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Design of optical memory elements based on n-type organic field-effect transistors comprising a light-sensitive spirooxazine layer

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Experimental procedure

The photoswitchable OFETs and memory devices were fabricated on glass substrates. The glass slides were cleaned by sonication in a base piranha solution (a mixture of hydrogen peroxide and ammonia, both obtained from ChimMed, Russia), rinsed with deionized water and dried in an oven at 60^{o}C for 30 min. Aluminium gate electrodes with a thickness of 200 nm were deposited by thermal evaporation in vacuum (2 x·10^{-6} mbar) through a shadow mask. Afterwards, AlO_x was grown by anodic oxidation of aluminum gate electrodes in 0.01 mol citric acid (Acros Organics) at constant potential of 12 V. Afterwards, the samples were rinsed with deionized water and dried in a vacuum oven at 60^{o}C for 30 min. A toluene solution of the spirooxazine (obtained from Sigma-Aldrich, concentration 10 mg ml^{-1}) was spin coated at 750 rpm onto the aluminum oxide layer inside a nitrogen glove box. Then the samples were transferred to the vacuum chamber (also integrated inside glove box) and [60]fullerene was thermally deposited with a rate of 0.3–0.4 nm s^{-1} at 320^{o}C under vacuum (2 x 10^{-6} mbar) to form a 100 nm thick semiconductor layer. The devices were finalized by evaporating 100 nm thick silver source and drain electrodes through a shadow mask. The channel length (L) and width (W) were 60 and 1000 μm, respectively.

The electrical characterization of the devices was performed using double-channel Keithley 2612A instrument. A diode laser with a power of ~ 20 mW and a sharp maximum at 405 nm was modulated in a pulse regime using Advantest R6240A source-measurement unit thus providing the illumination required for programming the memory elements.

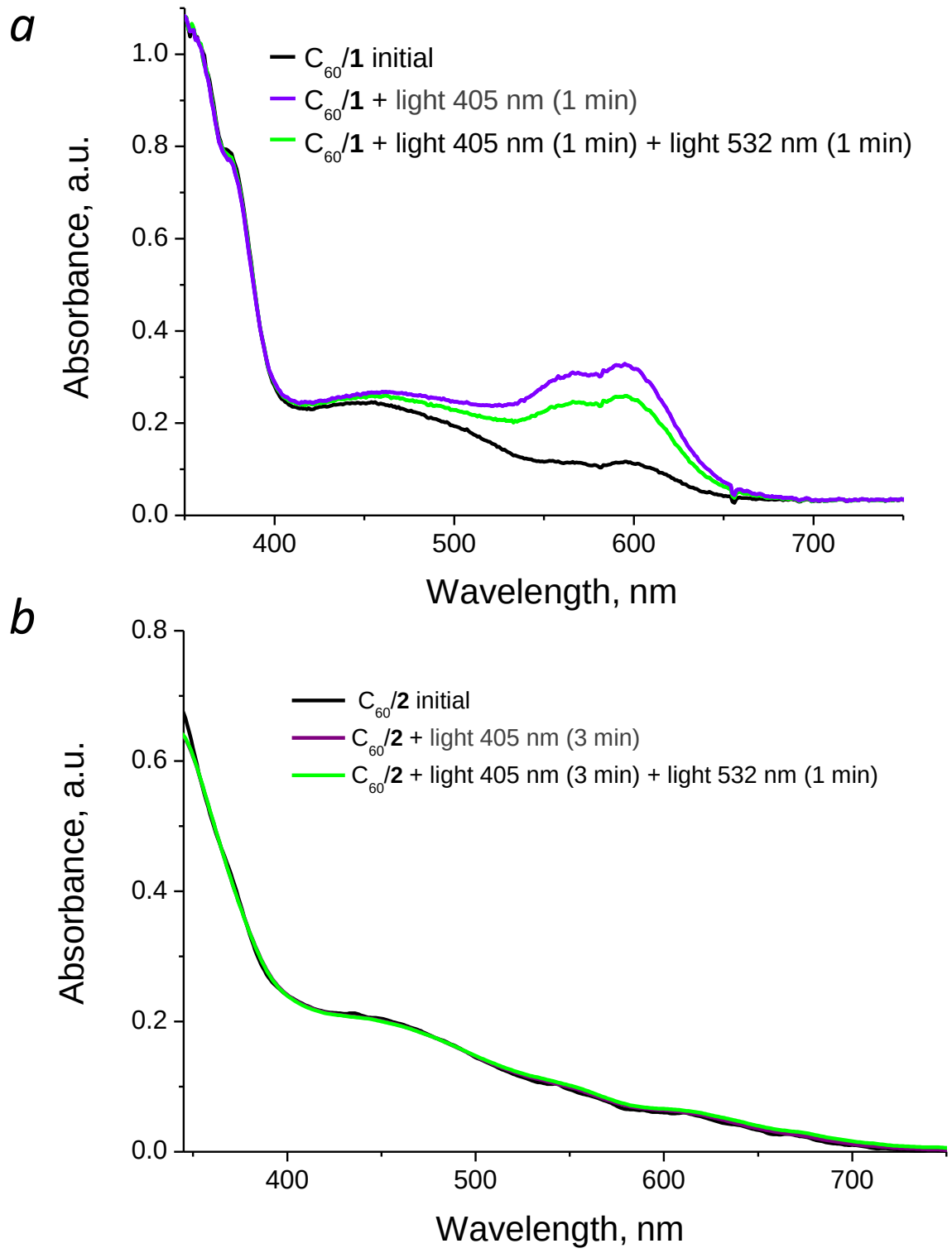

Figure S1 Absorption spectra of the C_{60}/**1** and C_{60}/**2** bilayer films in different states: pristine (initial), illuminated with violet and then with green light.

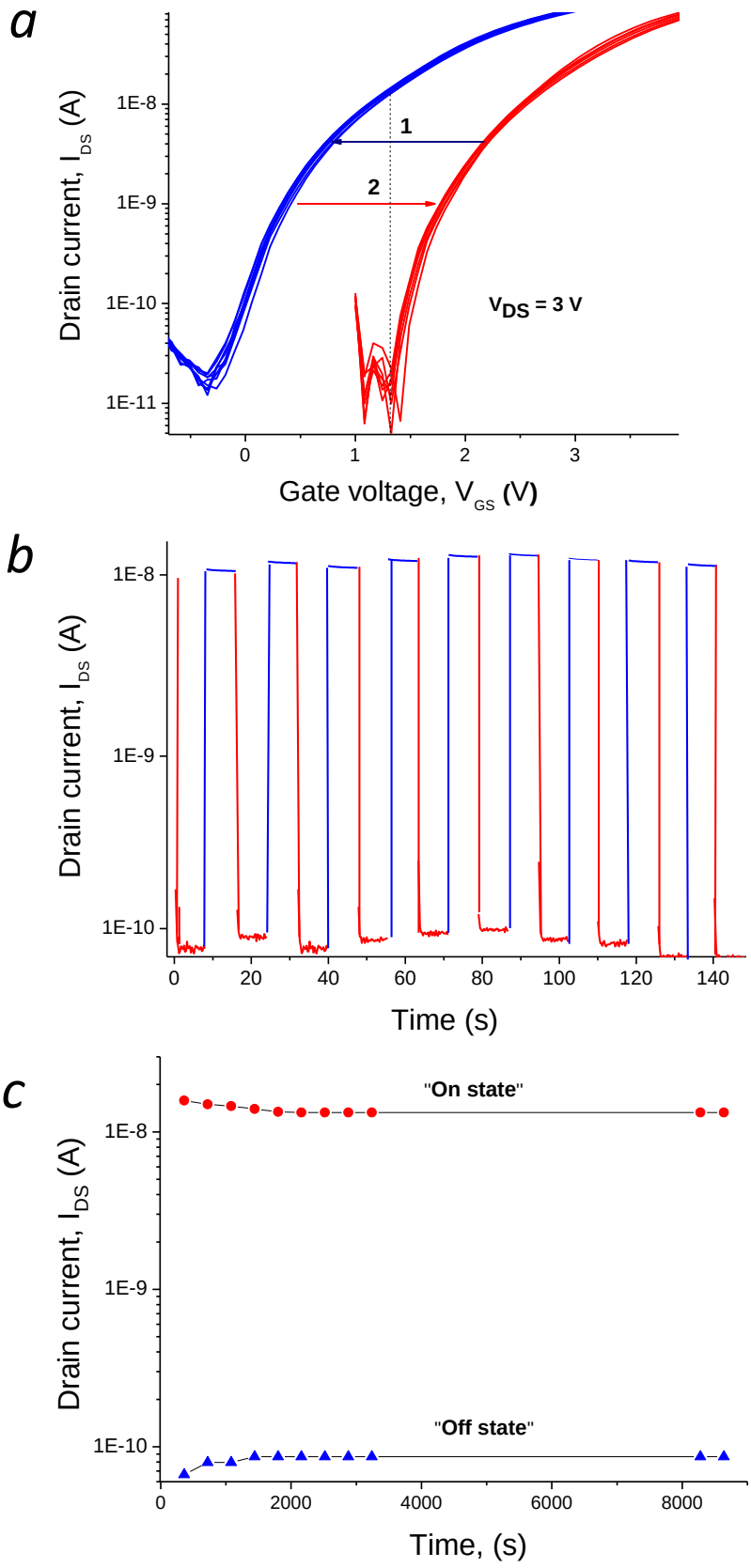

Figure S2 Transfer characteristics of the OFET switched between two arbitrary selected states using the following programming conditions: (1) V_p=-4V, light (λ=405 nm), 10 ms and (2) V_p=12 V, light (λ=405 nm), 50 ms (a); ten manually recorded write-read-erase cycles for one of the devices (b); retention characteristics of the device in "on" and "off" states (c).