Supporting Information

Photoluminenscence Recovery from Single-Walled Carbon Nanotubes on Substrates

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Part 1: Preparation of self-assembly monolayers[1].

N-octadecyltrimethoxysilane (Aldrich Chemical Company Inc.), hexyltrimethoxy-silane (Tokyo Kasei Kogyo Co. Ltd) and ethyltriethoxysilane (Acros organics) were used as silanes to prepare C_{18}, C_6 and C_2 SAMs. Si substrates with 300 nm thermal oxides were cleaned in piranha solution and followed by ultrapure water washing and drying in N_2 blow. About 100 μL of silane was hydrolyzed for 1 hour in 10 mL of tetrahydrofuran containing 50 μL of 1.38 mol/L HCl. Then 1.0 mL of that solution was diluted with 20 mL of cyclohexane, and clean SiO_2/Si substrates were immersed in this solution for 0.5 hour to form SAMs. Figure S1 presents typical AFM images of SAMs.

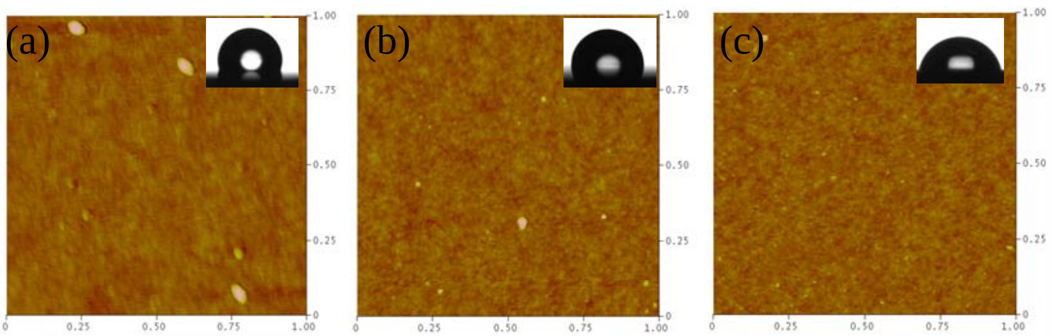

Figure S1. Typical AFM images of C_{18} (a), C_6 (b) and C_2 (c) SAMs on SiO_2/Si. All images are with size of 1×1 μm^2. The insets show water wetting property of corresponding SAMs.

Part 2: Preparation of parallel SWNT arrays on $(11\bar{2}0)$ plane of sapphire[2].

Dispersion of Fe_2O_3 nanoparticles was spin-coated on annealed miscut C-plane of sapphire and calcined at 900 °C for 0.5 hour. And then the substrate was put in quartz tube with diameter of 10 cm. A mixture of 2200 sccm Ar and 400 sccm H_2 was loaded in as a carrier gas. After that, the quartz tube was heated to 850 °C and an ethanol bubbler was introduced as a carbon source for 5-10 min and then the quartz tube was cooled down. Figure S2 shows typical SEM images of SWNTs grown on sapphire.

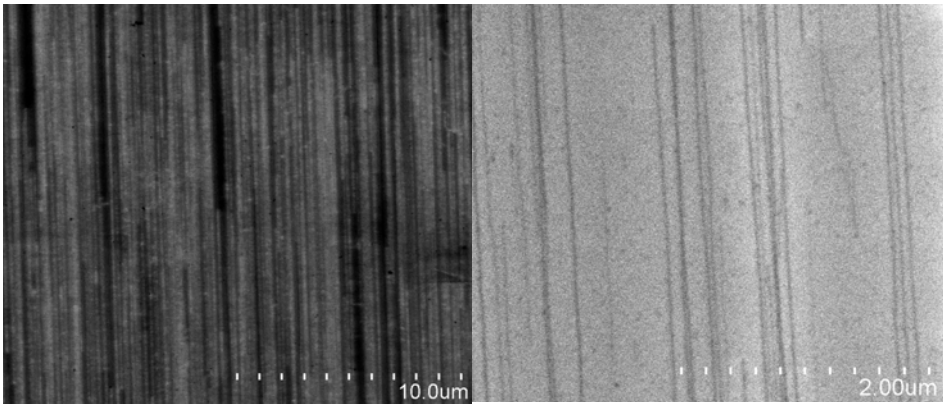

Figure S2. Typical SEM images of parallel SWNT arrays on sapphire.

Part 3: Energy level diagram of SWNTs, defects in SiO_2 and surface states of Al_2O_3.

Reference for energy alignment is to the vacuum levels of SWNTs and SiO_2. This model is based on no interface dipole between the two materials. This may be reasonable in our system because SWNTs and SiO_2 were separated by SAMs. To obtain energy level diagram in Figure S3, we use following parameters. (1) The Fermi level of SWNTs is at the middle of bandgap. Work function of SWNTs is 4.73 eV[3]. (2) The bandgap of SWNT is 0.9 eV. (3) Electron affinity of SiO_2 is 1.1 eV[4]. (4) The bandgap of SiO_2 is 8.8 eV[5]. (5) Energy levels of defects in SiO_2 are from Reference[5, 6]. Finally, we find out four defects with unoccupied energy level below the conducting band of SWNT. To get energy level alignment for SWNTs and Al_2O_3, we use following parameters. (1) Surface state of Al_2O_3 is 3 eV above valence band. And bandgap of Al_2O_3 is 8.5 eV[7]. (2) Electron affinity of Al2O3 is 0.1 eV[8].

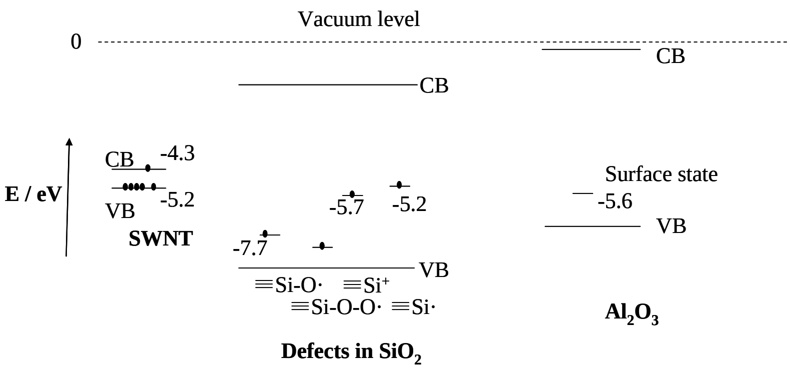

Figure S3. Energy level diagram of SWNTs, several defects in SiO_2 and surface state of Al_2O_3.

Part 4: Examination of laser-induced heating on SWNTs lying on SAM/SiO_2/Si.

From our previous results[9], laser-induced heating effect on SWNTs can be observed by Raman shift of SWNTs at different laser power. Raman spectra from SWNTs on C_{18} SAM functionized SiO_2 were recorded to examine heating effect at different laser power (Figure S4). We found that both of radial breathing mode (RBM) and G mode were unchanged from laser power at 1% to 100%. This shows that no laser-induced heating on SWNTs/SAM/SiO_2. (Note: The temperature coefficients for both RBM and G frequency are about -10^{-2} $cm^{-1}/°C$[10].)

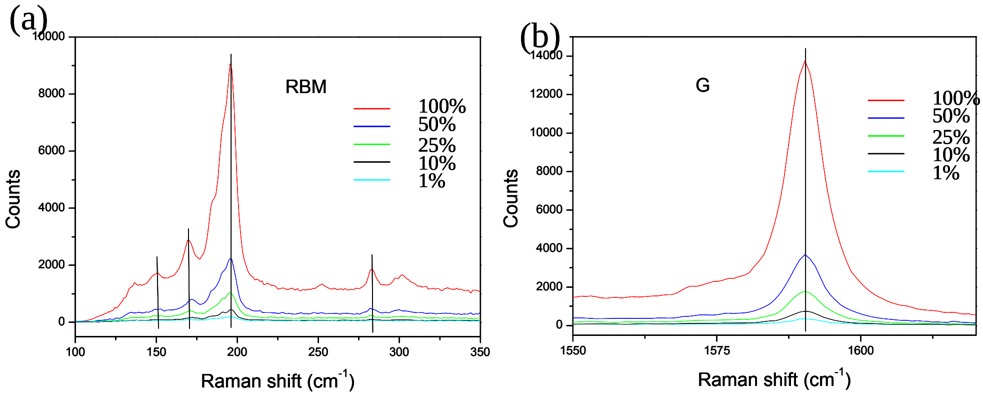

Figure S4. Raman spectra from SWNTs transferred on C_{18}/SiO_2/Si. Lines in different color represent spectra recorded at different power level of incident laser.

Part 5: Complete Ref. 15.

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