Supporting Information

Highly Sensitive Ion Regulation Enabled by Photothermal Wood Nanochannels

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Keywords: ion transport, photothermal effect, wood, MoS_2, ionic circuit

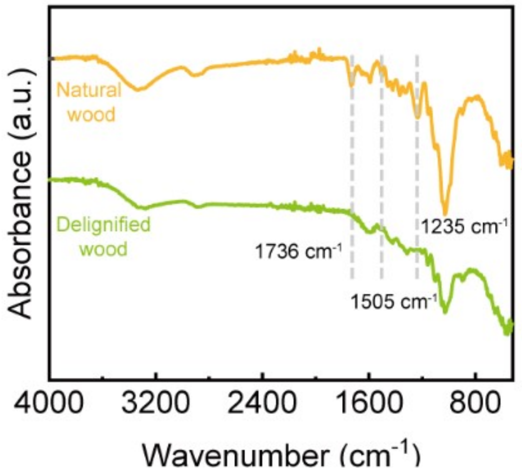

Fig. S1 FTIR spectra of natural wood and delignified wood.

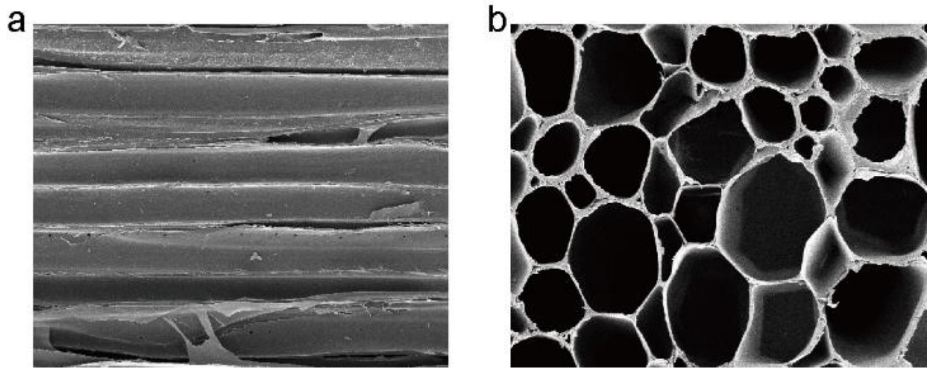

Fig. S2 SEM images of the delignified wood with channeled structure.

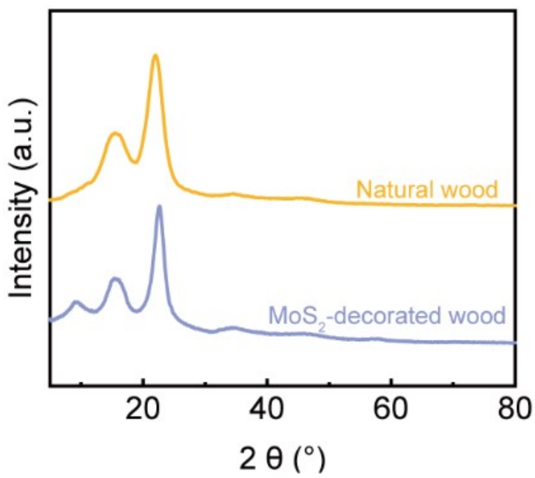

Fig. S3 XRD of natural wood and MoS_2-decorated wood. The peaks at 22 ° and 16 ° were assigned to cellulose, while the other peaks at 9 °were indexed to (002) planes of the MoS_2 nanosheets. The result confirms the in-situ growth of MoS_2 in the wood structure.

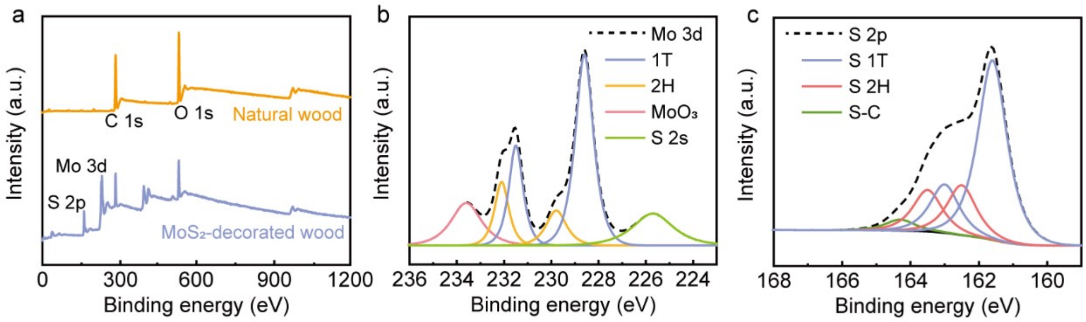

Fig. S4 (a) XPS survey spectra of natural wood and MoS_2-decorated wood, (b) high-resolution XPS of Mo 3d and (c) S 2p spectra of MoS_2-decorated wood.

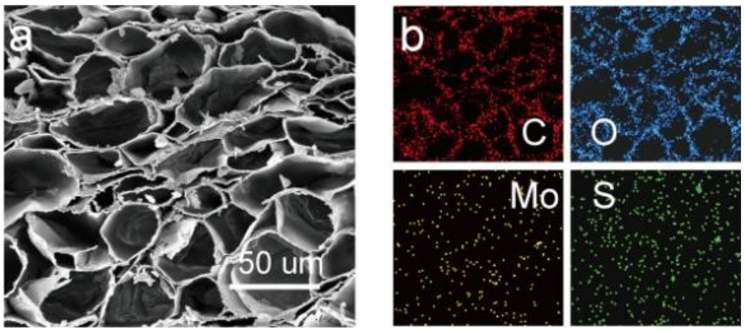

Fig. S5 Cross-section SEM image and corresponding EDX images of MoS_2-decorated wood samples.

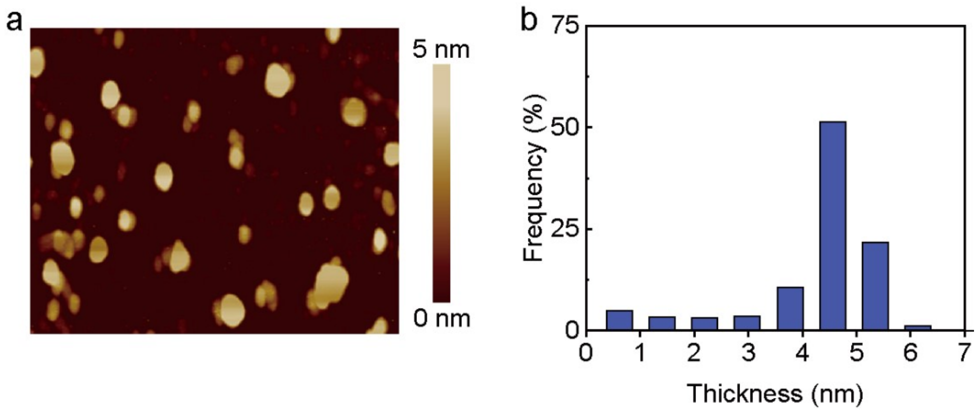

Fig. S6 AFM of MoS_2 nanosheets, showing the thickness of approximately 5 nm.

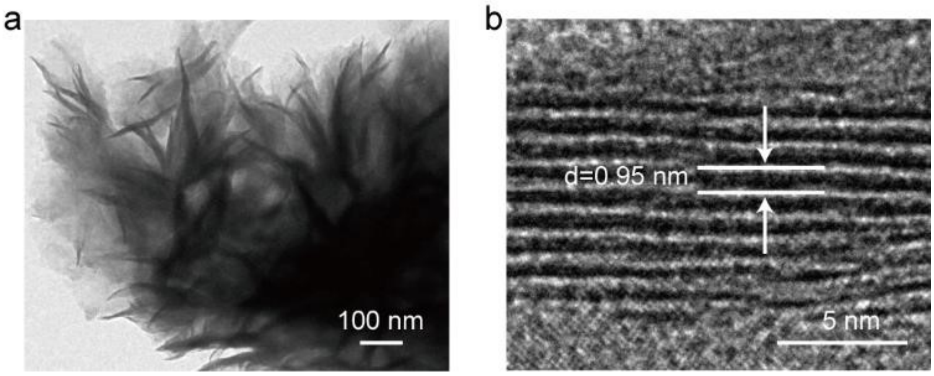

Fig. S7 TEM of the MoS_2 nanosheets.

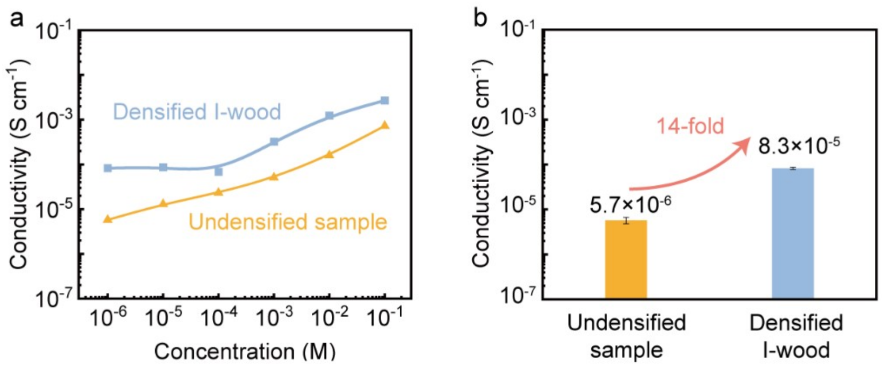

Fig. S8 Ionic conductivity of undensified sample and densified I-wood. a) Ionic conductivity tests at different KCl concentrations. b) the ionic conductance in 1×10^{-6} M KCl solution

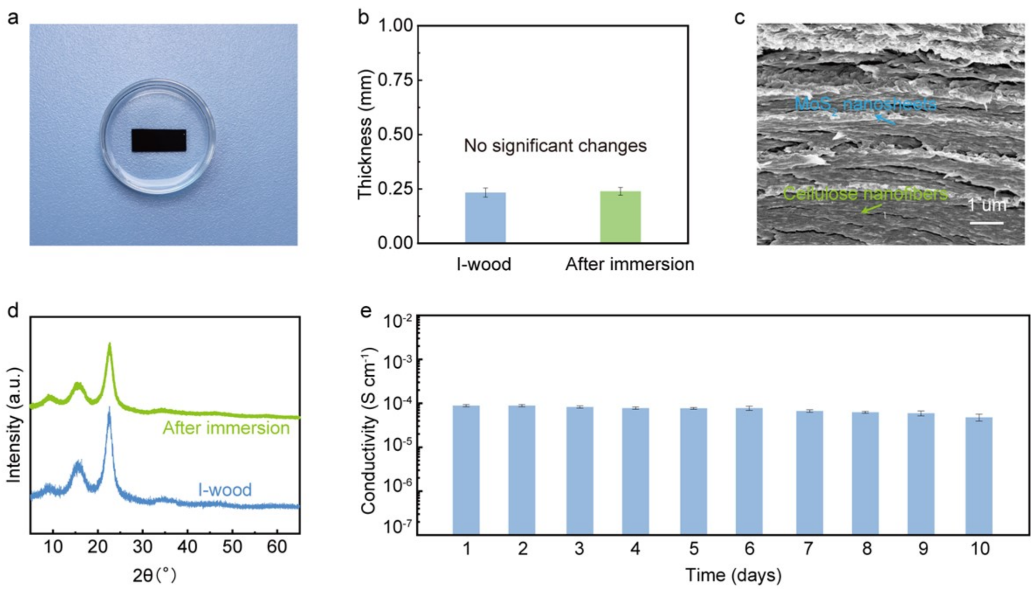

Fig. S9 Structure stability of I-wood in water. (a) photograph of I-wood soaking in water. (b) the change in thickness after immersion in water for 24 h, (c) XRD (d) and SEM images of the I-wood after immersion. (e) The ionic conductivity of the I-wood after immersion in KCl electrolyte (1×10^{-4} M) for 10 days.

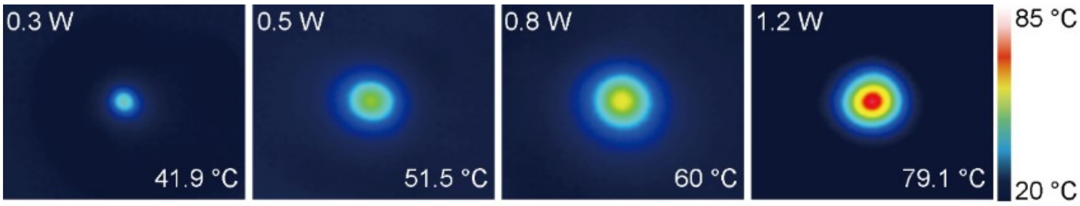

Fig. S10 Infrared images of the I-wood irradiated with NIR light at different light intensities (0.3-1.2 W cm^{-2}).

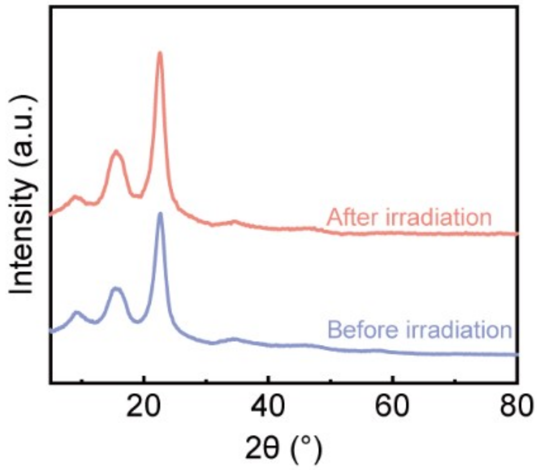

Fig. S11 XRD of the I-wood before and after the NIR light irradiation, showing no significant changes in crystal structure of I-wood after NIR light irradiation.

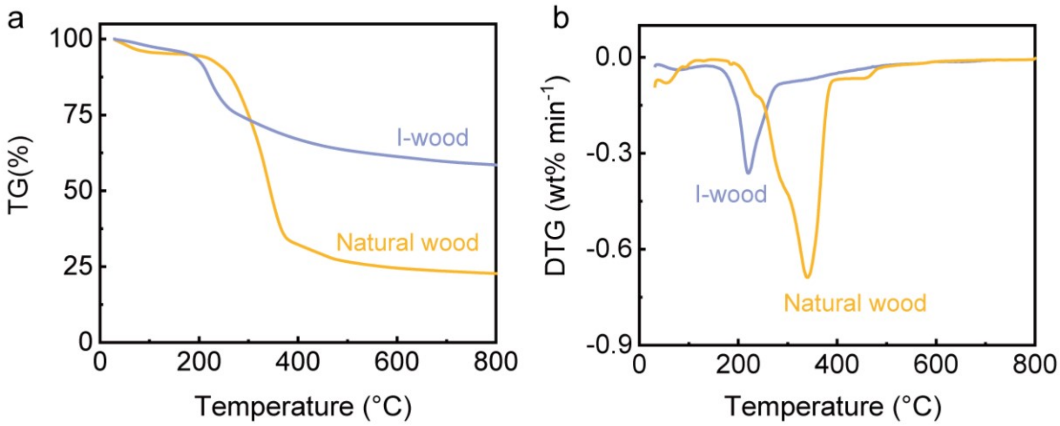

Fig. S12 TG and DTG curves of the natural wood and I-wood, showing the excellent thermostability below 220 ℃.

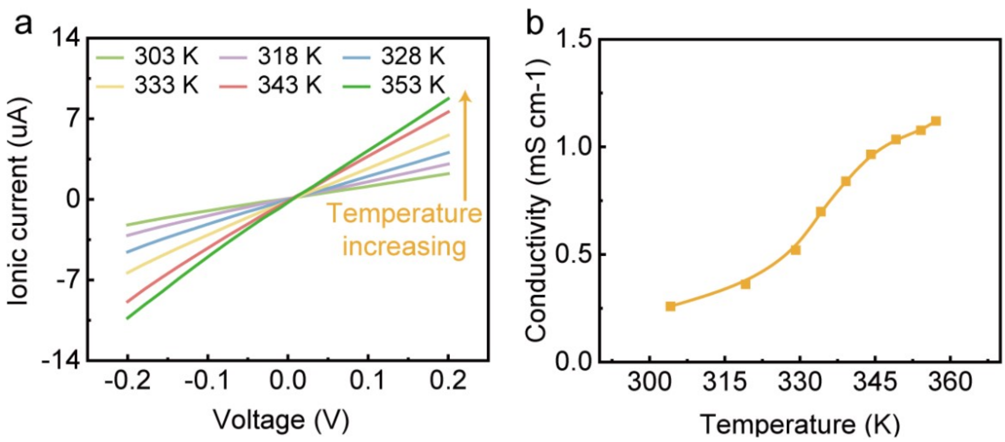

Fig. S13 a) I-V curves of the I-wood in different temperatures electrolytes. b) The ionic conductivities of the I-wood in different temperatures electrolytes.

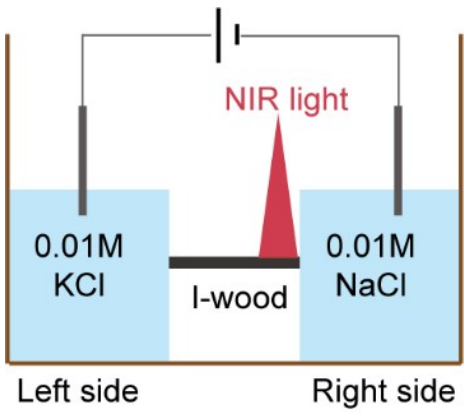

Fig. S14 Schematic diagram of the K^+ ions concentration measured by ICP before and after NIR light irradiation.

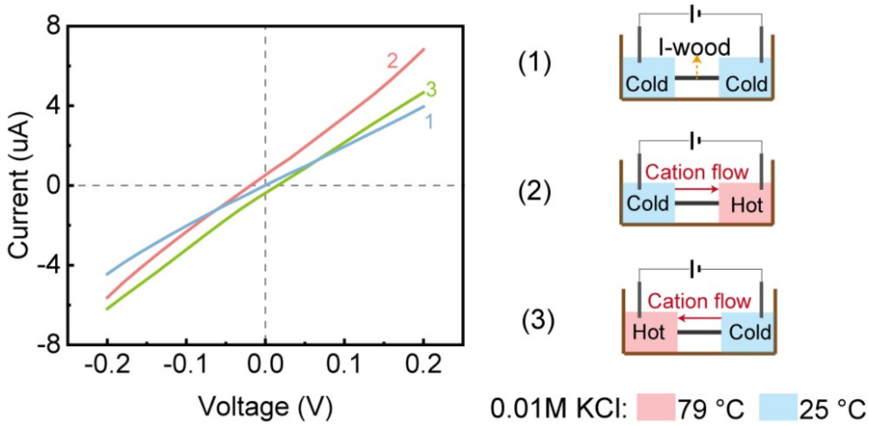

Fig. S15 I-V curves at different temperatures gradients, generating ionic currents in the opposite direction of the temperature gradient.

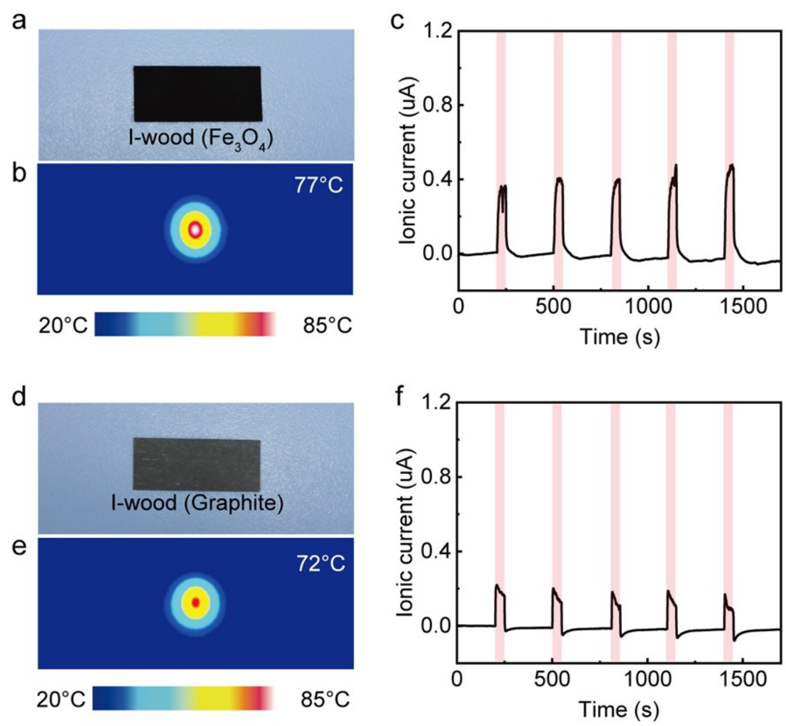

Fig. S16 Photothermal conversion performance and ionic currents of Fe_3O_4- and graphite- based I-wood.

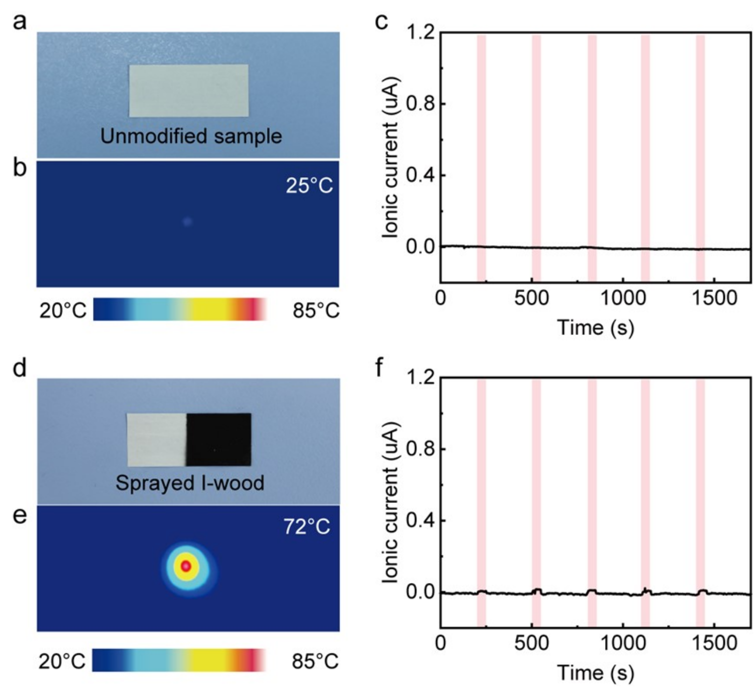

Fig. S17 Photothermal conversion performance and ionic currents of unmodified sample and sprayed I-wood.

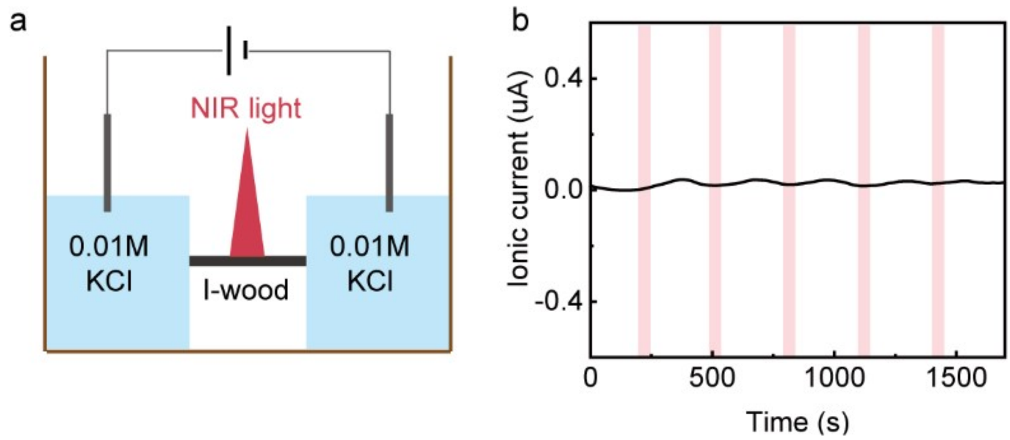

Fig. S18 Ion transport behaviors of the I-wood with its middle exposed to the NIR light, without generating a significant ionic current.

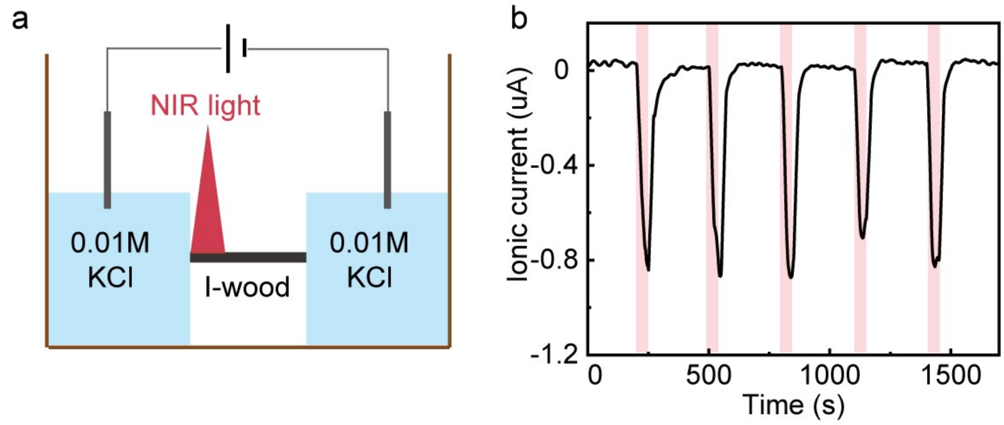

Fig. S19 Ion transport behaviors of the I-wood with its left side exposed to the NIR light.

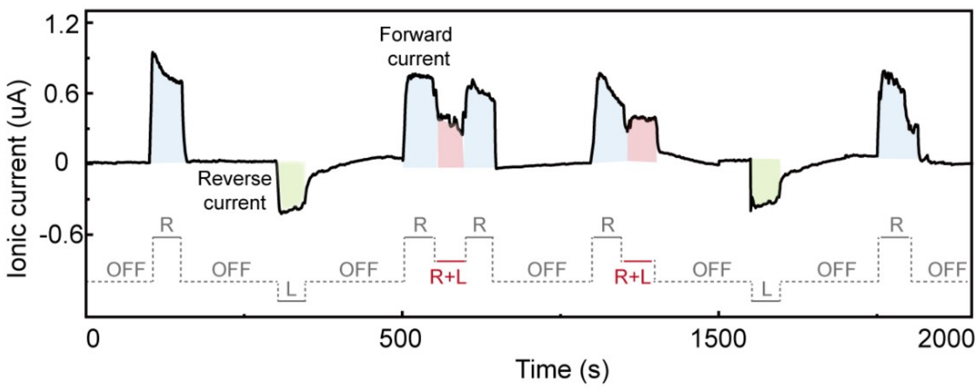

Fig. S20 Ionic currents are generated from different illuminated directions with different light intensities (R: 1.2 W cm^{-2}, L: 0.5 W cm^{-2}).

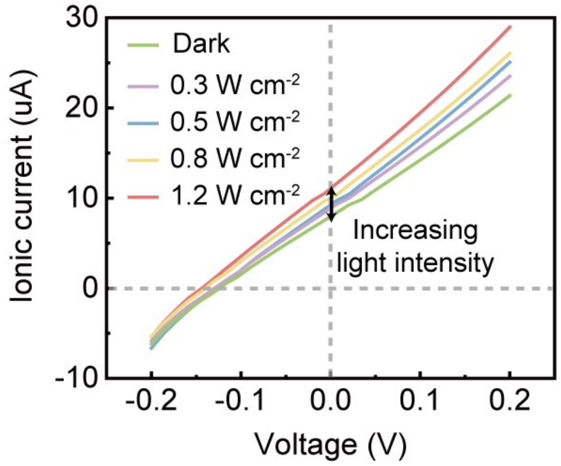

Fig. S21 The I-V curves under different light intensities (0 - 1.2 W cm^{-2}) at a 50-fold (KCl: C_{high}=0.5 M, C_{low}=0.01 M) concentration gradient, indicating the potential application of photothermal-driven ion transport for enhancing osmotic energy conversion.

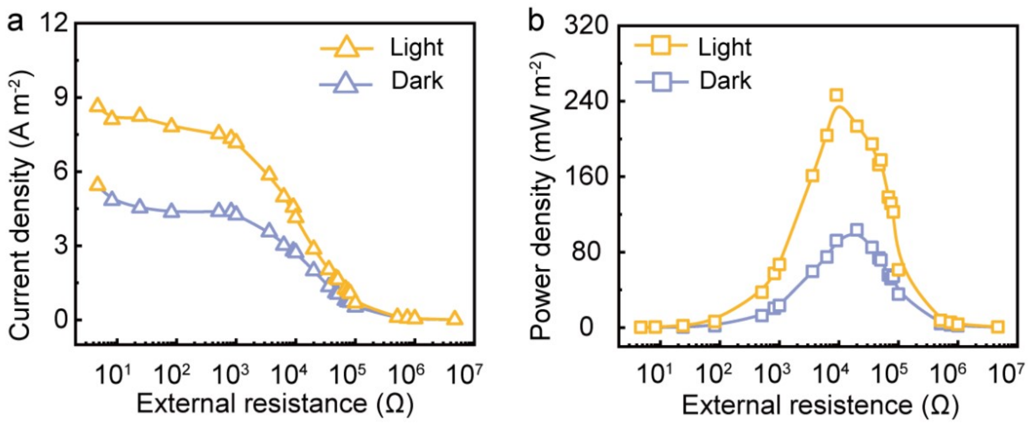

Fig. S22 The current densities a) and power densities b) under different external resistances in the dark and upon NIR light irradiation with a 50-fold concentration gradient (KCl: C_{high}=0.5 M, C_{low}=0.01 M).

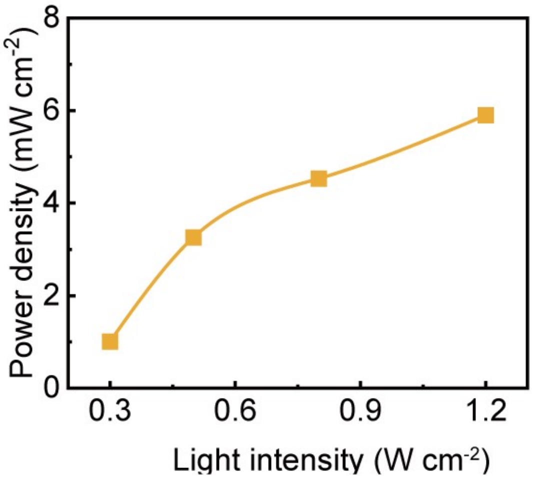

Fig. S23 Output power densities from equilibrium electrolyte solution system (KCl, 0.01 M) under different light intensities.