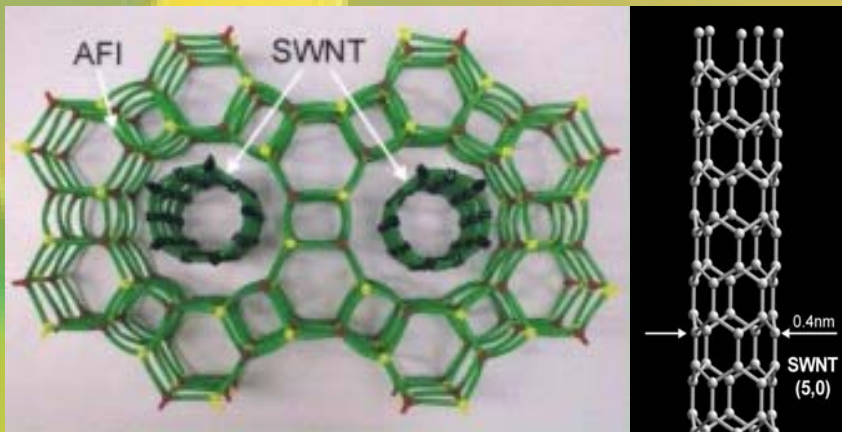


Efficient Visible Photoluminescence from Carbon Nanotubes in Zeolite Templates

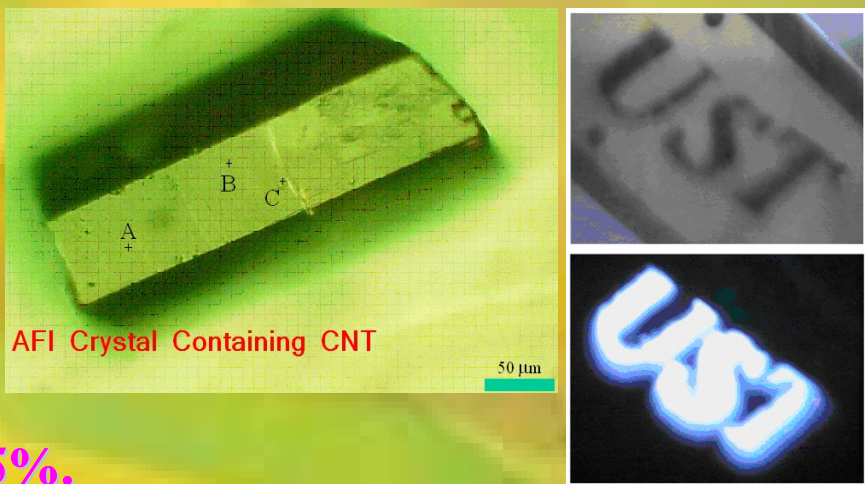
Jiandong Guo, Chunlei Yang, Z. M. Li, Ming Bai, H. J. Liu, G.D. Li, E. G. Wang, C. T. Chan, Z. K. Tang, W. K. Ge, and Xudong Xiao

Physical Review Letters, Volume 93, Number 1. 2 July 2004

Single-walled carbon nanotubes (SWNT) exhibit many interesting mechanical and electrical properties due to their unique one-dimensional structure and are regarded as a very important material for nanoscale device applications.



The 0.4nm SWNTs are fabricated by pyrolysis in the ordered channels of a zeolite crystal (AFI).



Strong visible photoluminescence (PL) was observed from 0.4nm carbon nanotubes. The PL exhibits a broad emission band with an efficiency of 1~5%.

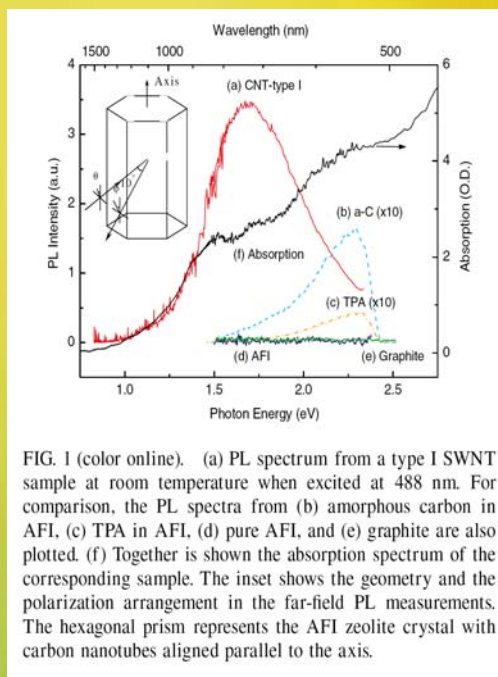
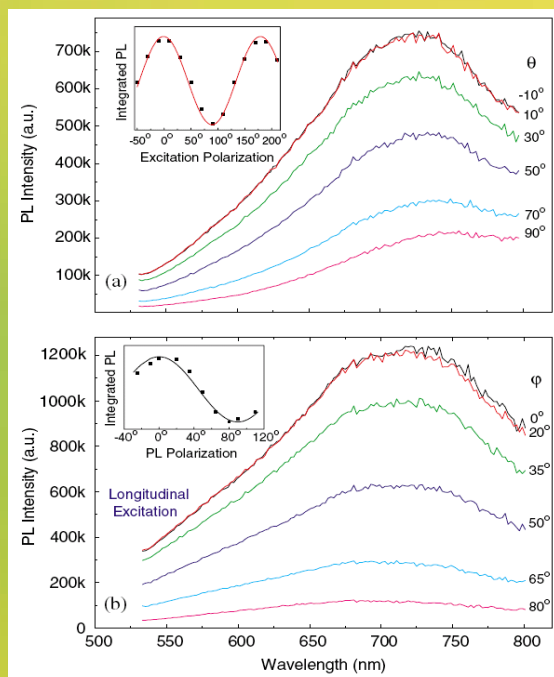
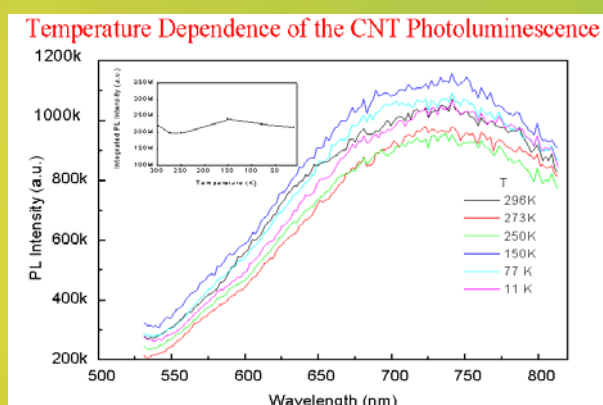


FIG. 1 (color online). (a) PL spectrum from a type I SWNT sample at room temperature when excited at 488 nm. For comparison, the PL spectra from (b) amorphous carbon in AFI, (c) TPA in AFI, (d) pure AFI, and (e) graphite are also plotted. (f) Together is shown the absorption spectrum of the corresponding sample. The inset shows the geometry and the polarization arrangement in the far-field PL measurements. The hexagonal prism represents the AFI zeolite crystal with carbon nanotubes aligned parallel to the axis.

Strong polarization dependence is observed both on the excitation and emission. The PL intensity decreases monotonically from longitudinal excitation to transversal excitation. And the emitted PL tends to be polarized along the direction of the nanotubes. This indicates that the



electronic states of the nanotube are much easier to be polarized along the nanotube than perpendicular to it.

The PL intensity is found to be independent of the temperature of the sample, with little variation from 11K to 296K.