 1 ml of phosphate buffered MO aqueous solution (pH = 7) and 5 mg of sedimented catalyst particles]. Initial optical density values of a working solution were about 2.1–2.4.

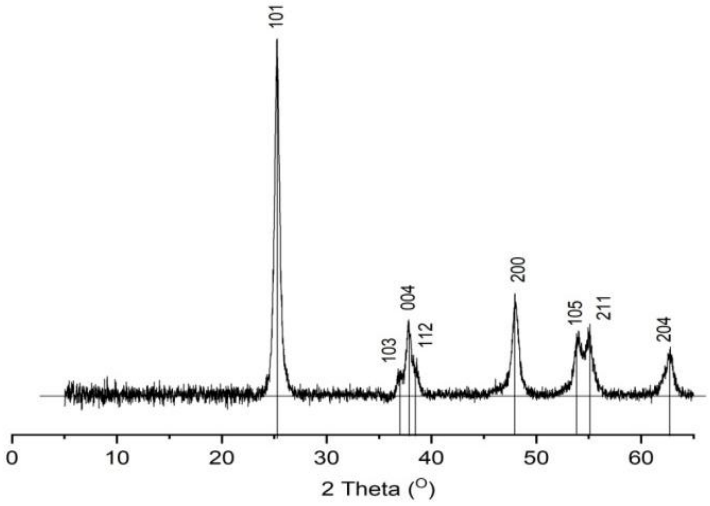


**Figure S1** XRD pattern of argon-annealed photocatalyst 0.10 at% $Sb^{III}/a$-$TiO_2$