

# **Top-Contact Self-Aligned Printing for High-Performance Carbon Nanotube Thin Film Transistors with Sub-Micron Channel Length**

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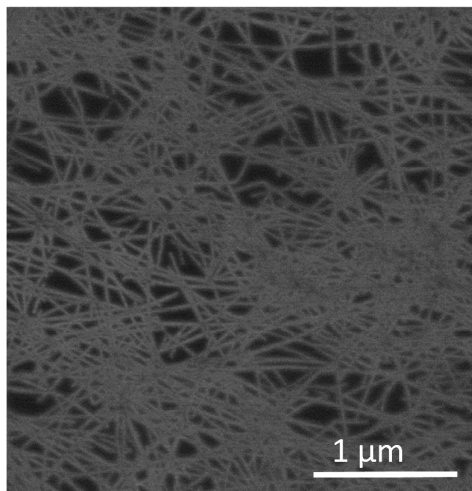


Figure S1. SEM image of the highly uniform printed carbon nanotube network.

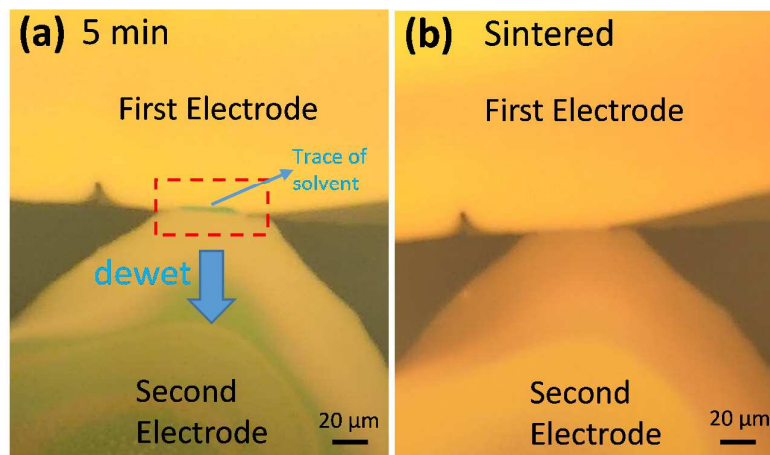


Figure S2. (a) Optical microscope image showing the dewetting of the second electrode from the first electrode surface about 5 minutes after printing. The color contrast on the first electrode may come from solvent residue after the dewetting of the second electrode. (b) Optical microscope image showing the trace of solvent was removed after sintering due to solvent evaporation.

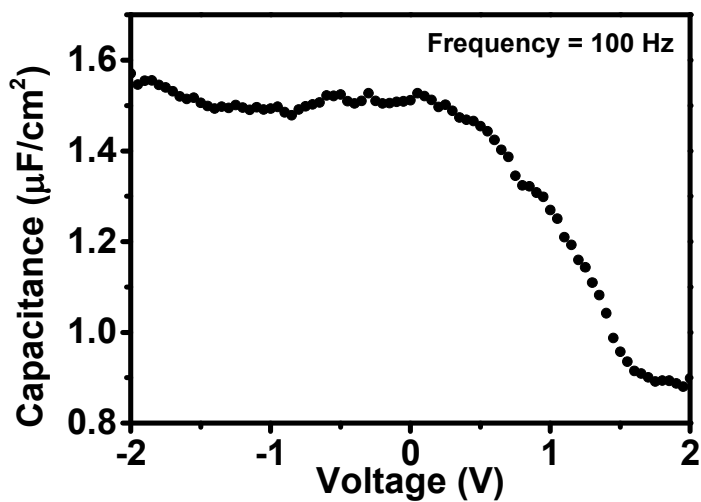


Figure S3. Capacitance-voltage characteristic for the printed ultrashort channel CNT TFT, measured at a frequency of 100 Hz.

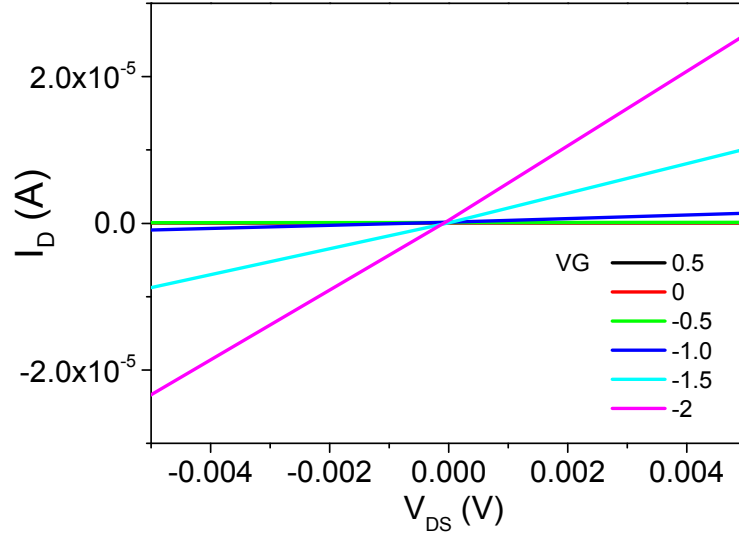


Figure S4. Output characteristic of the top-contact self-aligned printed ultrashort channel CNT TFT in linear region.

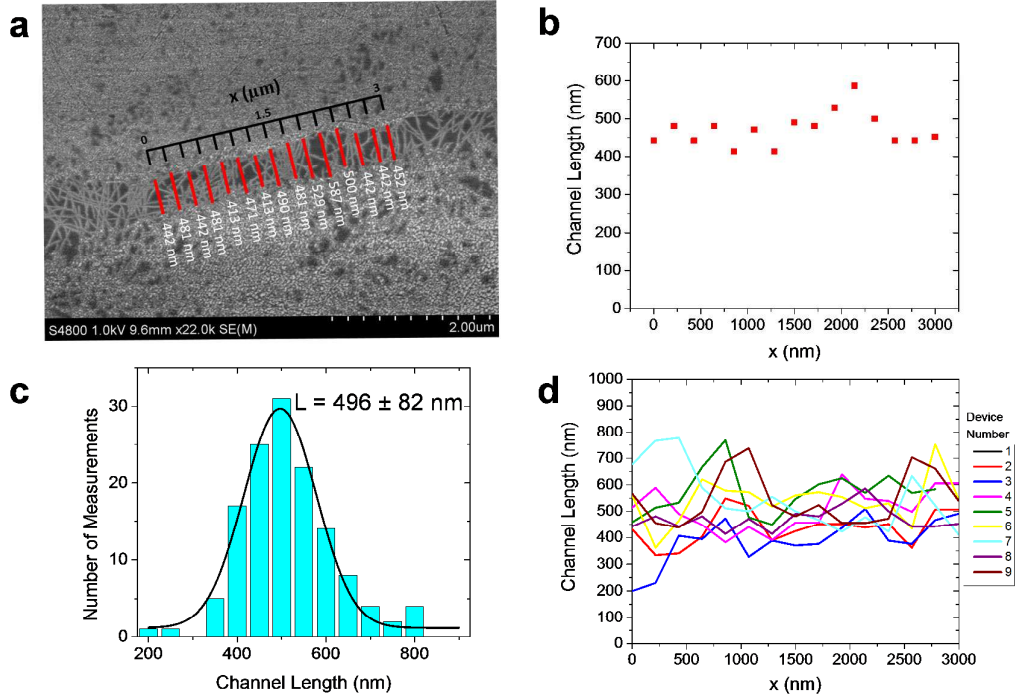


Figure S5. Statistical data of channel length measurements on printed ultrashort channel devices. (a) SEM image of printed ultrashort channel with 15 evenly spaced channel length measurements along the channel's  $x$  axis. (b) Plot of channel length measurements from (a). (c) Combined histogram of channel length measurements

from 9 printed ultrashort channel devices. (d) Combined plot of channel length measurements from 9 printed ultrashort channel devices.

We have carried out statistical characterization of channel length variation within a single device and among a distribution of devices as shown in Figure S5. Figure S5a shows an SEM image of an as-printed ultra-short channel. 15 locations along the channel (x direction) with 200 nm spacing were measured for each device. The result for a representative device is plotted in Figure S5b with location as the X axis and measured channel length as the Y axis. The overall statistical data of channel length measured from 9 devices with 135 locations are shown in Figure S5c, indicating a normal distribution with average channel length of 496 nm and standard deviation of 82 nm. The profile of channel length versus location (x) measured from 9 devices is plotted in Figure S5d, showing the device-to-device variation in channel length.

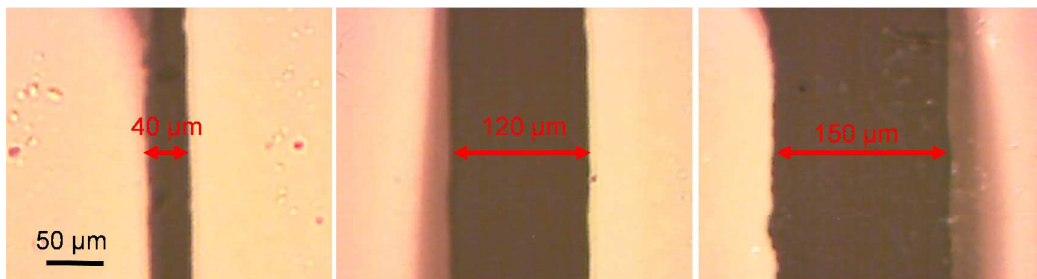


Figure S6. Optical images showing the printed CNT TFTs with different channel lengths, 40  $\mu\text{m}$ , 120  $\mu\text{m}$  and 150  $\mu\text{m}$ .