

Quantification of Carbon Nanotube Film Properties from Scanning Electron Microscope Images

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We report a strategy for quantifying the inter-tube spacings in semi-random[1] CNT films based on scanning electron microscope (SEM) images. First, image editing software is used to calculate the average apparent CNT diameter and to paint the intertube regions with a distinctive color (color A) absent in the CNT pixels. This image is inputted into MATLAB and analyzed via the following algorithm. The program sweeps along each column of the image. In order to determine the position of each CNT along the scan line, the program searches for stretches of non-A pixels with lengths equal to or greater than the apparent diameter of the CNTs. The position of the topmost edge of every CNT along the scan line is then recorded. The procedure is repeated for all columns of the image and the resulting matrix contains the position of each CNT along each column. Finally, the distances between the adjacent CNTs are extracted from this matrix. The same procedure is implemented on the transpose (inverted) image to minimize the error caused by CNTs parallel to the scan line. The probability distribution is plotted from the combination of these data, and the real CNT diameter is used in the final calculation.