Supplementary information:

Dynamics of local Stark effect observed for complete D149-dye sensitized solar cell

Gotard Burdziński [a], Jerzy Karolczak [a, b] and Marcin Ziółek [a] [*]

[a] *Quantum Electronics Laboratory, Faculty of Physics, Adam Mickiewicz University in Poznan, Umultowska 85, 61-614 Poznan, Poland*

[b] *Center for Ultrafast Laser Spectroscopy, Adam Mickiewicz University in Poznan, Umultowska 85, 61-614 Poznan, Poland*

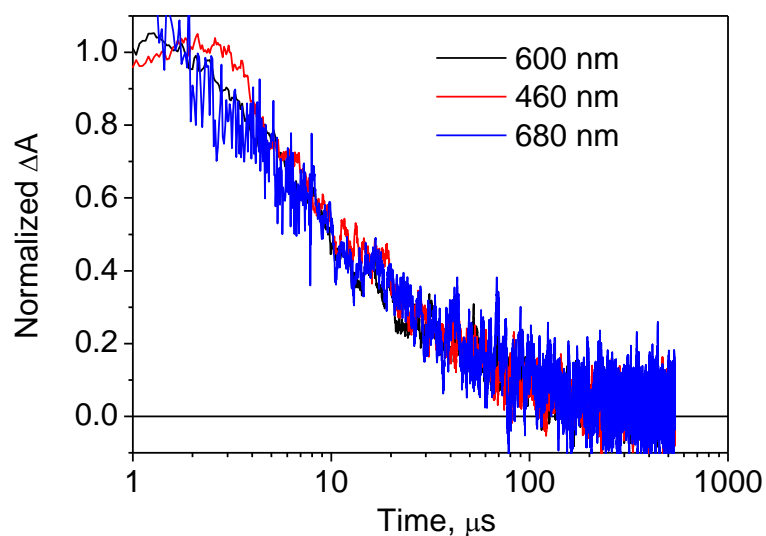[*] corresponding authors: marziol@amu.edu.pl

Figure S1. Normalized transient absorption kinetics for D149/ACN measured at the indicated wavelength under excitation at 532 nm with 300 $\mu J/cm^2$ energy density of the pump pulse. The time axis is in logarithmic scale.
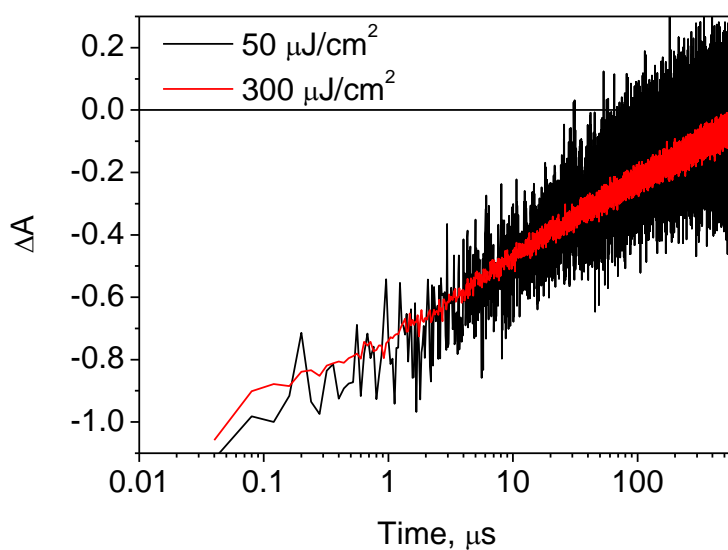

Figure S2. Normalized transient absorption kinetics for D149/EL measured at 620 nm under excitation at 532 nm with different indicated energy densities of the pump pulse. The time axis is in logarithmic scale.
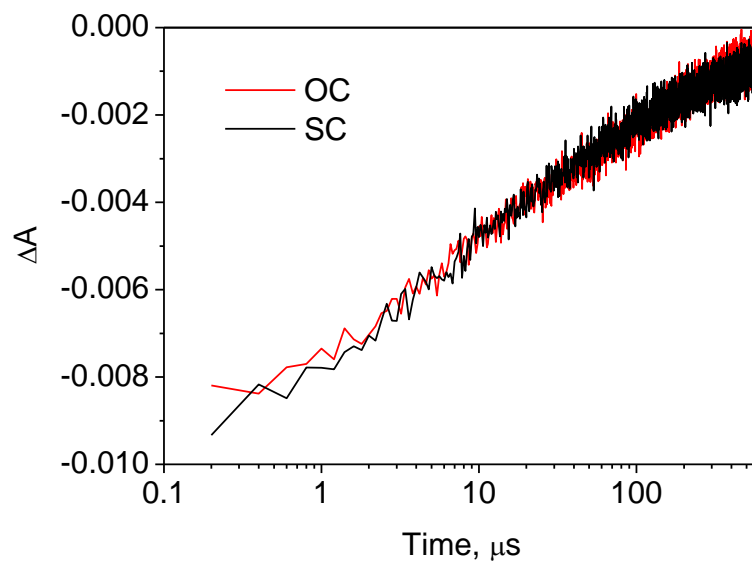
Figure S3. Transient absorption kinetics for D149/EL measured at 620 nm under excitation at 532 nm with 300 μJ/cm^2 pump pulse in open circuit (OC) and short circuit (SC) conditions. The time axis is in logarithmic scale.
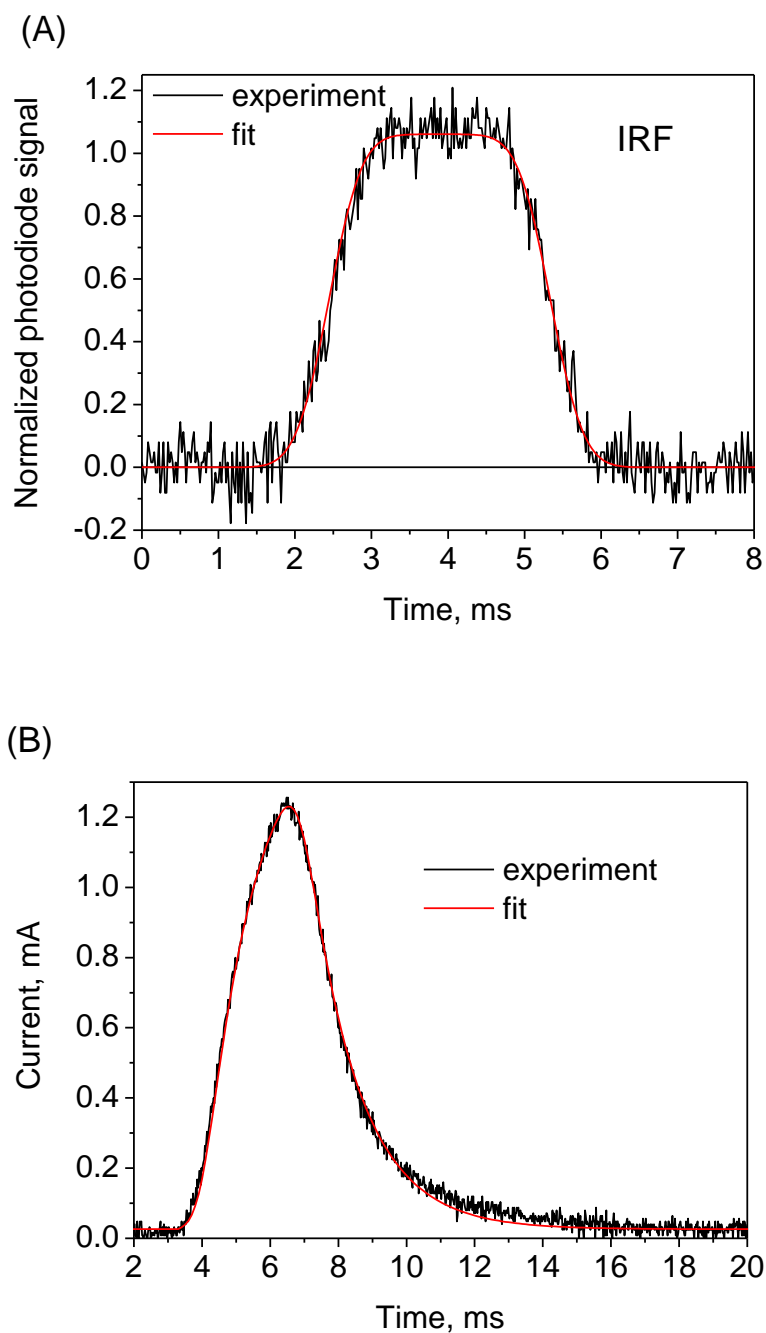
(A)

(B)

Figure S4. (A) Determination of instrument response function (IRF). Black line shows normalized signal of the xenon lamp irradiation modulated by a chopper and detected by the fast photodiode. The red line is a fit of a hat-like function that represents IRF. (B) Transient photocurrent (black line) measured for D149/EL under excitation with the modulated xenon lamp with 1 Sun energy density at short circuit conditions (note longer time scale than in figure (A)). The red line corresponds to the fit of one exponential function convoluted with IRF from (A). The fitted decay time constants is $\tau_{SC}=1.46$ ms. Note that the same dynamics reflected in the rise of the signal.
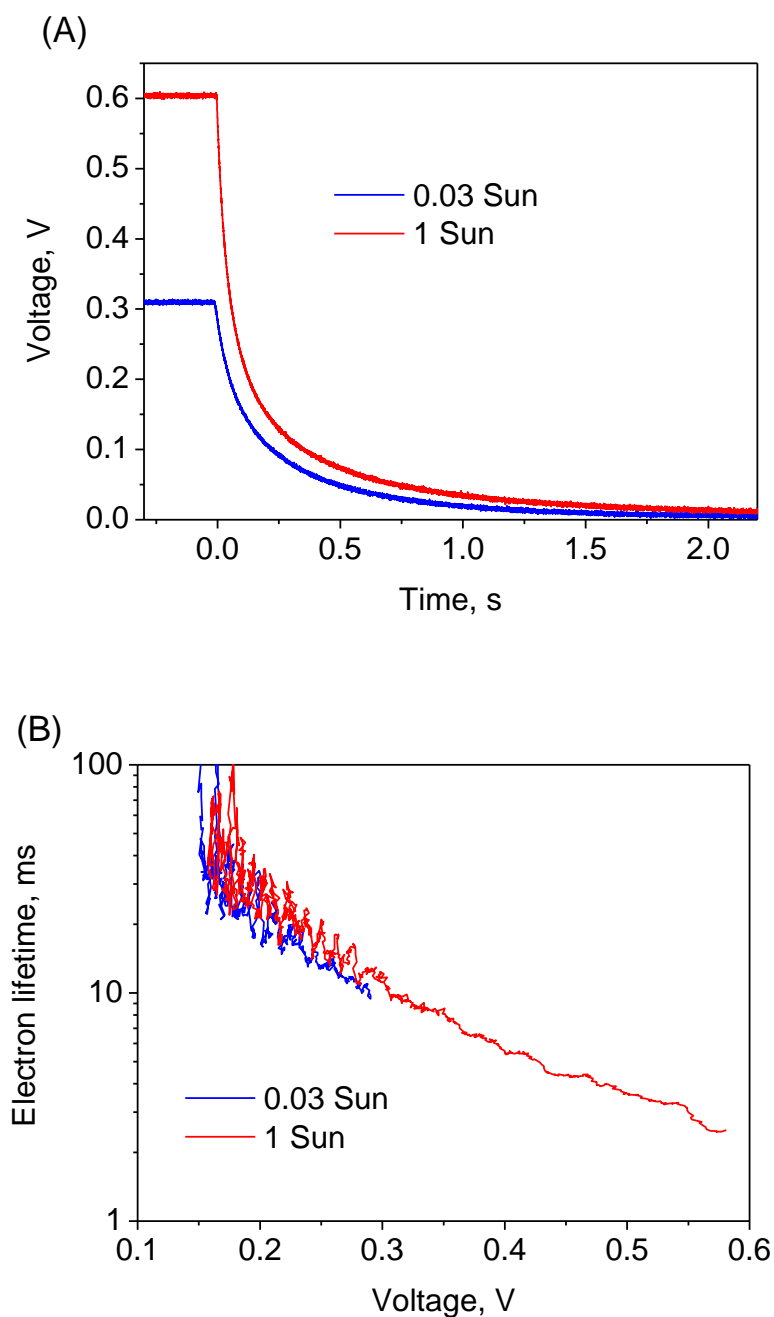
4

(A)

(B)

Figure S5. (A) Open circuit voltage decays measured for D149/EL after turning off the xenon lamp irradiation filtered to simulate 0.03 and 1 Sun intensity. (B) Electron lifetime calculated from the data in part (A) according to the following formula $\tau_{lifetime} = -\dfrac{k_B T}{e} \left(\dfrac{dV_{OC}}{dt} \right)^{-1}$.

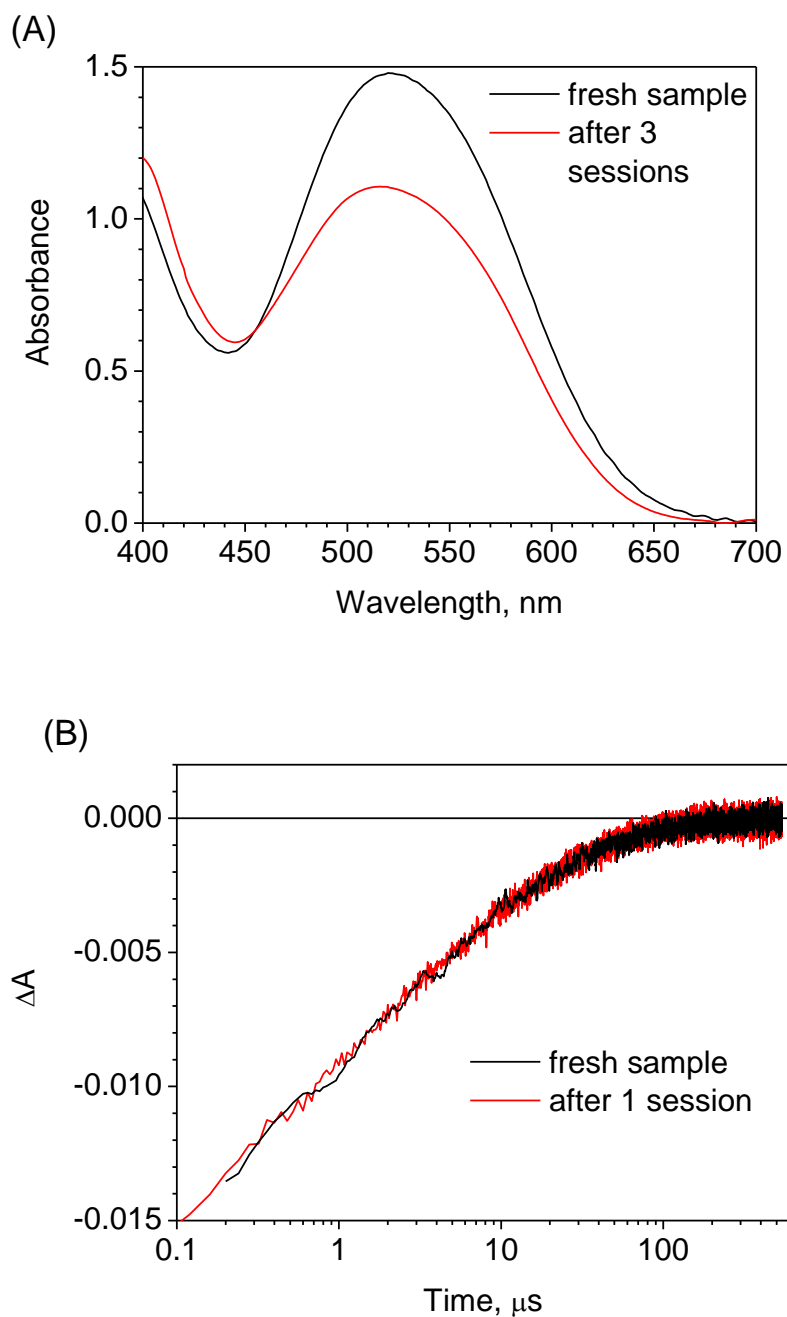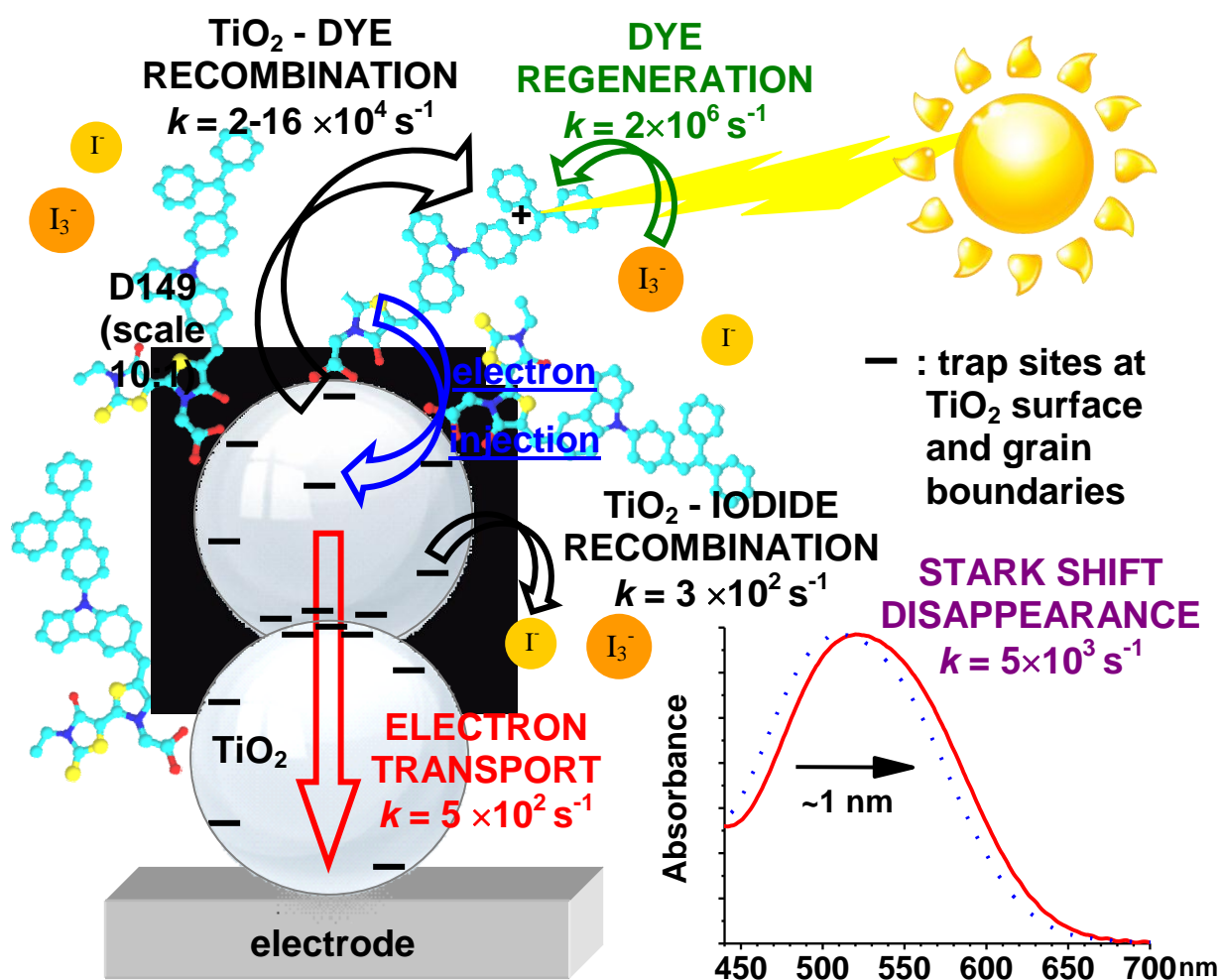The lifetime for V_{OC}=550 mV is about 3 ms.

5

Figure S6. Resistance of sample properties to extensive laser irradiation exposure. (A) Stationary absorption of D149/EL and (B) transient absorption kinetics for D149/ACN (measured at 620 nm) before and after the indicated number of measurement sessions (4 hours in flash photolysis experiment).

Scheme S1. Schematic representation of the measured rate constants accompanying the charge separation in complete D149-sensitized solar cell.