

Supporting Information

"Long-Life Electrons in Metal-Doped Alkali-Metal Tantalate Photocatalysts Excited under Water"

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1. Reagents

Na₂CO₃ (99.8%, Kanto), K₂CO₃ (99.5%, Wako), Ta₂O₅ (99.99%, Rare metallic), SrCO₃ (99.9%, Kanto), La₂O₃ (99.99%, Wako), methanol (99.7%, Wako), FeCl₃·6H₂O (99.0%, Junsei), NaIO₃ (99.5%, Junsei), H₂O₂ (30%, Wako), *n*-decane (99.0%, Wako), Iodine (99.9%, Wako), N₂ gas (99.995%, Tomoe) and ultrapure water produced by Direct-Q 3UV (Millipore).

2. IR transmittance thorough the prism

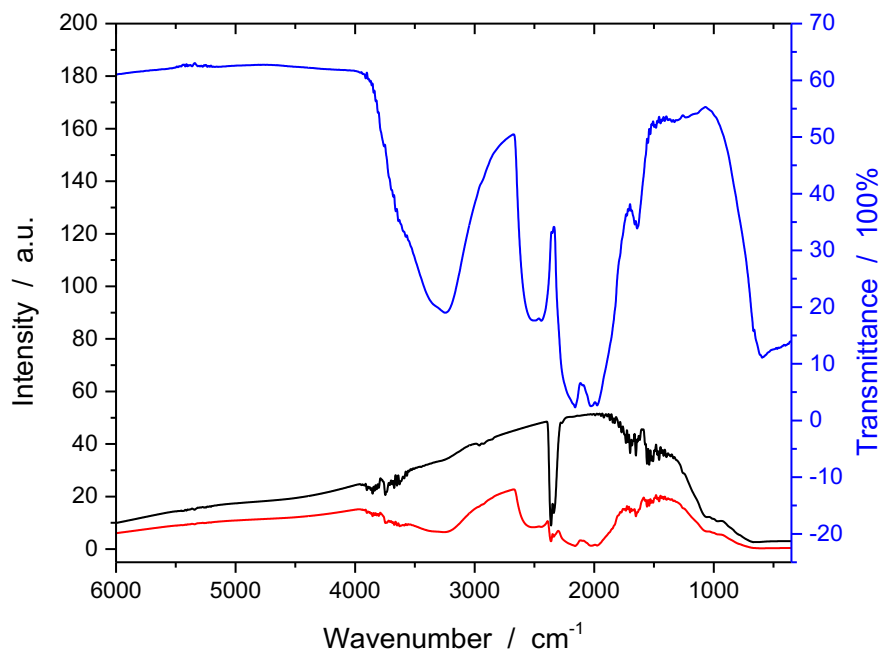
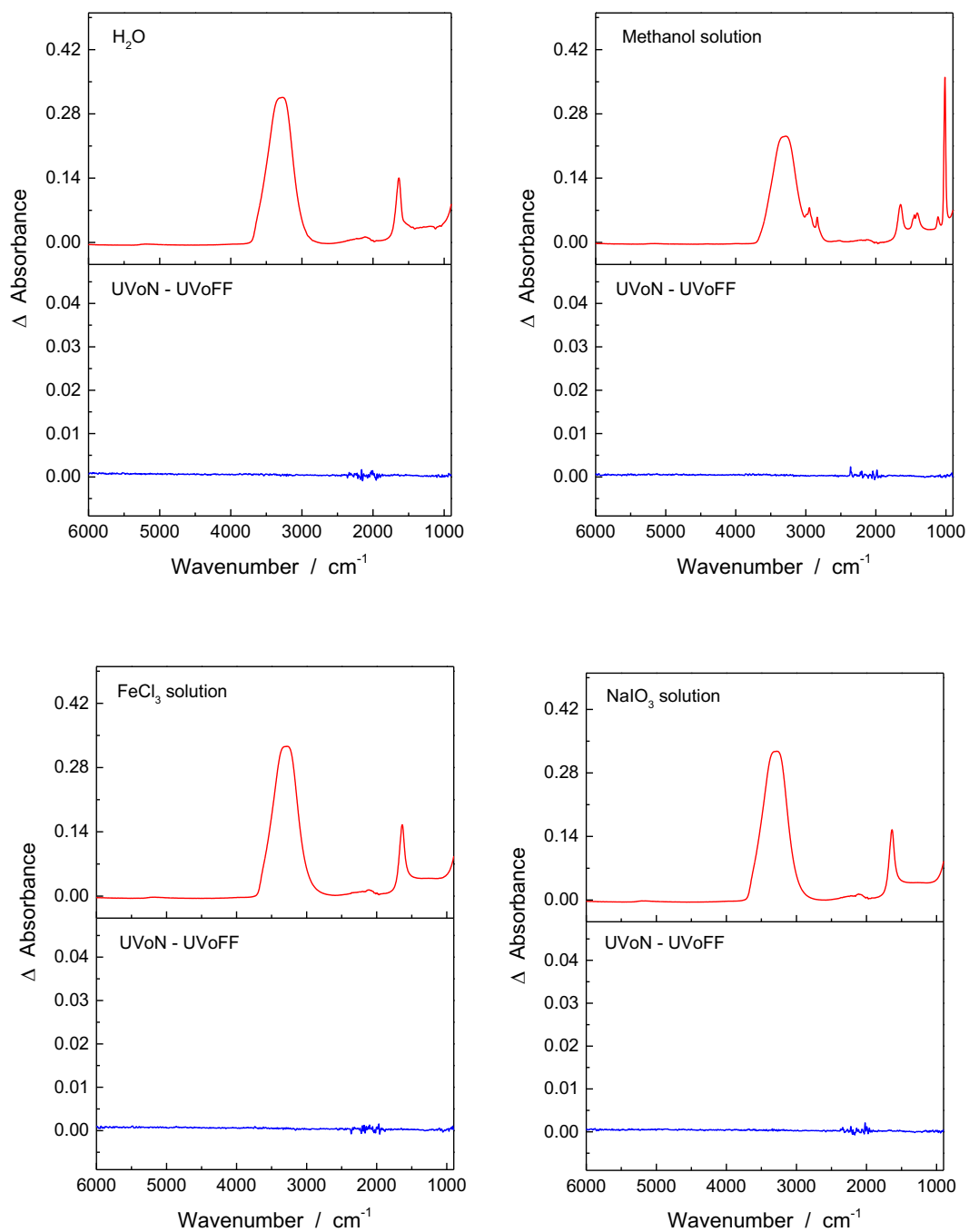


Figure S1. Transmittance spectrum of the ATR prism assembly with a water droplet on the reflection plane. Intensity spectra of IR light received by the MCT detector without the assembly (black). Intensity with the assembly and water on the reflection plane is shown with the red curve. Transmittance (blue) was given by the ratio of the red spectrum over the black spectrum. The spectrometer was purged with N₂ gas.

3. IR absorption of the solutions



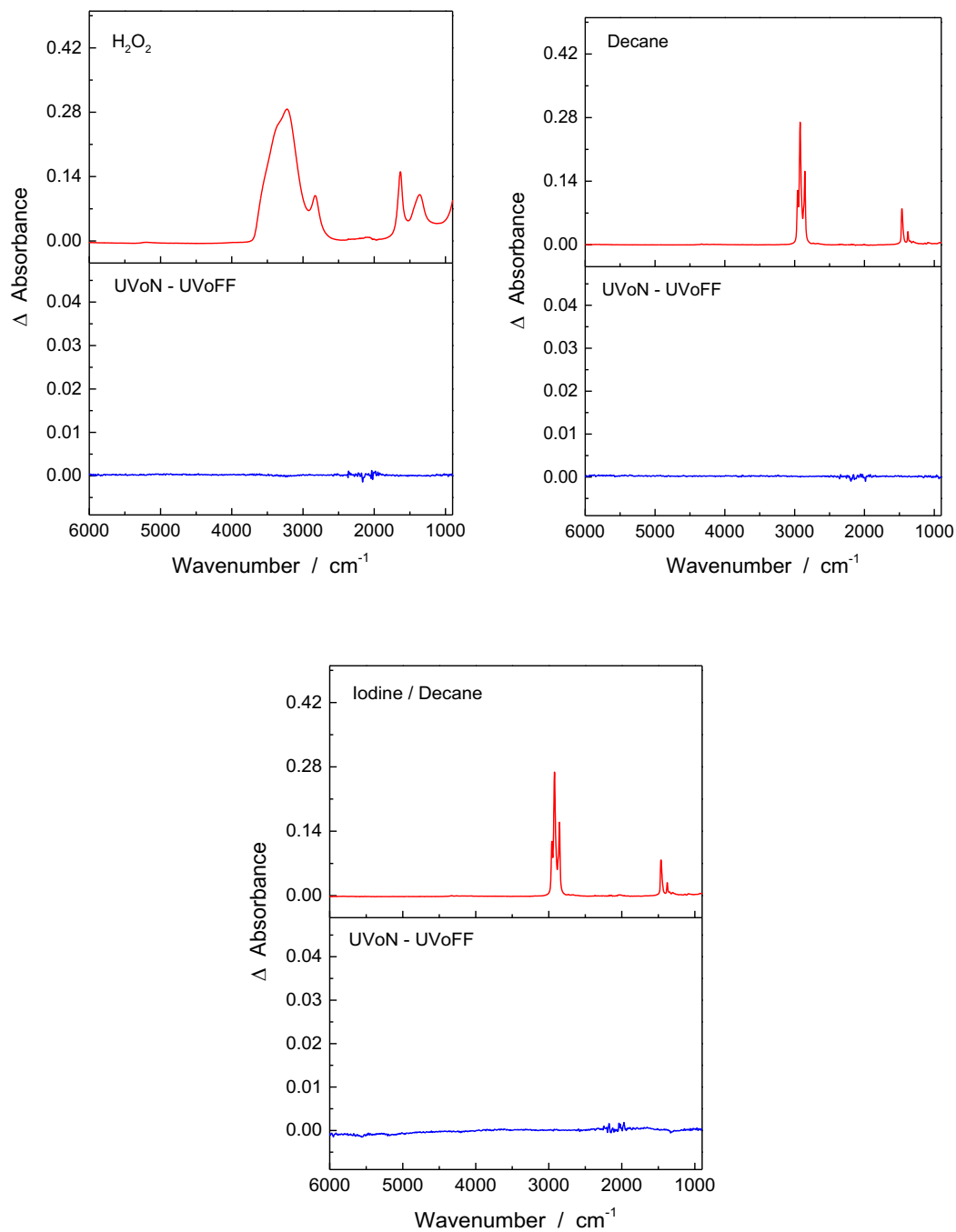


Figure S2. Absorbance spectra of liquid droplets on the reflection plane of the prism. Red spectra were observed without UV irradiation. Blue curves showed no absorbance change (Δ absorbance) during UV irradiation. UV light power: 19 W m^{-2} . The droplets were exposed to air.

4. Crystalline structure of the photocatalysts

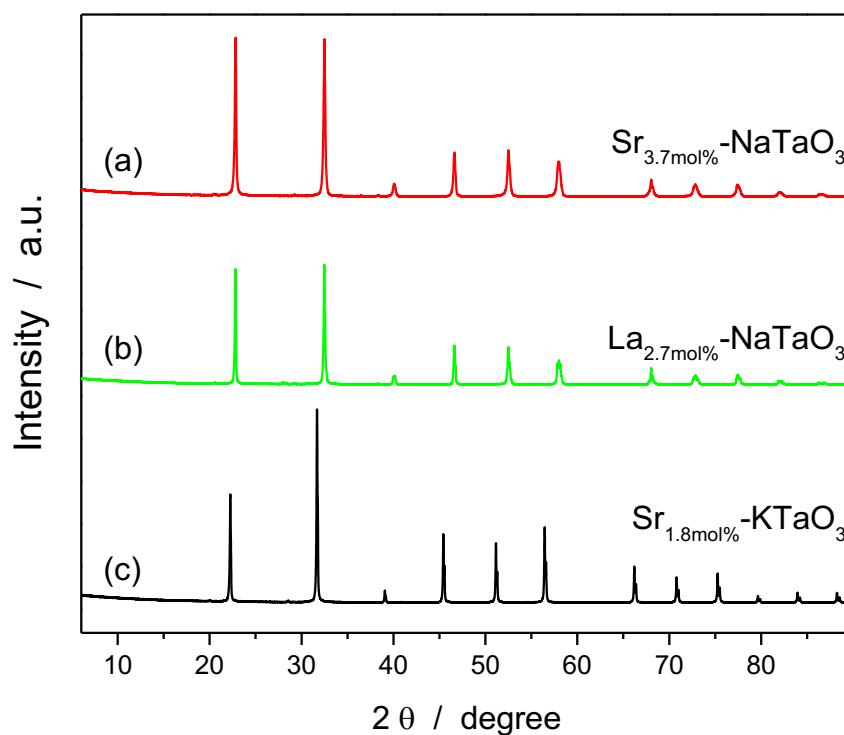


Figure S3. X-ray diffraction patterns of the photocatalysts observed with an X-ray diffractometer (SmartLab, Rigaku). NaTaO_3 photocatalysts doped with (a) Sr and (b) La cations. Diffraction of the KTaO_3 photocatalyst doped with Sr cations is shown in (c).

5. Shape of the photocatalyst particles

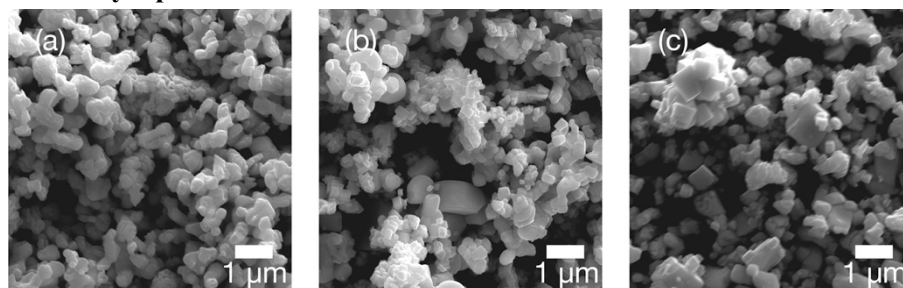


Figure S4. Micrographs of photocatalyst particles observed with a scanning electron microscope (JSM-7100F, Jeol). The NaTaO_3 photocatalysts doped with (a) Sr and (b) La cations. The micrograph of the KTaO_3 photocatalyst doped with Sr cations is shown in (c).

6. Electron decay in anaerobic decane

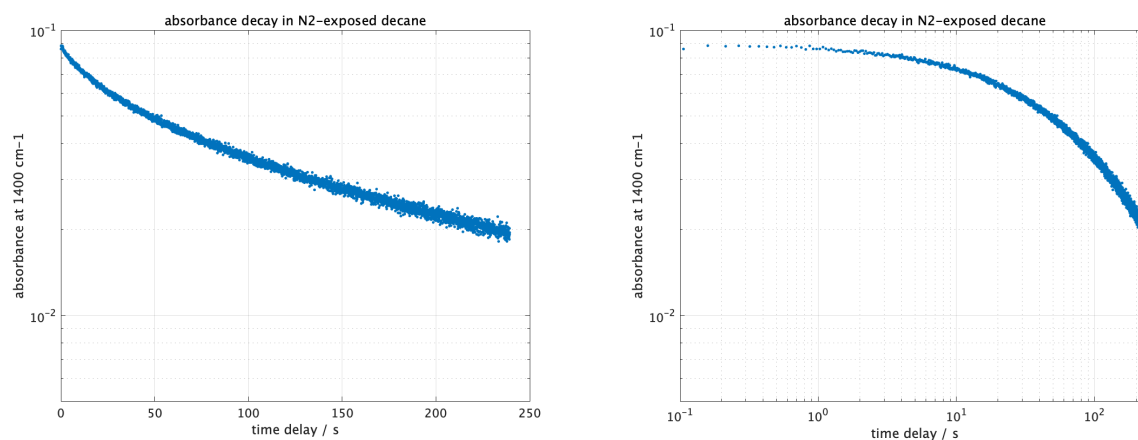


Figure S5. Absorbance change at 1400 cm⁻¹ observed on the Sr-doped NaTaO₃ particles immersed in anaerobic decane. Absorbance change is plotted as a function of delay time in (left) *semi-log* and (right) *log-log* graphs. The excitation light (19 W m⁻²) was stopped at time zero.

7. Electron decay in anaerobic water

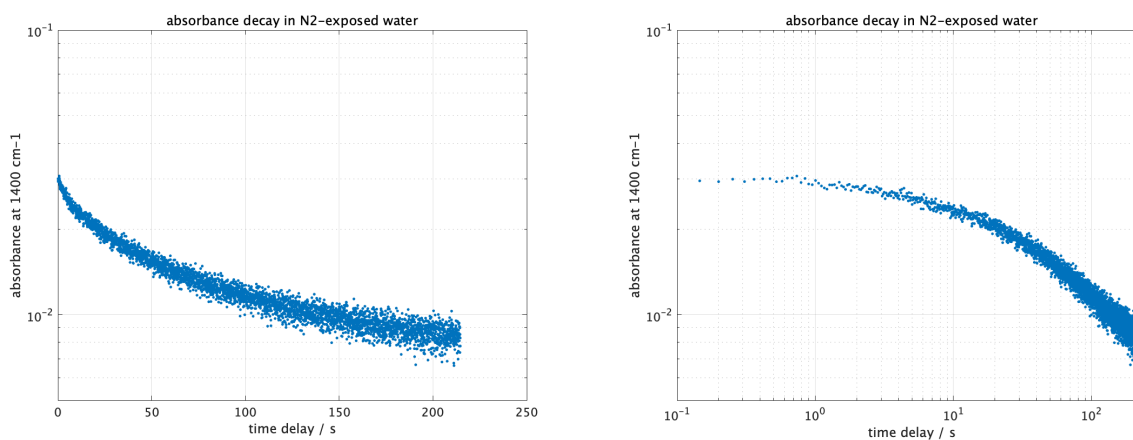


Figure S6. Absorbance change at 1400 cm⁻¹ observed on the Sr-doped NaTaO₃ particles immersed in anaerobic water. Absorbance change is plotted as a function of delay time in (left) *semi-log* and (right) *log-log* graphs. The excitation light (19 W m⁻²) was stopped at time zero.

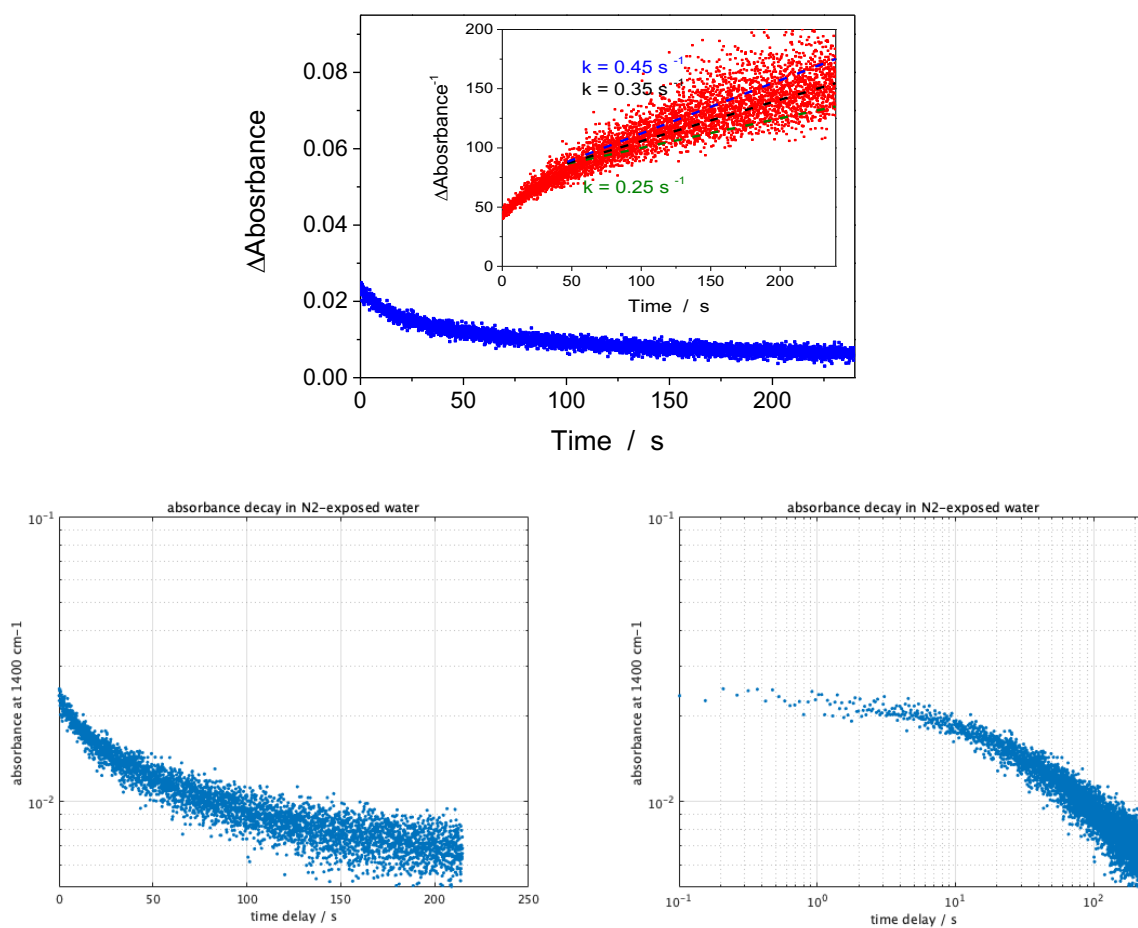


Figure S7. Another trace of absorbance change at 1400 cm^{-1} . The Sr-doped NaTaO_3 particles immersed in anaerobic water and UV-light irradiated on a different day. Absorbance change is plotted as a function of delay time in (top) reciprocal, (bottom-left) *semi-log*, and (bottom-right) *log-log* graphs. The excitation light (19 W m^{-2}) was stopped at time zero.