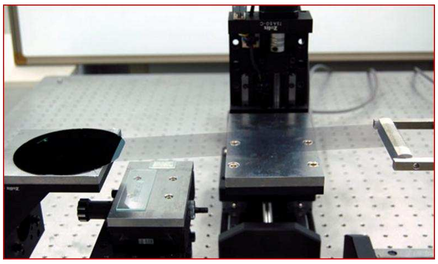
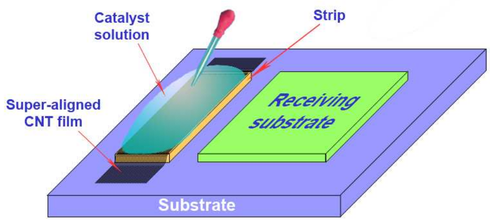
SUPPORTING INFORMATION PARAGRAPH (Word Style “TE_Supporting_Information”).

1．The method of transferring catalyst nanoparticles to the super-aligned CNTs film covered strip



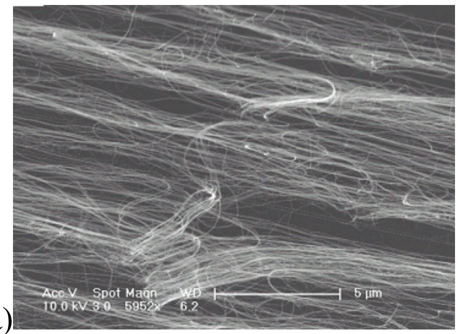


(a) (b)

Figure s1. (a) A single layer of super-aligned CNT film was drawing from a CNT array. (b) The catalyst solution was dropped onto a strip of silicon substrate which was covered by super-aligned CNTs film. Another substrate was used to receiving ultra-long CNTs.

2. SEM images of super-aligned CNT film supporting catalyst nanoparticles

We used super-aligned CNT film as a supporting frame and transferred the monodispersed nanoparticles onto it. We can see that the catalyst nanoparticles are limited to the frame. The CNT bundles provide a step that promotes the growth of ultra-long CNTs.

a) 

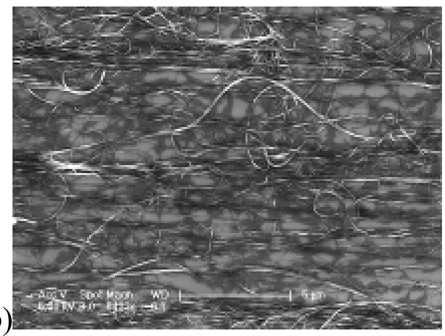
b) 

Figure s2. One layer of super-aligned CNT film before (a) and after (b) transferring catalyst nanoparticles

3. SEM and AFM characterization of CNTs grown on clean substrates

SEM imaging was performed using a FEI Sirion 200 at the operating voltage of 1 kV. AFM images were obtained using a Veeco NanoManV system. No evidence of catalyst-related residual material on the substrates is observed in these images.

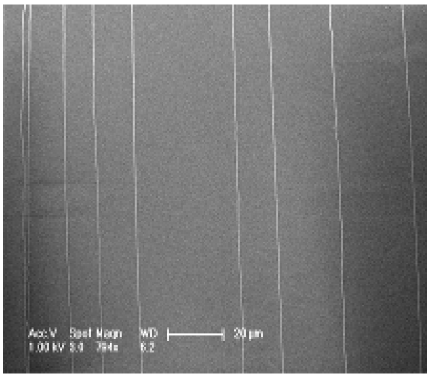
a)  b) 

Figure s3. CNTs grown on clean substrate. a). Aligned ultra-long CNTs, the SEM image showed that the substrate was free of catalysts. b). The AFM image of an ultra-long CNT, the image area is 300nm×300nm.

4. The Raman RBM peak distribution of a 10 cm long SWCNT

Raman spectra was taken using Labram Aramis Raman Spectroscope at the laser length 532nm. Many points were collected along one of the 10 cm long semiconducting SWNT. The RBM peak was consistent over the whole tube.

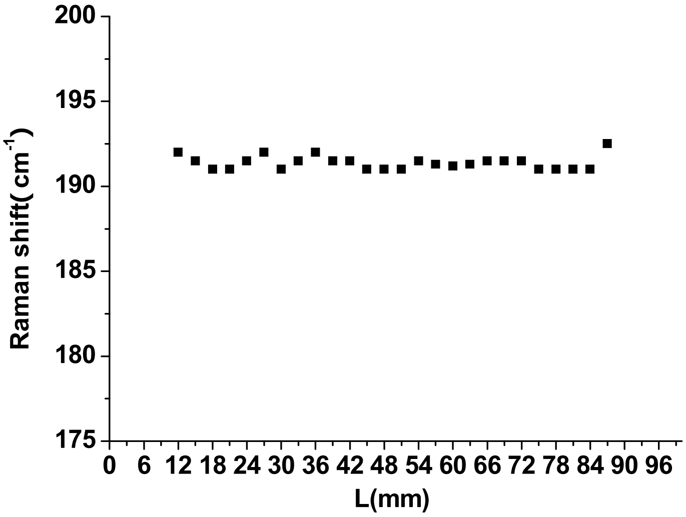


Figure s4. The Raman RBM peaks at many points along a 10 cm long SWNT. The RBM peaks were around 191±1 cm^{-1}.

5. Ultra-long CNTs crossing between neighboring receiving substrates

In our growth process, different substrates were used as catalyst support and to receive ultra-long CNTs. Two 10 cm long Si strips were used as receiving substrates. We find that ultra-long CNTs remain on their respective substrates when the neighboring substrates are separated. CNTs break and the ends recoil back to the edge of their respective substrates. The CNT at the vicinity of the break point curls up at the substrate edge.

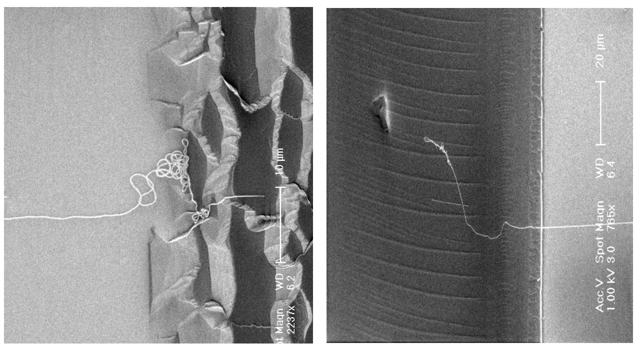


Figure s5. One ultra-long CNT crossed the slit between the neighboring receiving substrates. When we separated the two substrates, the CNT broke and bounced back to the edge separately.

6. Changes in electrical characteristics of a single SWNT grown in an inhomogeneous temperature zone

SWNTs were grown across an inhomogeneous temperature zone. To characterize them we fabricated FET arrays on one SWNT using e-beam lithography. The growth conditions were identical to those of the SWNT shown in Figure 3 except that the growth temperature was not homogeneous along the growth direction. We used a 40 cm long furnace with a 5 cm flat zone to do the experiments. In this furnace, the temperature of the flat zone was higher than that of the two end zones and the samples were intentionally placed at the edge of the flat zone to produce an inhomogeneous growth temperature across the sample. More than ten SWNTs grown under these conditions were studied in detail. The electrical characteristics were not uniform. A sample was shown in Figure s4, different sections of the SWNT have different properties. For example, the conductivity changes between metallic (M) to semiconducting (S).

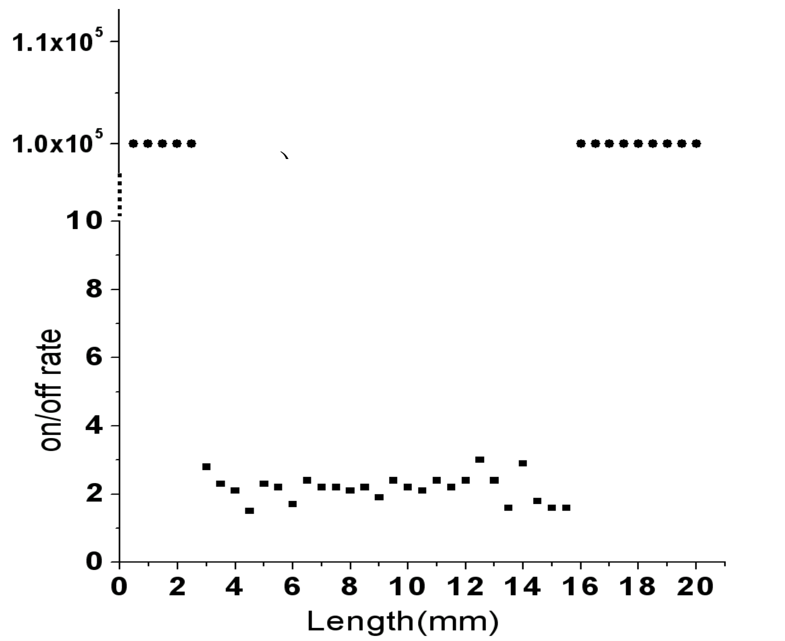


Figure s6. On/off ratio for the devices fabricated along one 20mm long SWNT. The electrical property changed from S to M at the position 2.5mm and from M to S at the position 15.5mm.