Supporting Information for

High density oxidative plasma unzipping of multiwall carbon nanotubes

Experimental

CNTs were synthesized in a home built pyrolysis setup, which consists of a single stage tubular furnace similar to regular CVD system. A suitable mixture of ferrocene (catalyst) and xylene (precursor) was taken in a long quartz tube whose one end is closed and the other open end is connected to a rubber bladder. The closed end of the quartz tube containing the catalyst and the precursor mixture is placed in a tubular furnace. The setup was heated up to 750^{o}C for 1.5 hours at a heating rate 20^{o}C per minute and then allowed to cool down to room temperature. All the chemicals were bought with 99.9 % purity (ferrocene (*Spectrochem chemicals*), xylene, HCl, HNO_3, H_2SO_4 (*SD fine chemicals*)) and were used without any further purification. All the aqueous solutions were prepared with deionized water (Millipore), whose resistance is ~ 18 MΩ.

The first step of purification of CNTs include air oxidation, to remove amorphous carbon (400^{o}C for 2 hours). Then the CNTs were treated with concentrated HCl to eliminate iron particles. The acid treated CNTs were washed several times with deionized water with the help of centrifuge and the resultant products were kept in an oven and dried overnight at 100^{o}C.

For thin films preparation, the purified CNTs were dispersed in pure ethanol and the mixture was sonicated for 30 minutes. The dispersed CNTs were spin coated on clean glass substrates (1 x 1 cm^2) and dried overnight at 120^{o}C in an oven. The average thickness of the film was about 30 μm.

The electron cyclotron resonance (ECR) system consists of a plasma source, mounted on to a stainless steel growth chamber. The beam diameter at the exit of the source is 100 mm. A flexible substrate holder allows free positioning of substrate along the axis of the source chamber. High density plasma source (ion density ~ 10^{11}- 10^{13} cm^{-3}) was generated by microwave (frequency = 916- 3500 MHz) in the presence of a static magnetic field. The magnetic field required for resonance is given by the relation B = mώ/q, where ώ is the frequency of the microwave, m and q are the mass and charge of electron. The necessary magnetic field needed for the resonance condition is 875 Gauss in our system.

The CNT thin films were kept at 10 cm away from the exit of plasma source. Before plasma exposure, the initial a base pressure of 3×10^{-5} mbar was obtained using the combination of rotary and turbo molecular pump. Then the carrier gases along with working gas (oxygen, nitrogen or hydrogen) were allowed in to the plasma system at a working pressure of 4×10^{-4} mbar. A constant power of 500/400 W microwaves was introduced into the chamber to get the required plasma density.

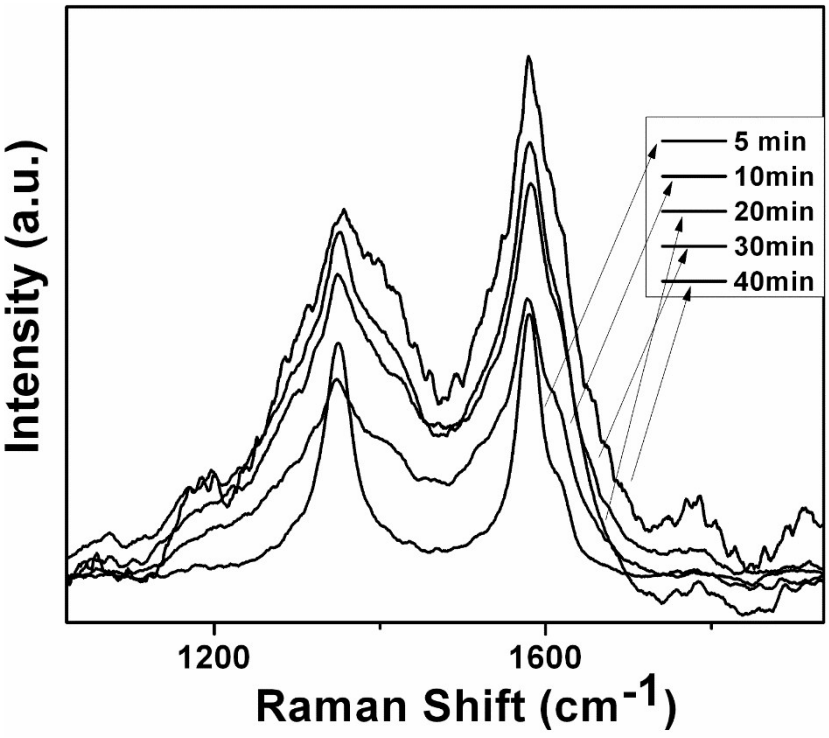

Figure S1: Raman spectra of oxygen plasma exposed CNTs at various exposure time