

Supporting Information

Electron transport via a soluble photochromic photoreceptor

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S1. Protein monolayer characterization

Quality of the photoreceptor protein monolayers has been characterized by ellipsometry and tapping mode atomic force microscopy imaging under constant dry N₂ flow purge (4% relative humidity). Solver P47 (NT-MDT, Zelenograd, Russia) and Multimode/Nanoscope-V (Bruker-Nano, Santa Barbara, CA, USA) SPM systems were used with Pt-coated Si probes (SNC18, 15 kHz, 0.2 N/m from Mikromasch). Topography and phase images were obtained simultaneously at a scan rate of 1 Hz. During the semi-contact scans, the average force, applied to the protein monolayer, and probe oscillation amplitude were kept minimal to prevent any deformation or damage of protein monolayers.

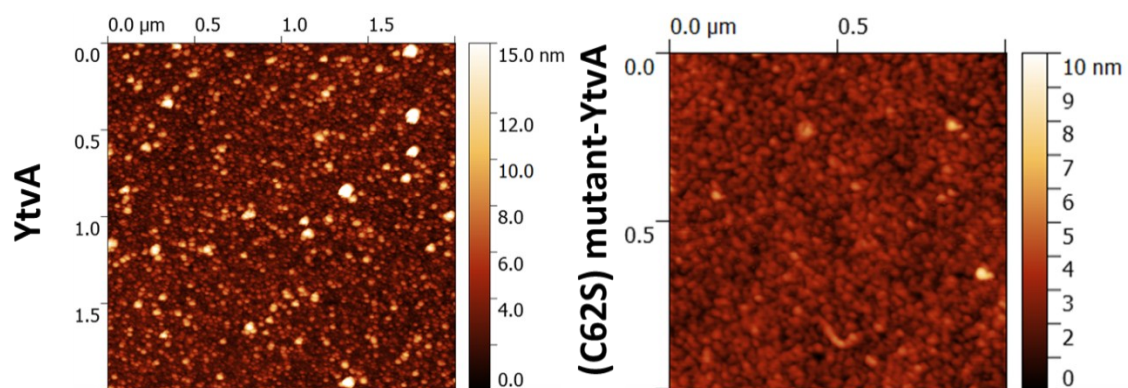


Figure S1: Tapping mode topography of photoreceptor protein monolayers on Si/SiO₂/Linker substrate.

S2. Infrared Absorption Spectroscopy of protein monolayers

Secondary structure of wild-type and mutated photoreceptor protein under dehydrated condition was confirmed with protein monolayers on cysteamine-treated gold substrate by Polarization Modulation Infrared Reflection Absorption Spectroscopy (PM-IRRAS) and monolayers on silicon/silicon oxide/3-APTMS by Grazing Angle Internal Reflection Spectroscopy (GATR) techniques. The distinct peaks of the Amide I and Amide II indicate the preservation of protein secondary structure even in dehydrated solid state monolayer.

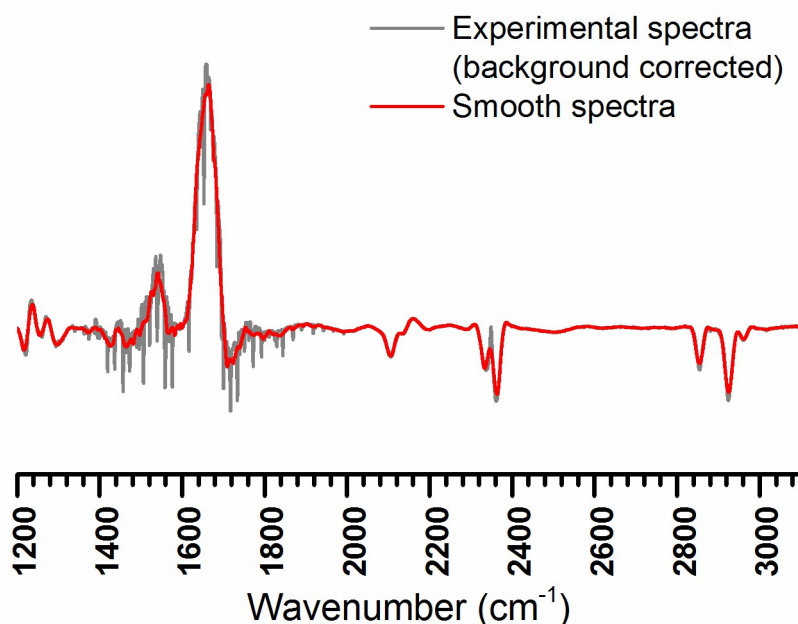


Figure S2: IR absorption of photoreceptor protein monolayer on silicon/silicon oxide/3-APTMS by Grazing Angle Internal Reflection Spectroscopy (GATR) techniques.

S3. Temperature dependent electron transport measurements across photoreceptor proteins

Temperature dependent electron transport efficiencies across photoreceptor proteins were carried out utilizing LOFO top contacts (Lift-Off-Float-On Gold pads of 500 μm diameter, 80 nm thick). Current-Voltage across these protein junctions were measured over ± 1 V at vacuum environments (10^{-4} - 10^{-6} Torr) from room temperature (295K) to 80K with Liquid N₂ cooling then followed by heating to 350K with a temperature step of 20K in each cycle. Figure S2 represents a summary of Current-Voltage curves over different temperatures.

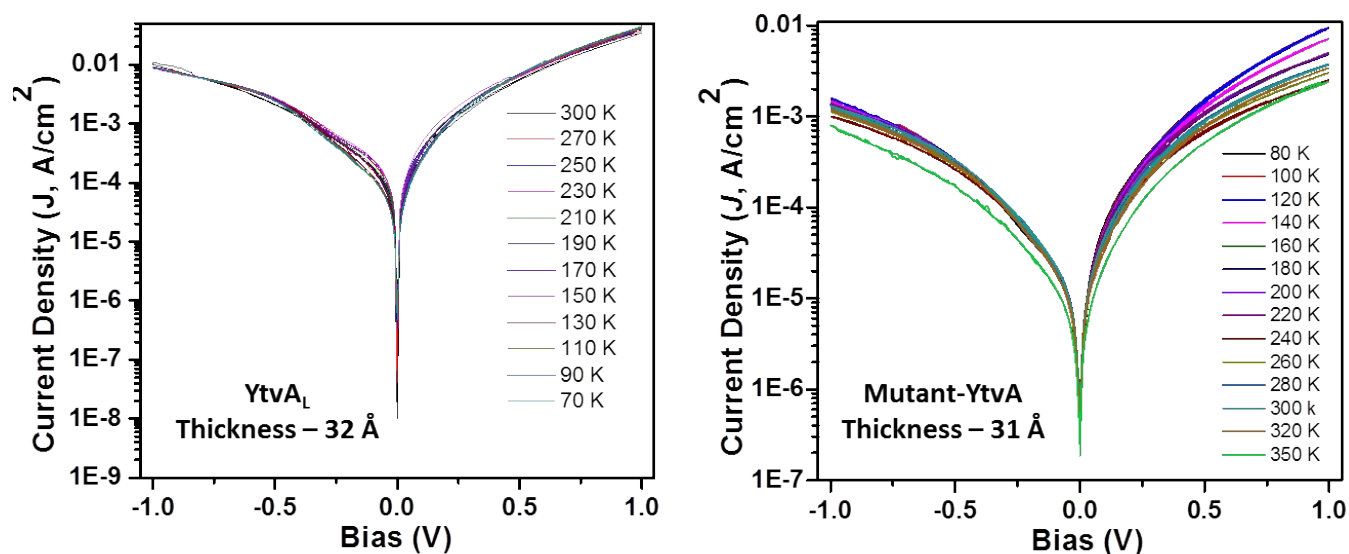


Figure S3: Current-Voltage characteristics at different temperature varying from 70K to 350K across solid state photoreceptor proteins junctions.

S4. Electrostatic surface charge on the LOV domain of YtvA photoreceptor protein in monomeric form and its probable interaction with positively charged surface

The possible orientation of the photoreceptor protein in the electrostatically self-assembled monolayer was studied by estimation of the surfaces charges using the Adaptive Poisson-Boltzmann Solver (APBS)-generated electrostatic surface charge mapping and by hydrophobic surface mapping with PyMOL software.

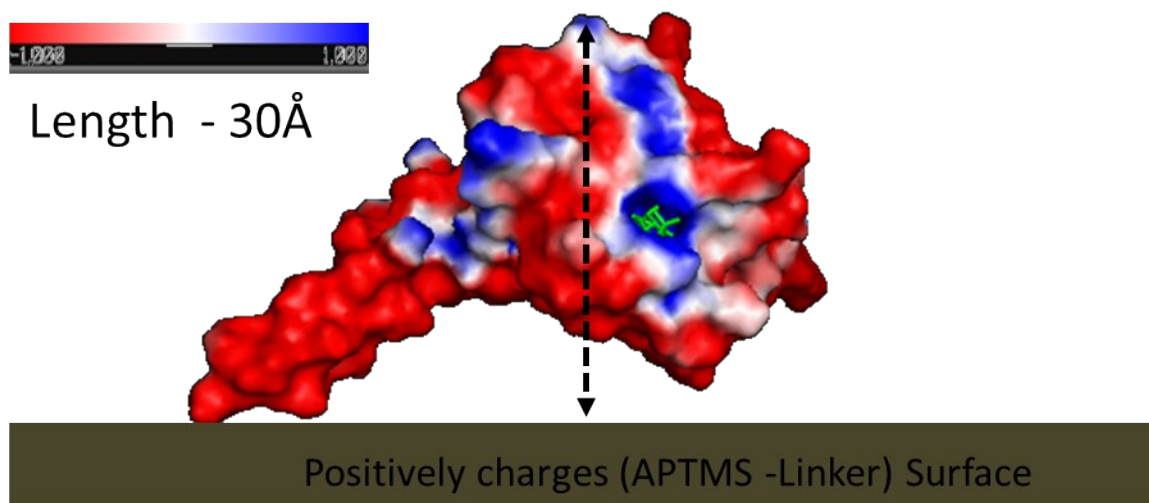


Figure S4: Distribution of Electrostatic surface charge on YtvA monomer (represented relatively in color scale). Depending on surface charge distribution, possible orientation of protein on positively charges substrate was proposed.