

Supplementary Information

Wavelength-Selective Silencing of Photocurrent in Au-coated C₆₀ Wire Hybrid

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Experimental methods

Preparation of C₆₀ wires

C₆₀ wire was prepared by LLIP method. C₆₀ is dissolved in m-xylene to make a saturated solution. 2 mL of the C₆₀-saturated solution was placed in a 20 mL vial and afterwards 2 mL isopropyl alcohol was slowly added. The vial was kept at 4 °C for 7 days.

Fabrication and measurement of C₆₀ wire FET device

The FET device was fabricated by dropping C₆₀ wire solution prepared by the LLIP method on pre-patterned source and drain electrodes.^{10a} The pre-patterned electrodes were defined on SiO₂/Si (100 nm thick SiO₂ layer on a highly-doped p-type Si(100)) substrates by addressing Cr (5 nm)/Au (20 nm) electrodes by using a conventional photolithography process (photoresist: AZ7210). About 195 wires were bridged between source and drain electrodes with a channel length of 7.5 μm. For single C₆₀ wire devices, C₆₀ wires were first prepared on a SiO₂/Si substrate followed by addressing Cr (5 nm)/Au (20 nm) electrodes by using a conventional photolithography process (photoresist: AZ7210), resulting in 7.5 μm of electrode gap. Electrical transport properties and photocurrents were measured by using a semiconductor analyzer (KEITHLEY 4200). A quartz halogen lamp (Fiber-Lite Model 190,

30 W, Dolan-Jenner) and a hand-held UV lamp of 254 nm (SPECTROLINE model ENF-240C/FE, 4 W, Spectronics corporation) were used as illumination sources for photocurrent measurements. Photocurrent at single wavelength was measured by using 532 nm (Jinsung laser, DPGL 3020F, 50 mW) and 660 nm (Sanghai Dream Lasers Technology, SDL-660-LM-1000T, 700 mW) lasers.

Measurement of UV/Vis spectrum of Au-C₆₀ hybrid

For measuring UV/Vis spectrum of Au-C₆₀ hybrid, C₆₀ thin film was prepared on quartz substrate by a vacuum evaporation at 650 °C in 1.5×10^{-6} torr for 30 min. The sample stage containing the quartz substrate was cooled by water circulation during the evaporation. The C₆₀ thin film was then immediately immersed in 10 mM HAuCl₄ solution (ethanol : DI water = 1 : 1 in volume %), rinsed with DI water and dried with N₂ gas. UV/Vis spectra were measured by using an Agilent 8453 diode array spectrophotometer.

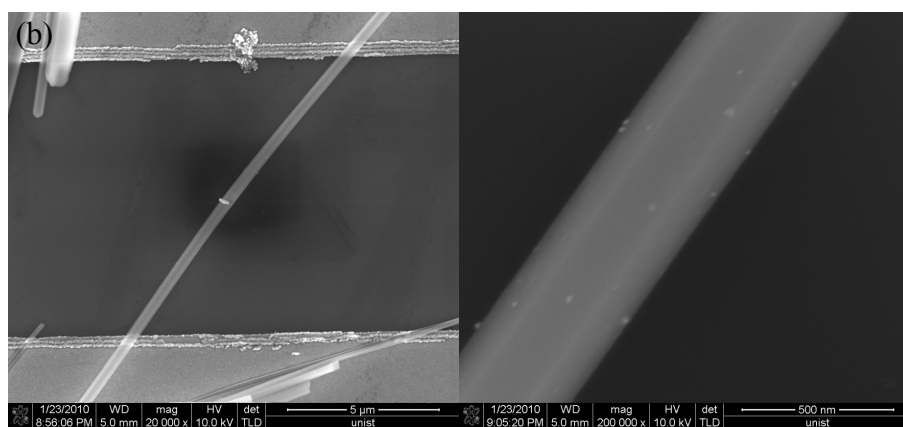
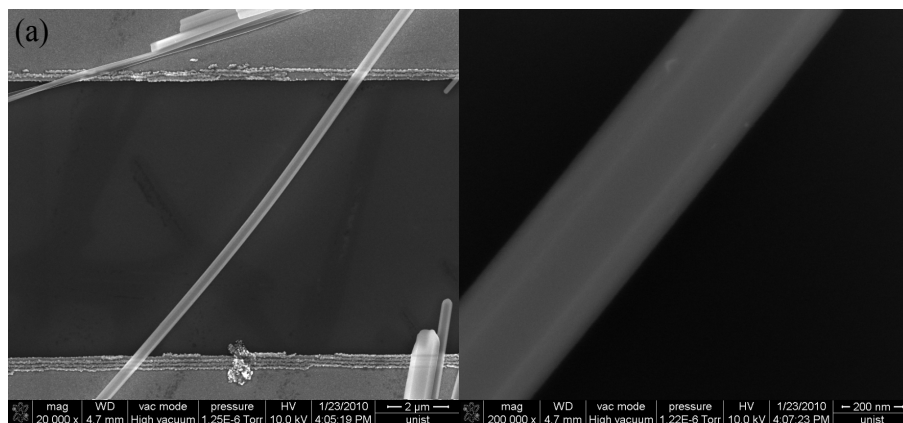


Fig. S1. (a) SEM images of C₆₀ wire in a FET device before immersion into HAuCl₄ solution and (b) SEM images and EDX spectrum of C₆₀ wire in a FET device after immersion into HAuCl₄ solution.

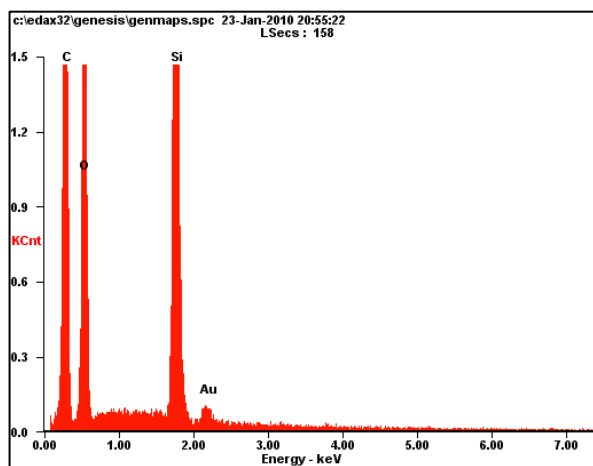
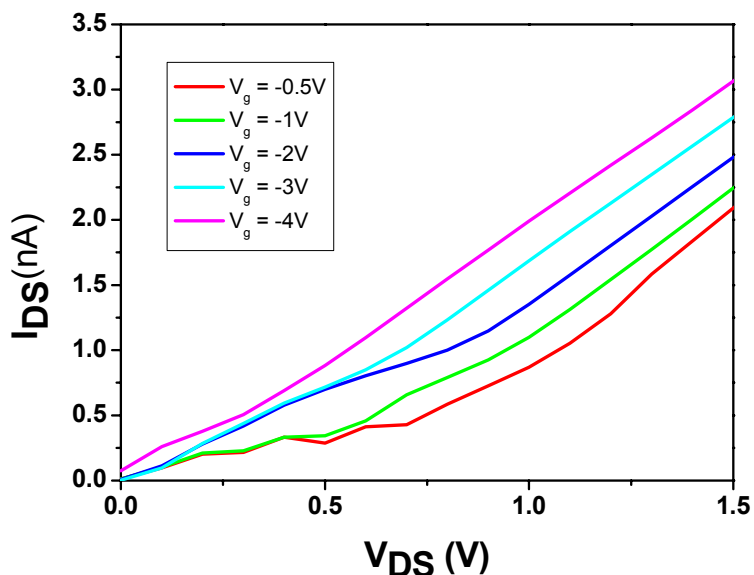
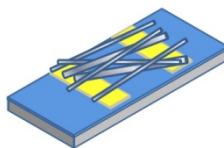


Fig. S2. $I-V_d$ curves at various back gate voltages in the multiple C₆₀ wires FET device immersed in HAuCl₄ solution for 75 min. The inset shows the schematic diagram of the FET device.



The multiple C₆₀ wires FET device was fabricated by dropping C₆₀ wire solution prepared by the LLIP method on pre-patterned source and drain electrodes.^{10a} About 195 wires were

bridged between source and drain electrodes with a channel length of $7.5\mu\text{m}$. The schematic diagram of the multiple C_{60} wires FET device is shown in an inset of Fig. S1. After the device is immersed in HAuCl_4 solution in dark, it shows p-type semiconducting behavior which is confirmed by $I\text{-}V_{\text{d}}$ curves at various back gate voltages in Fig. S1. Note that all measurements in Fig. S1 were performed at ambient condition. From the $I\text{-}V_{\text{d}}$ curves in Fig S1, a mobility of hole carriers seems to be low. Such low mobility may be due to high contact resistance by dropping C_{60} wire solution on pre-patterned devices and low crystallinity of C_{60} wires. As a control experiment, C_{60} wire FET showed no gate effect when it was immersed into solution of DI water and ethanol (1:1) without HAuCl_4 .

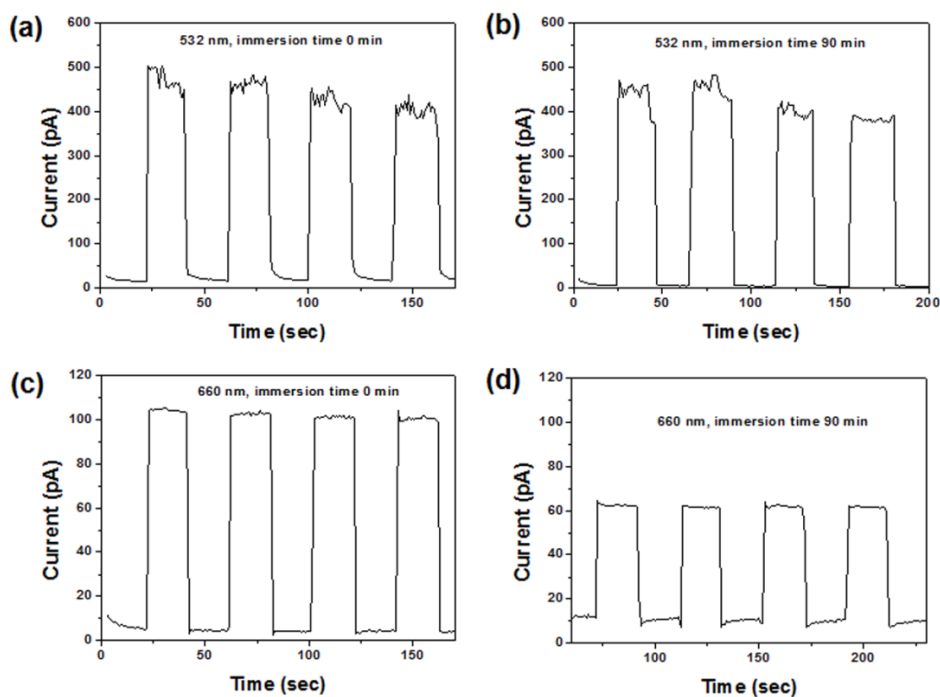


Fig. S3. Photocurrents of a single C_{60} wire device immersed in Au (diameter of 5 nm) colloid solution for 0 and 90 min upon illumination of 532 nm (a and b) and 660 nm (c and d) laser under source-drain bias of 20 V and zero-gate voltage.

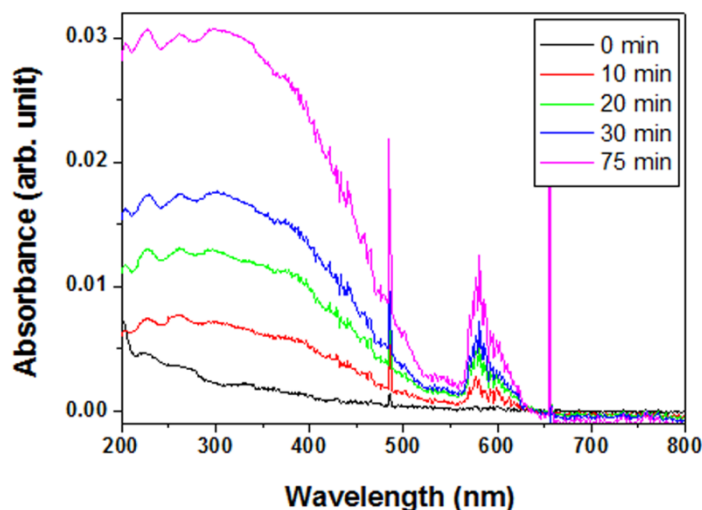


Fig. S4. UV/VIS absorption spectra of C_{60} thin film on a quartz substrate at different immersion time into $H AuCl_4$ solution: 0, 10, 20, 30, and 75 min.

