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Complications Pertaining to the Detection and Characterization of Individual and Embedded Single Walled Carbon Nanotubes by Scanning Electron Microscopy

Alvin W. Orbaek and Andrew R. Barron*

Department of Chemistry, and Department of Mechanical Engineering and Materials Science, Rice University, Houston, TX 77005

Supplementary Materials

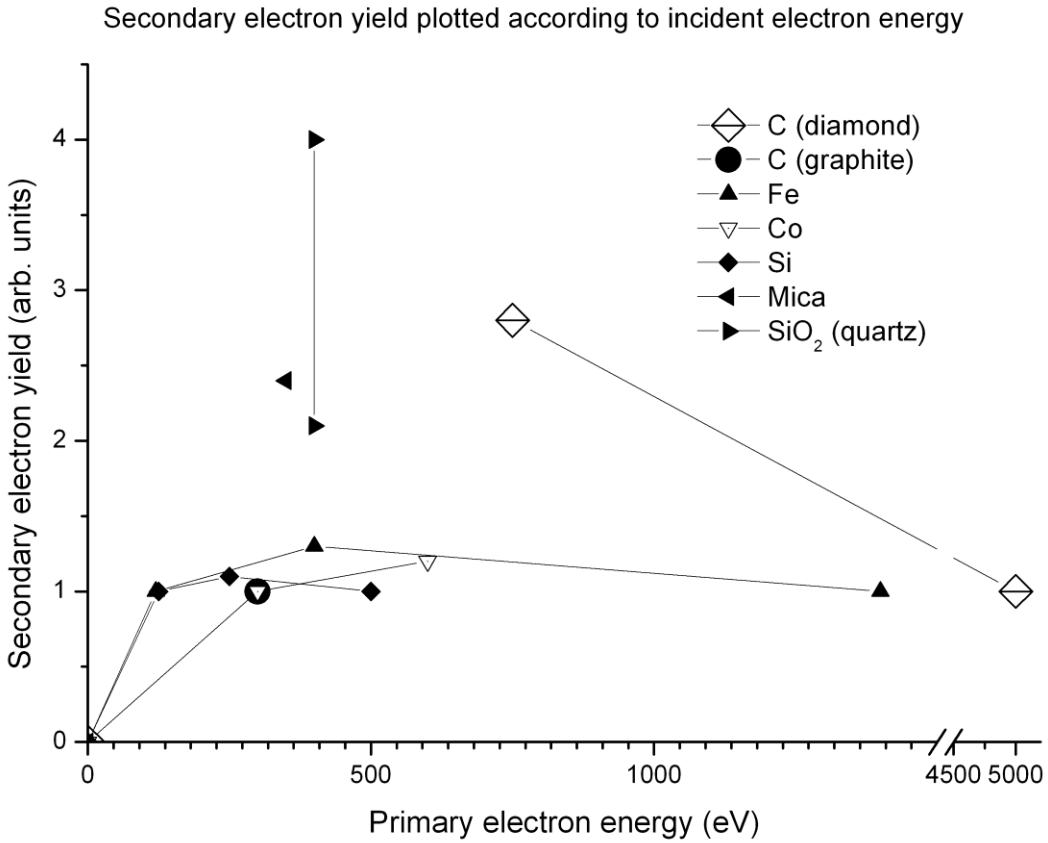

Fig. S1. Secondary electron emission from various materials related to this work. Values obtained from CRC Press Handbook of Chemistry and Physics. SEM from various materials is a non-linear variable property dependent not only on the conductivity of the sample but also more specifically on the point at which secondary electron emission is achieved. The incident energy required to achieve maximum emission depends on the material used. So for sample with mixed material compositions some compromise of imaging capacity has to be accepted to see all the materials present.

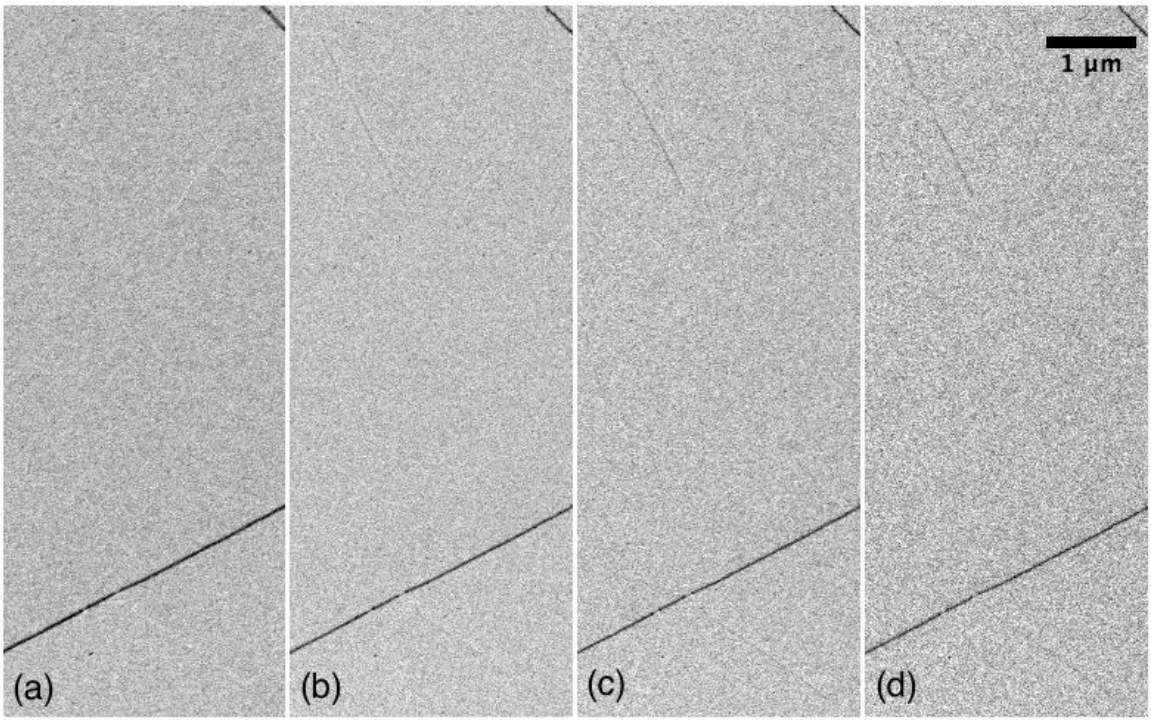

Fig. S2. SEM image showing two distinct nanotubes appear at different dwell times. All images acquired with a 8x frame integration. (a) 20 µs dwell time, (b) 10 µs dwell time, (c) 5 µs dwell time, and (d) 2.5 µs dwell time. Scale bar applies to all images.

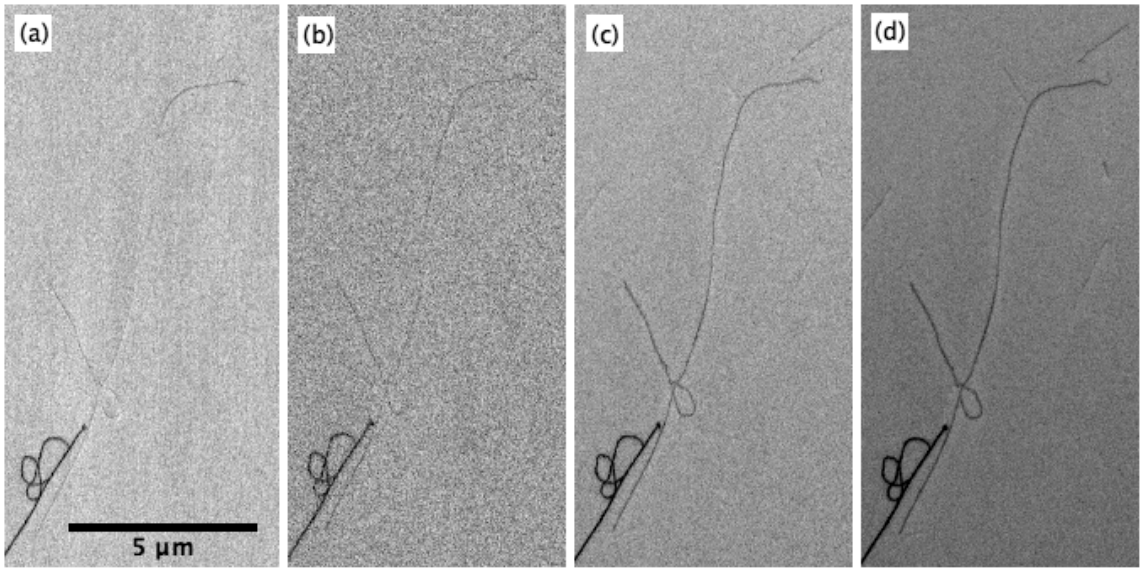

Fig. S3. High magnification images of isolated nanotubes seen at differing dwell times and integration values. Scale bar applies to all images. Notice dark nanotube array on bottom LHS that is connected to a SWNT network. Images were acquired at various dwell times and integration values (a) dwell time 40 µs and 1x integration which is standard operating procedure, (b) 1 µs and 4x integration, (c) 1 µs and 32x integration, and (d) 1 µs and 64x integration.

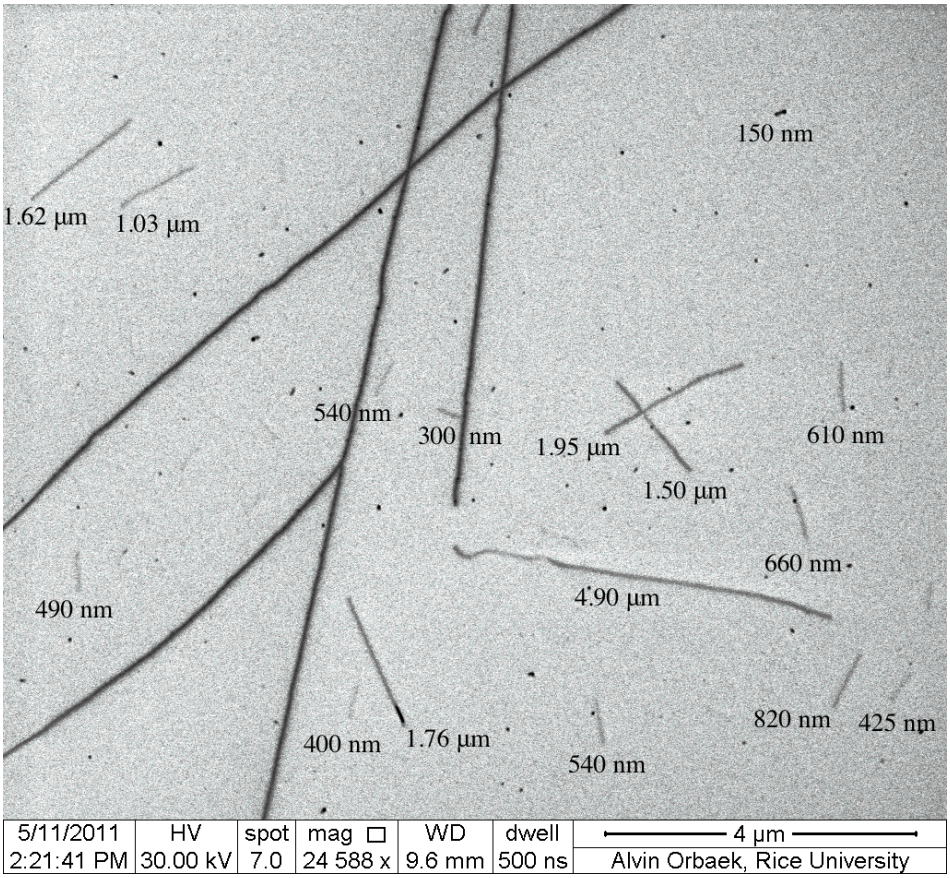

Fig. S4. SEM image that was used to determine effect of length on the occurrence and visibility of SWNT under various incident dwell times. (See Figure S4).

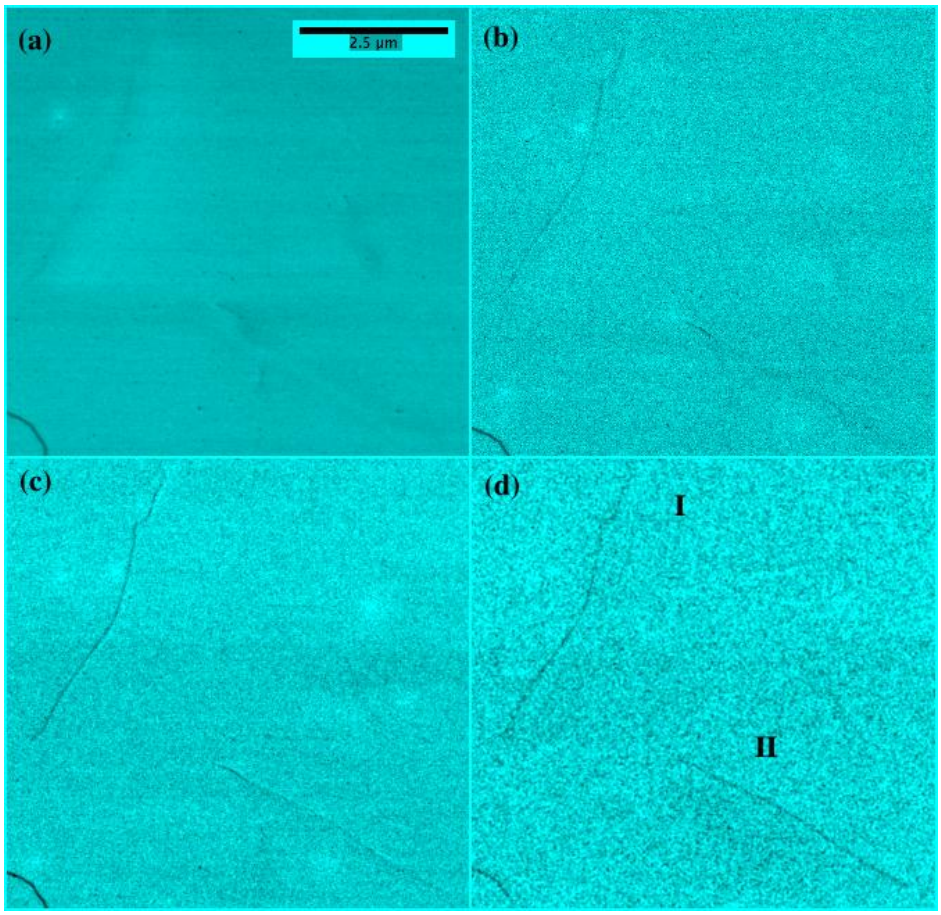

Fig. S5. SEM images taken at various dwell times for images were (a) 80 µs, (b) 10 µs, (c) 3 µs, and (d) 0.3 µs. Nanotube lengths are 4.3 mm and 4.5 mm for I and II respectively. Nanotube lengths are 4.3 µm and 4.5 µm for I and II respectively.

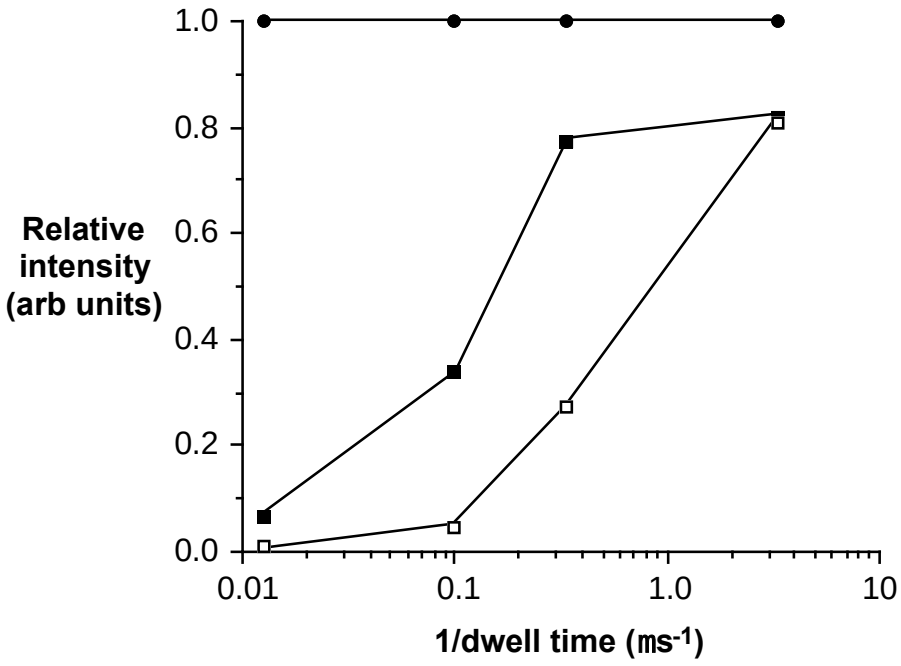

Fig. S6. Relative intensity of isolated SWNTs I (n) and II (□) of Figure S6, compared to the intensity of the network SWNT. Plotted according to inverse dwell time.

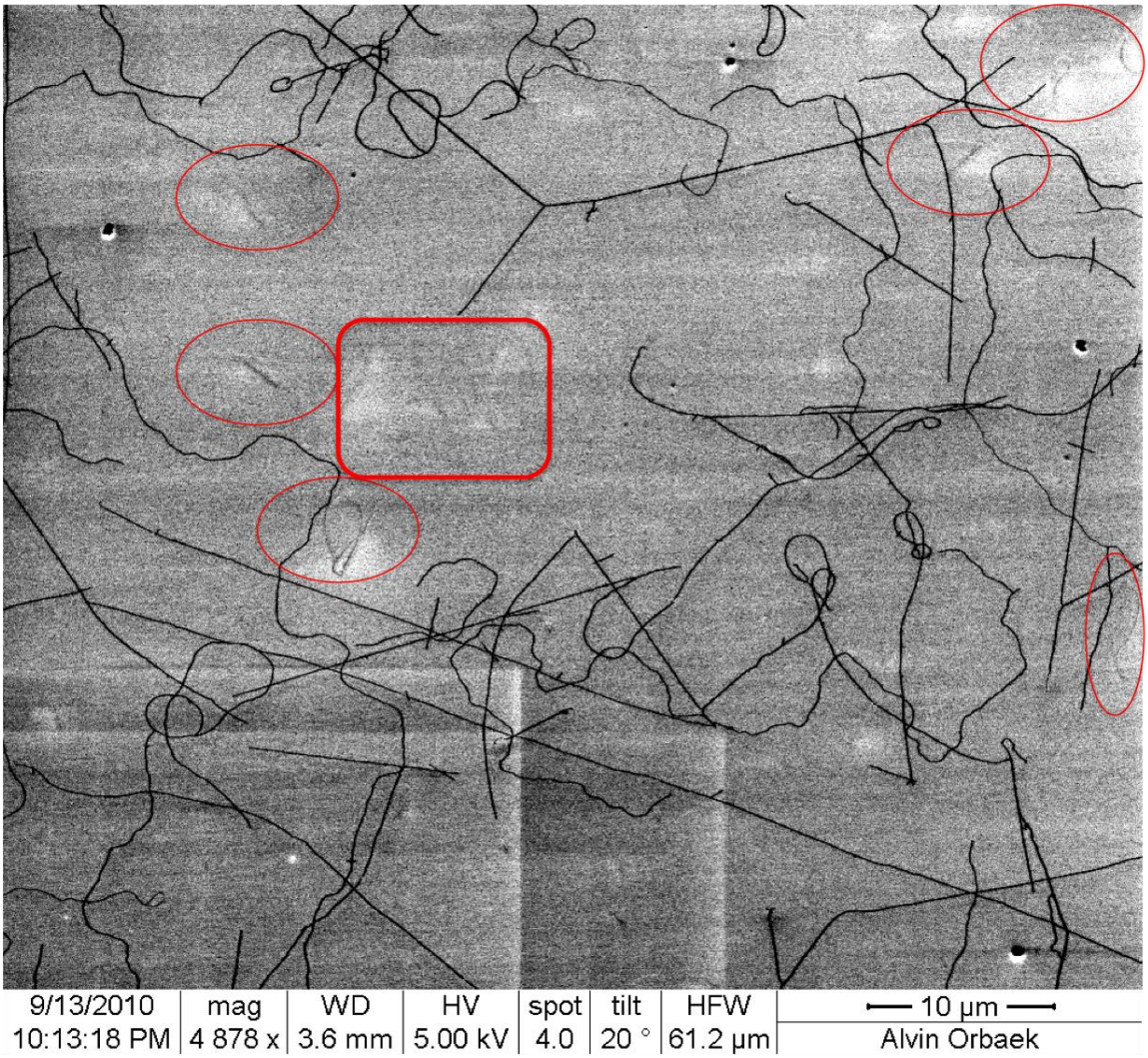

Fig. S7. SEM image showing relation of SWNT network to isolated nanotubes. The isolated nanotubes appear only very faintly, and there positions are marked using a red shapes. Of particular note the rectangular area is the area in which SWNT from Figure 2 was detected.

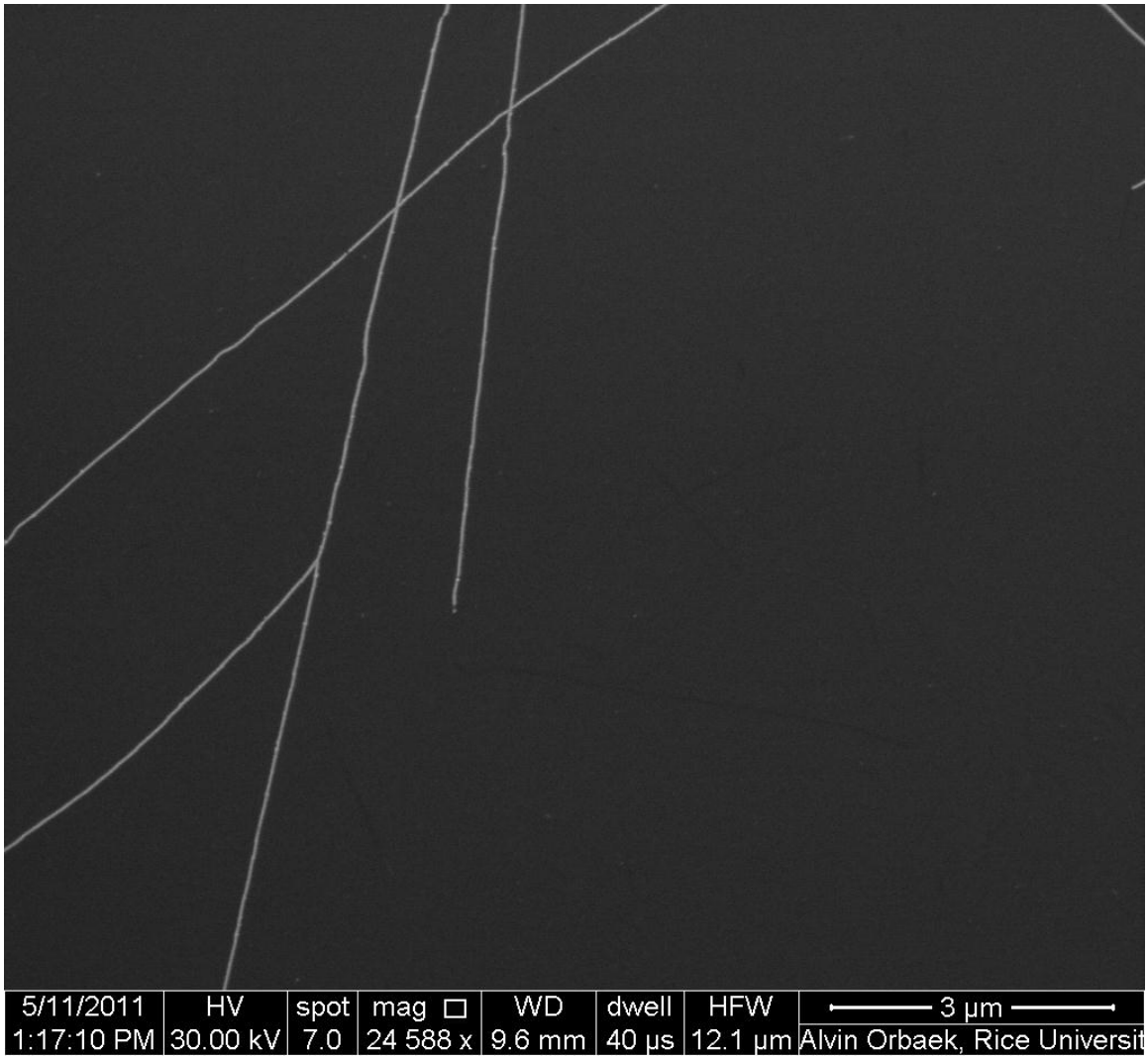

Fig. S8. SEM image acquired using 32x frame integration.

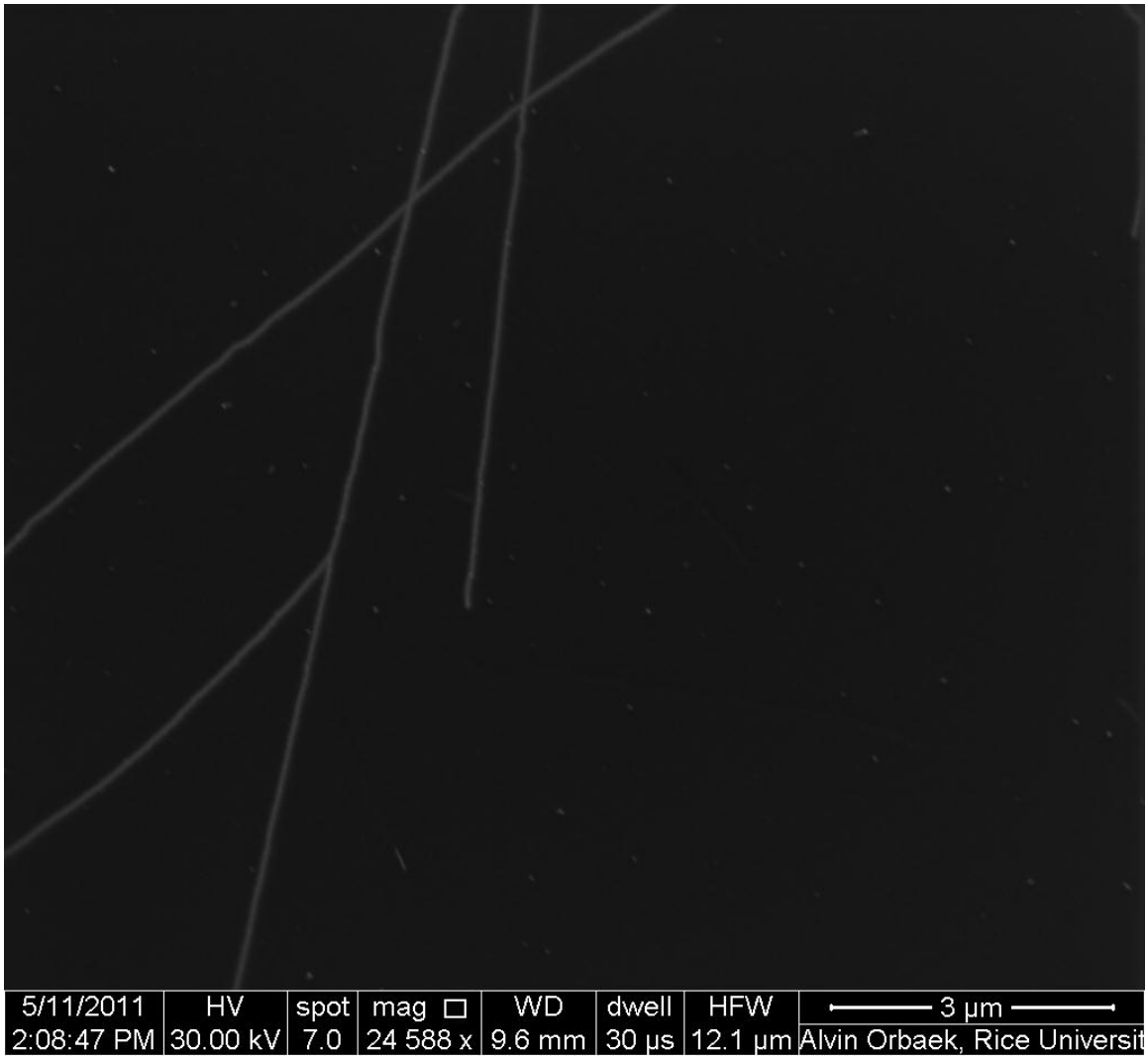

Fig. S9. SEM image acquired using 32x frame integration

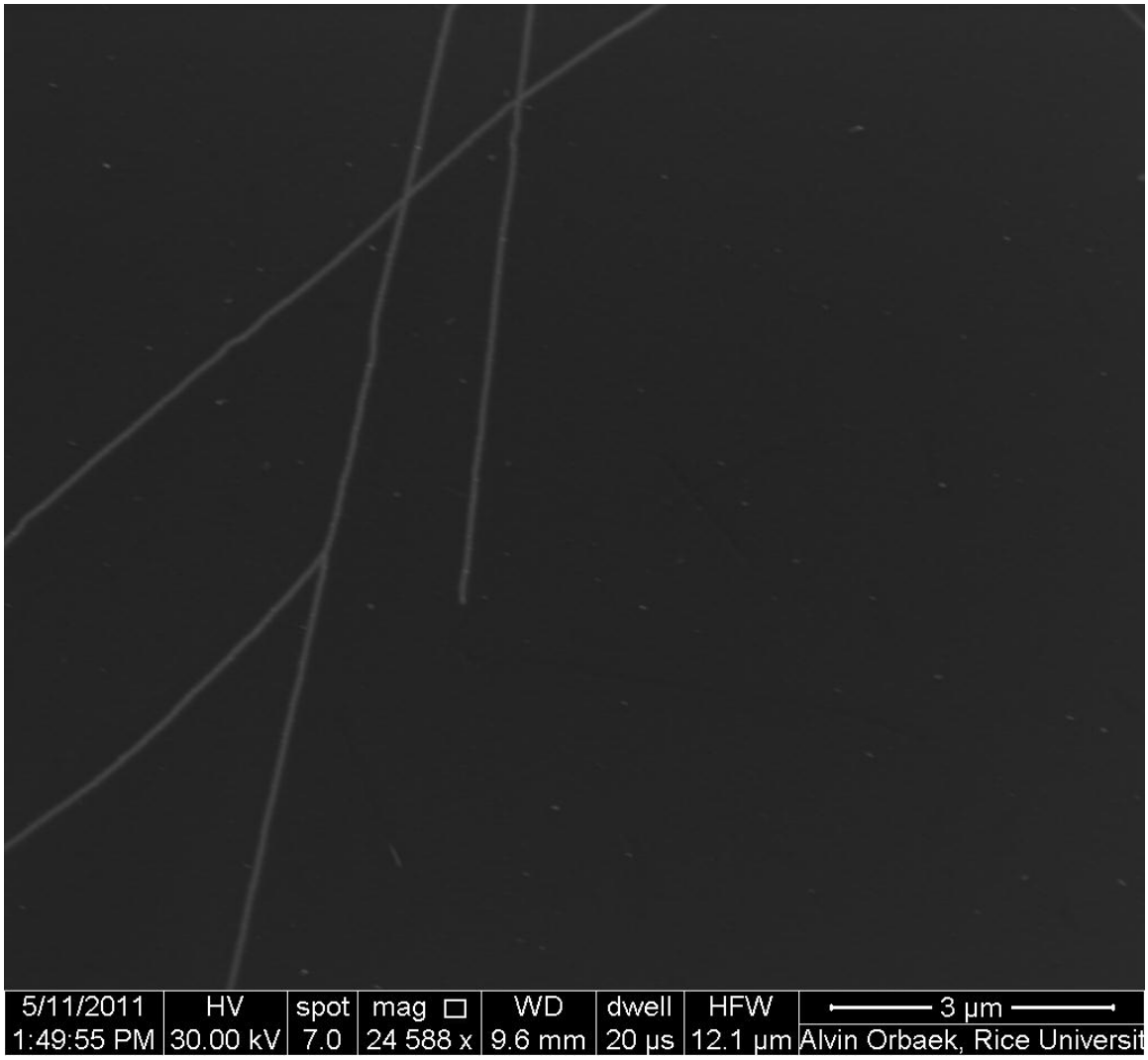

Fig. S10. SEM image acquired using 32x frame integration

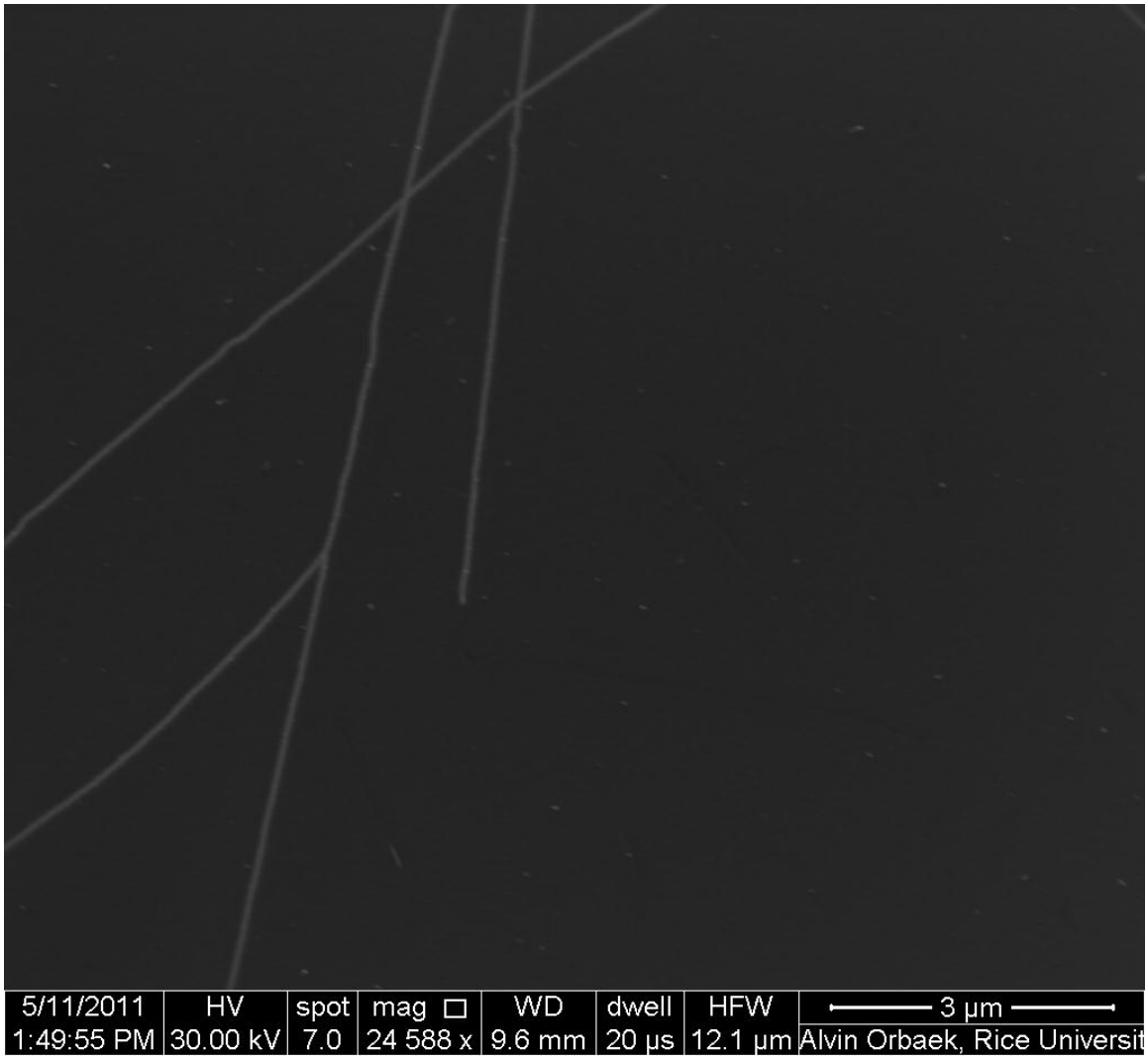

Fig. S11. SEM image acquired using 32x frame integration

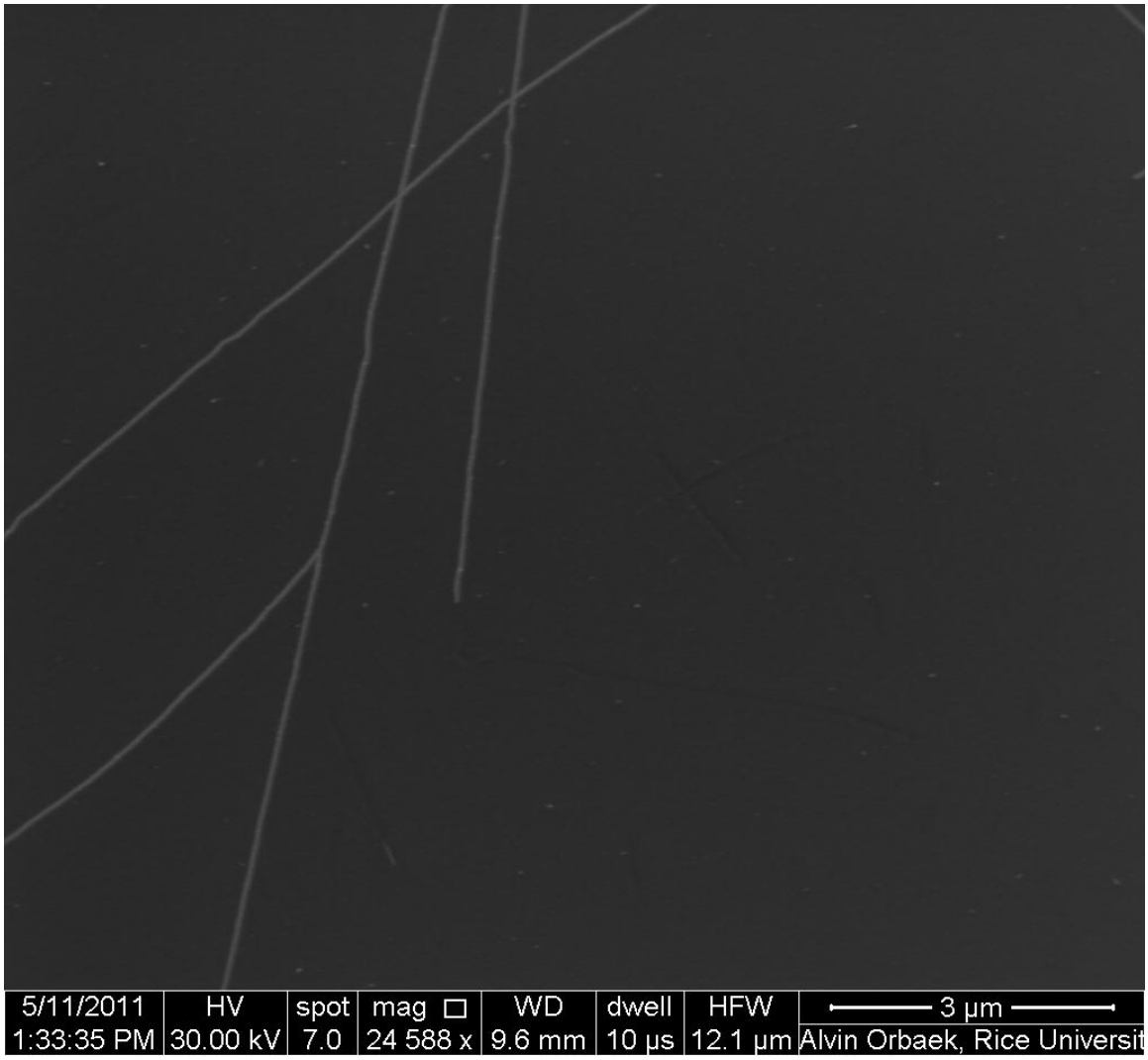

Fig. S12. SEM image acquired using 32x frame integration

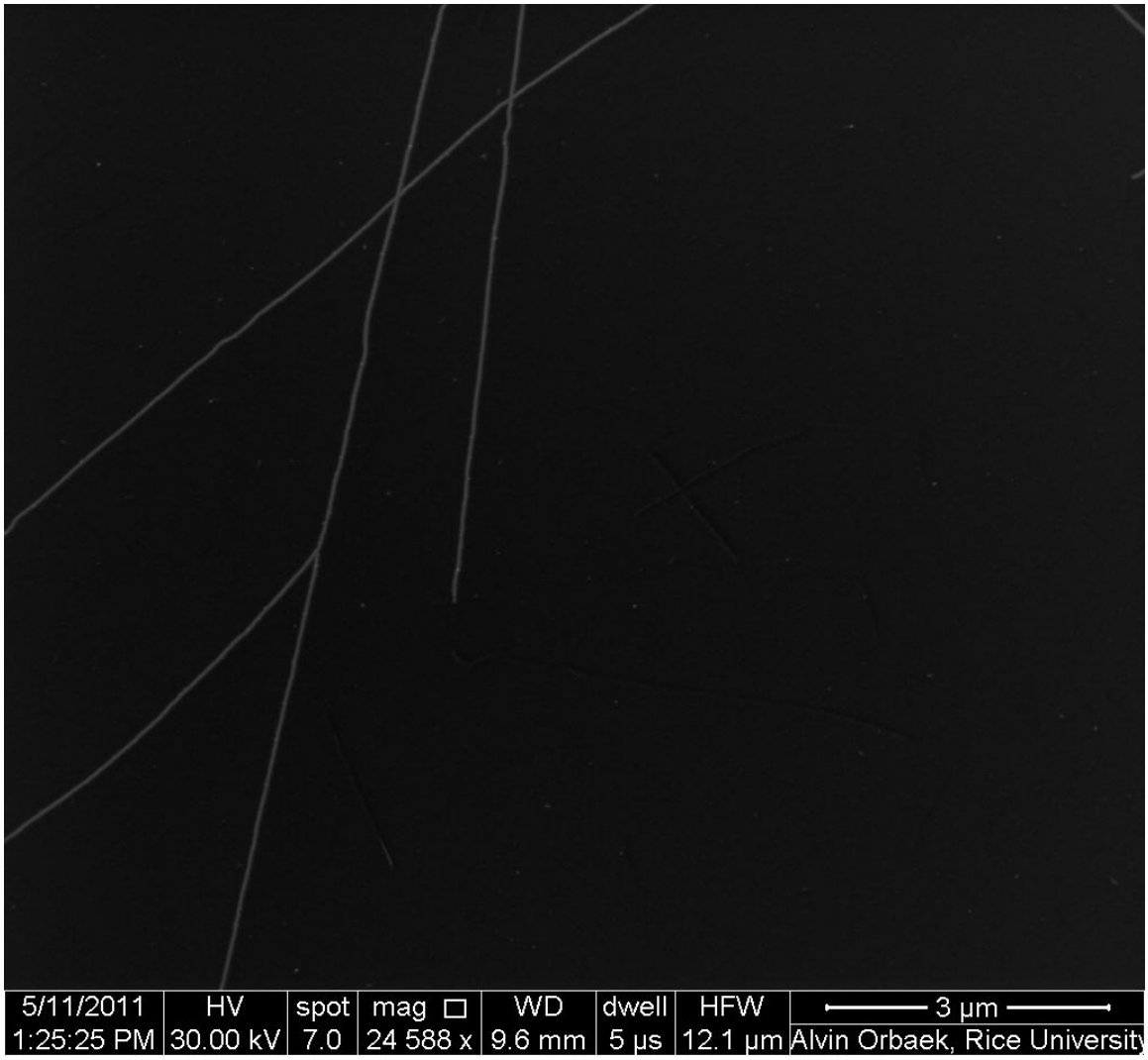

Fig. S13. SEM image acquired using 32x frame integration

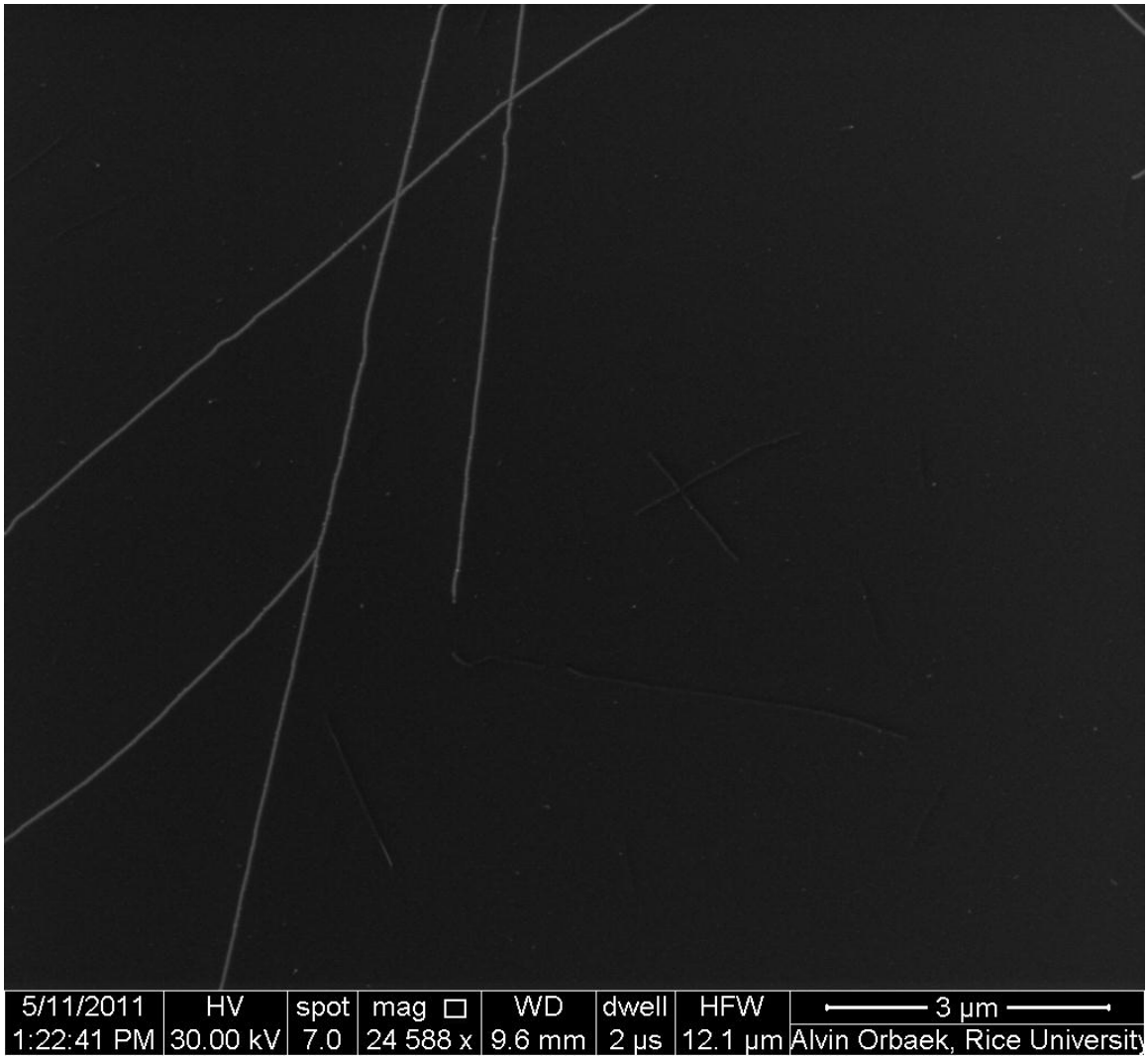

Fig. S14. SEM image acquired using 32x frame integration.

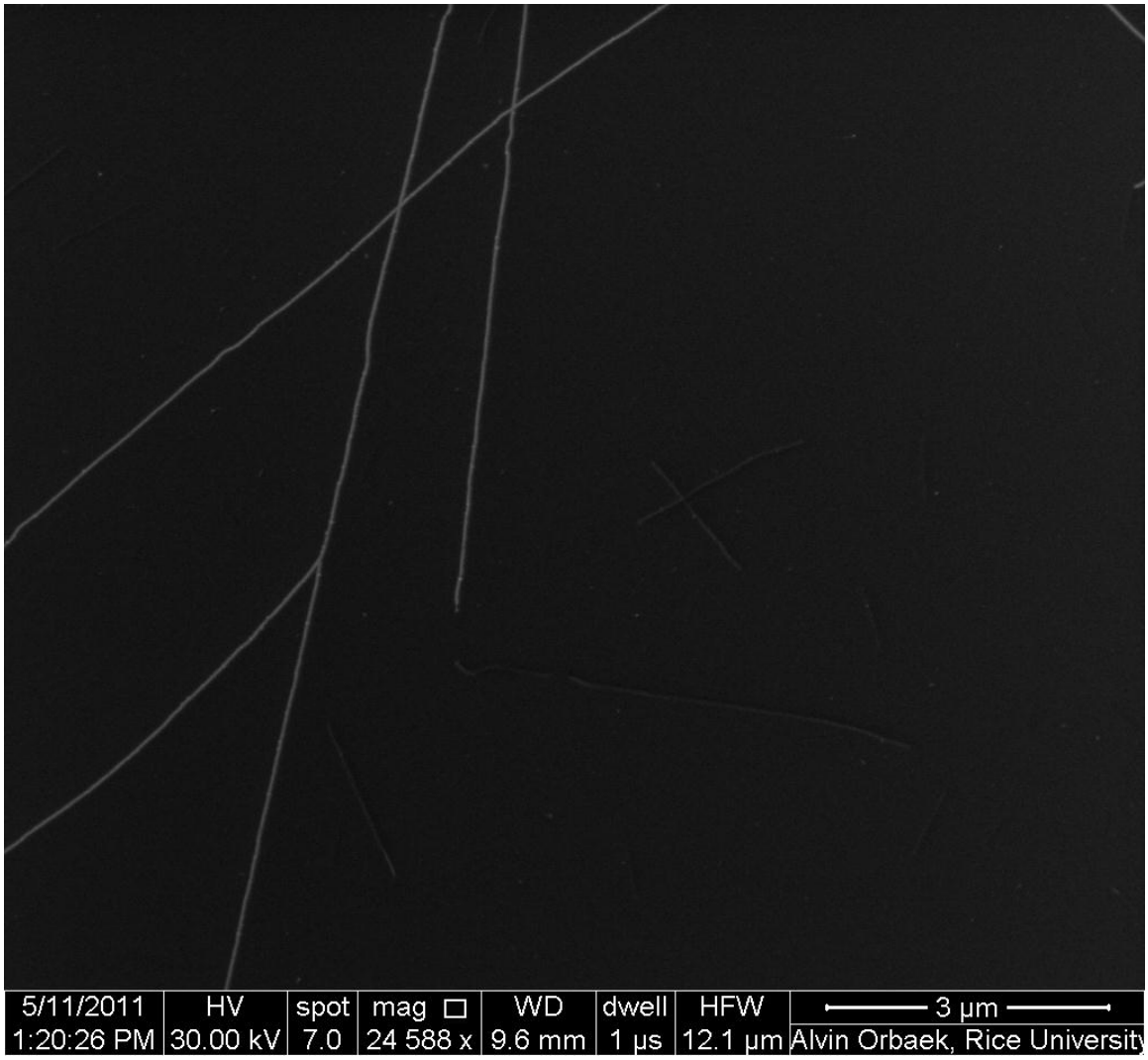

Fig. S15. SEM image acquired using 32x frame integration.

Fig. S16. SEM image acquired using 32x frame integration.

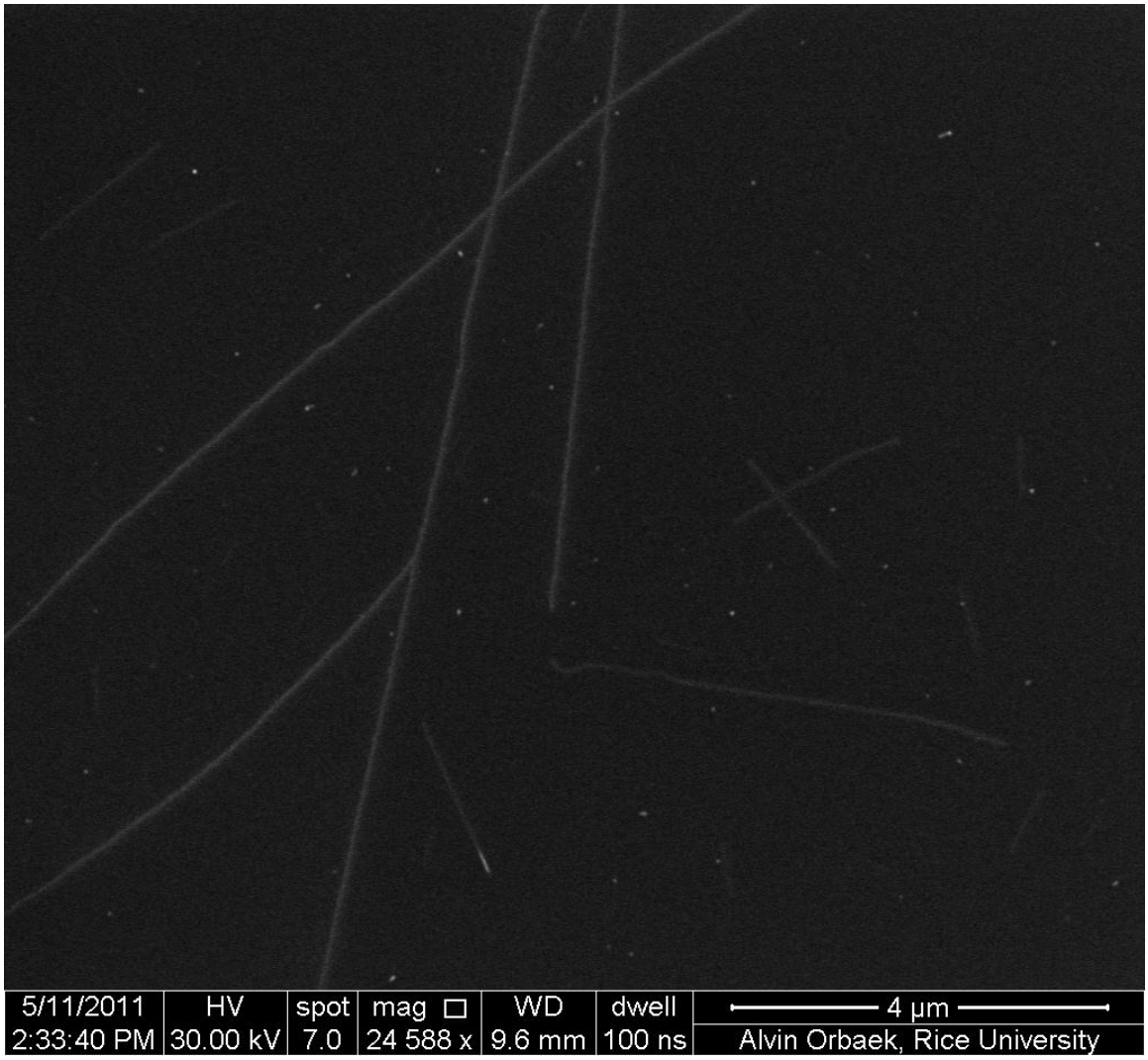

Fig. S17. SEM image acquired using 32x frame integration.

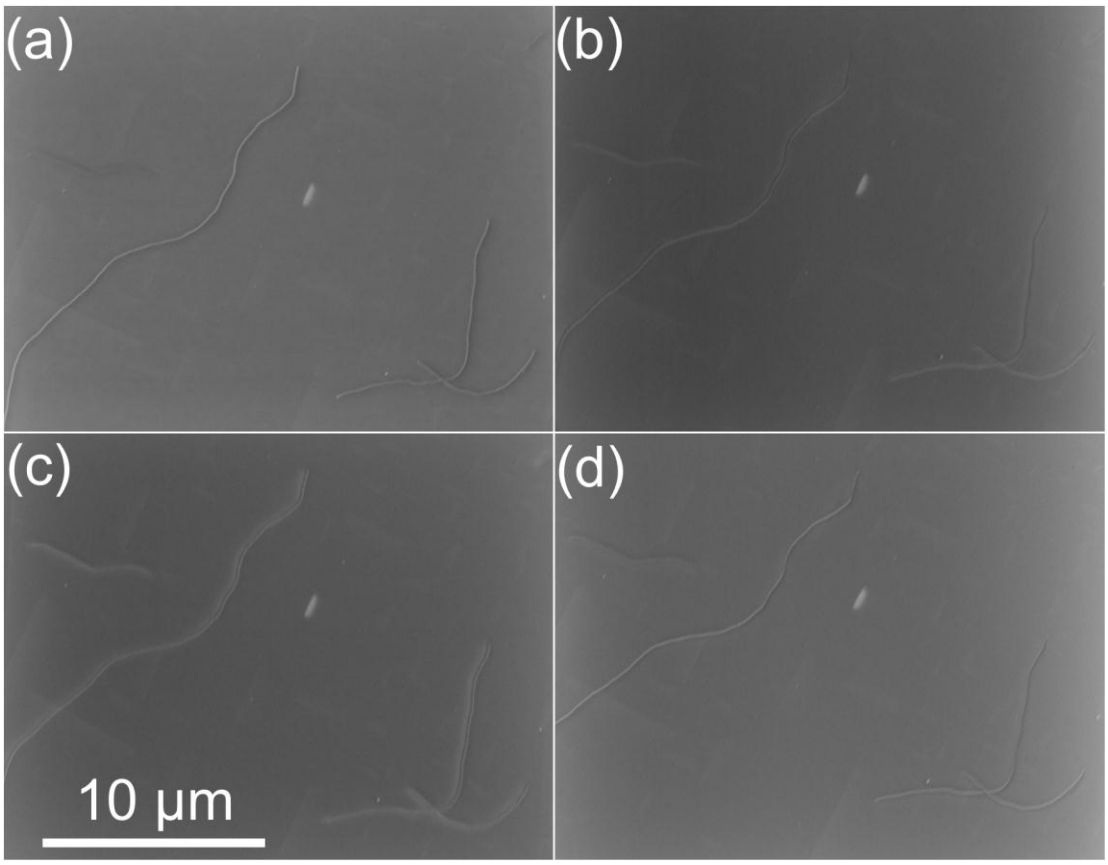

Fig. S18. SEM images of area acquired under variable raster scan directions, and dwell times, such that each image is orthogonal to one another starting with regular imaging conditions (a) and alternating 90 degrees. Image acquired at 10 µs dwell time, 32x frame integration applied; 30 kV acceleration voltage, with spot size 7 at working distance of 10 mm, using a 10,000x magnification. The scan orientation tracks from left to right (a), bottom to top (b), right to left (c), and top to bottom (d).