SYMPOSIUM ON VISIONS AND STRATEGIES FOR FAR FUTURES (D4)
Space Elevators and Tethers (4)

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LIGHT AND STRONG CNT FIBER SPUN WITH CNT WEB

Abstract

We invented a simple one-step growth method of ultra-long vertically aligned multi-walled CNT arrays. Our method requires no pre-process for catalyst thin film (pre-deposition), and only requires iron chloride powder and acetylene gas. The MWNT array can easily be drawn into a web. The endless drawn web is easily fabricated into the nanotube fiber, tape and sheet. The MWNT array was synthesized using a thermal chemical vapor deposition system. Densely grown MWNTs are vertically aligned on a quartz substrate. The height of MWNT array reached 2.4 mm in 20 min with the high growth rate over 0.1mm/min. Drawability (spinnability) of our MWNT arrays is very high as 2 mm-long array is drawable. The CNT web is endlessly drawn by pulling out the edge of the array with no twisting. Length limit of the web is just governed by the amount of CNTs on the substrate. During drawing, nanotubes are drawn with taking neighbors one after another with the aid of van der Waals force. Tiny nanotubes are highly aligned in the drawing direction. Therefore large scale anisotropic CNT products are easily fabricated. The CNT fiber size is ranging from 1 to 550 tex (g/km), and the CNT sheet is as wide as A4 scale. These products are using no chemical binder. The achieved fiber strength is 340 MPa and electrical resistivity is 0.0008 Ω•cm. Array samples are consistently drawable for each trial. Low cost, easy to scale up and highly drawable MWNT arrays promise advanced CNT products.