

What is Below the Support Layer Affects Carbon Nanotube Growth: an Iron Catalyst Reservoir Yields Taller Nanotube Carpets

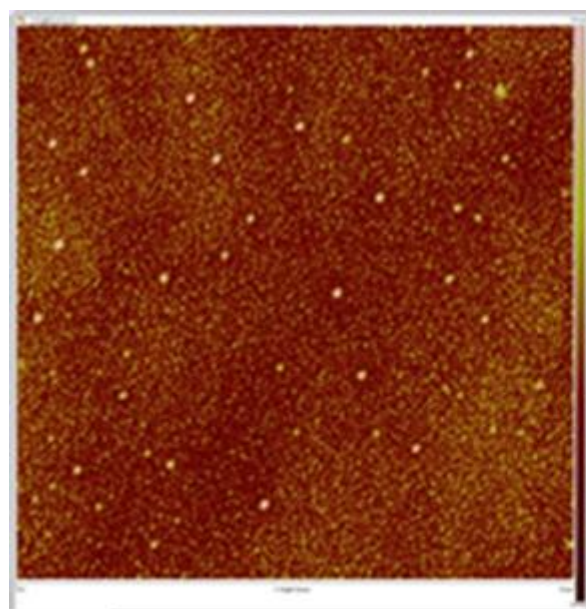
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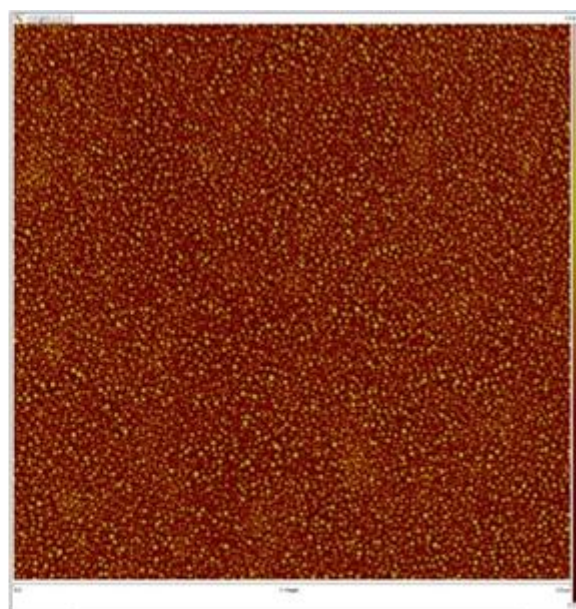
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Supporting Information:



Si/Fe=10nm Al₂O₃=3nm/Fe=1.2nm



Si/Al₂O₃=3nm/Fe=1.2nm

Figure 1 AFM measurements of samples annealed for 10 minutes at 790°C with and without reservoir. We can observe the large particles on the sample with the Fe reservoir.

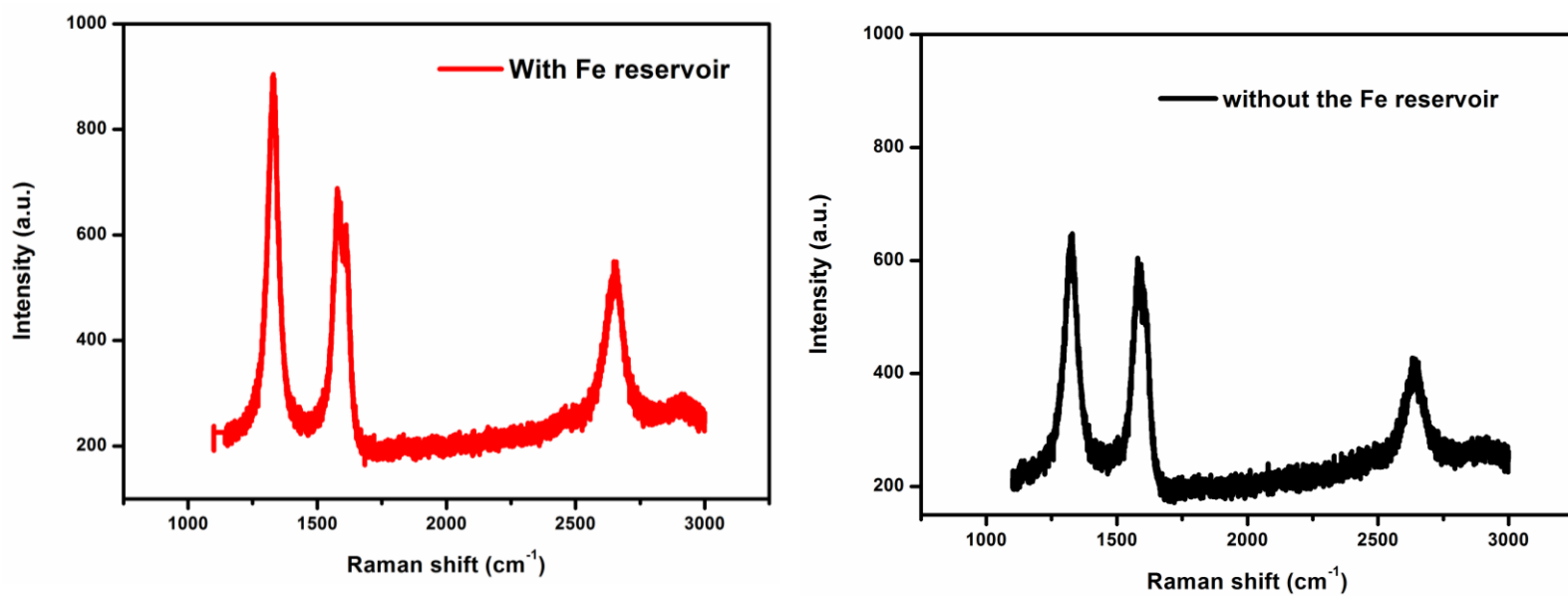
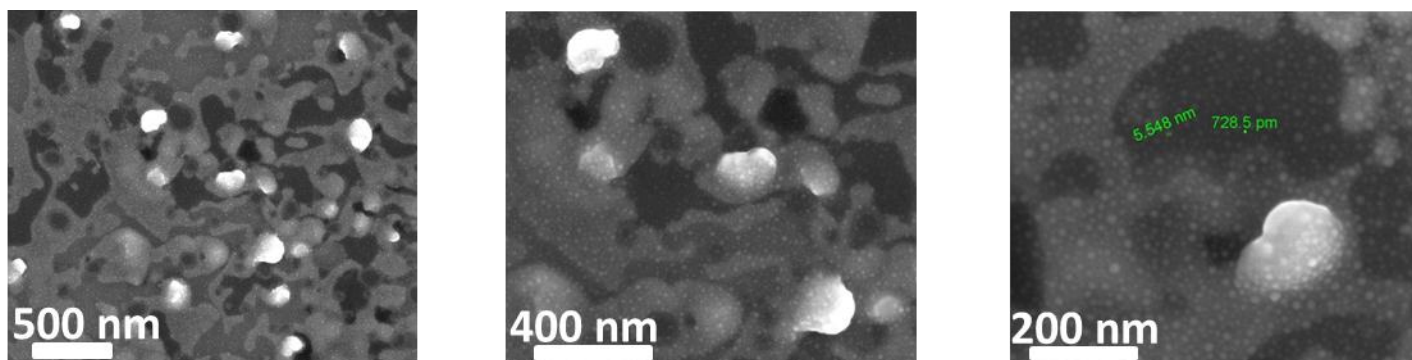


Figure 2 Raman spectroscopy measurements taken samples with and without Fe reservoir after 5 min anneal at 790°C. The G/D ratios are comparable

5 min anneal at 790 degrees- with "Fe reservoir"



5 min anneal at 790 degrees- without "Fe reservoir"

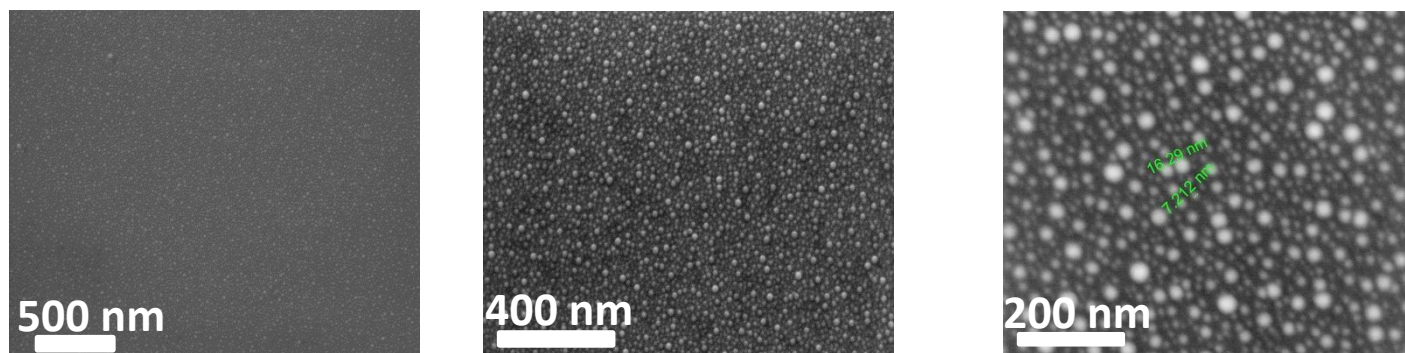
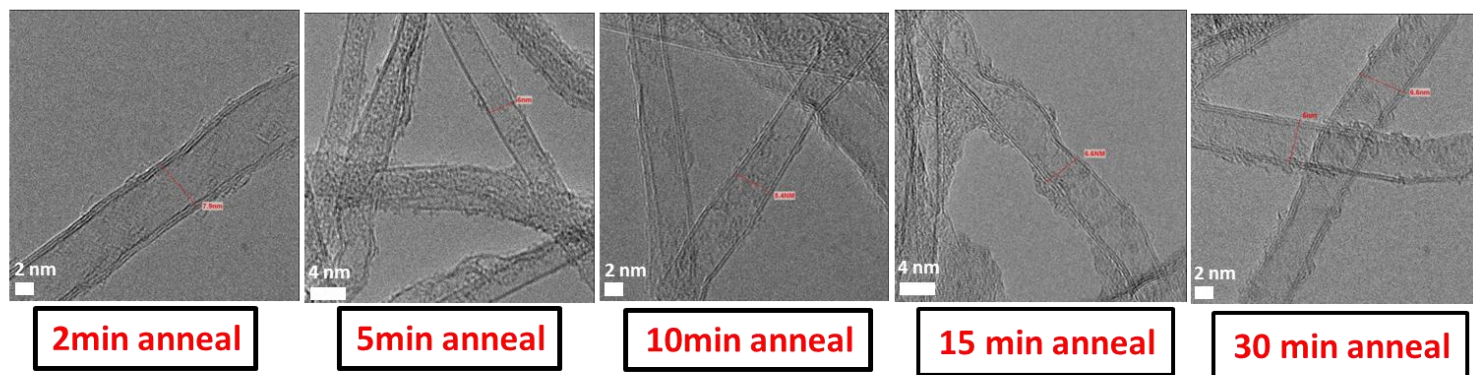


Figure 3 (a) and 2(b) show top-view HRSEM images taken for both Fe reservoir and the non-Fe reservoir samples, respectively, after a 5 minute annealing period, at 790⁰ (the magnifications are 50,000, 100,000 and 200,000 respectively).

With Fe “reservoir”



Without Fe “reservoir”

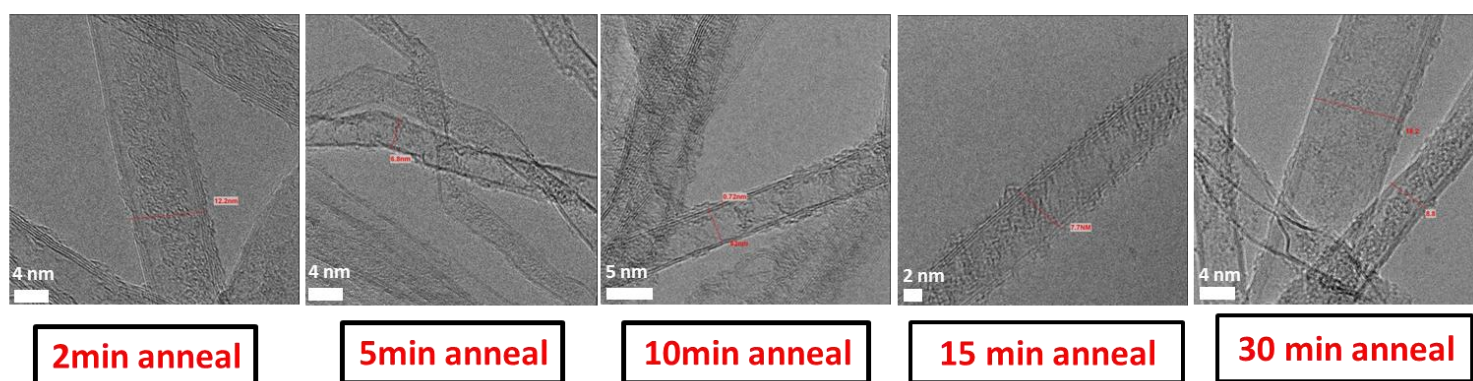


Figure 5 HRTEM images showing the crystalline CNT structure for samples with and without the Fe reservoir for annealing durations between 2-30 min. We can see that the CNT diameters are smaller for the sample with the Fe reservoir compared with the non-reservoir sample. This result correlates with the annealing experiments and support the mechanism described in the text.

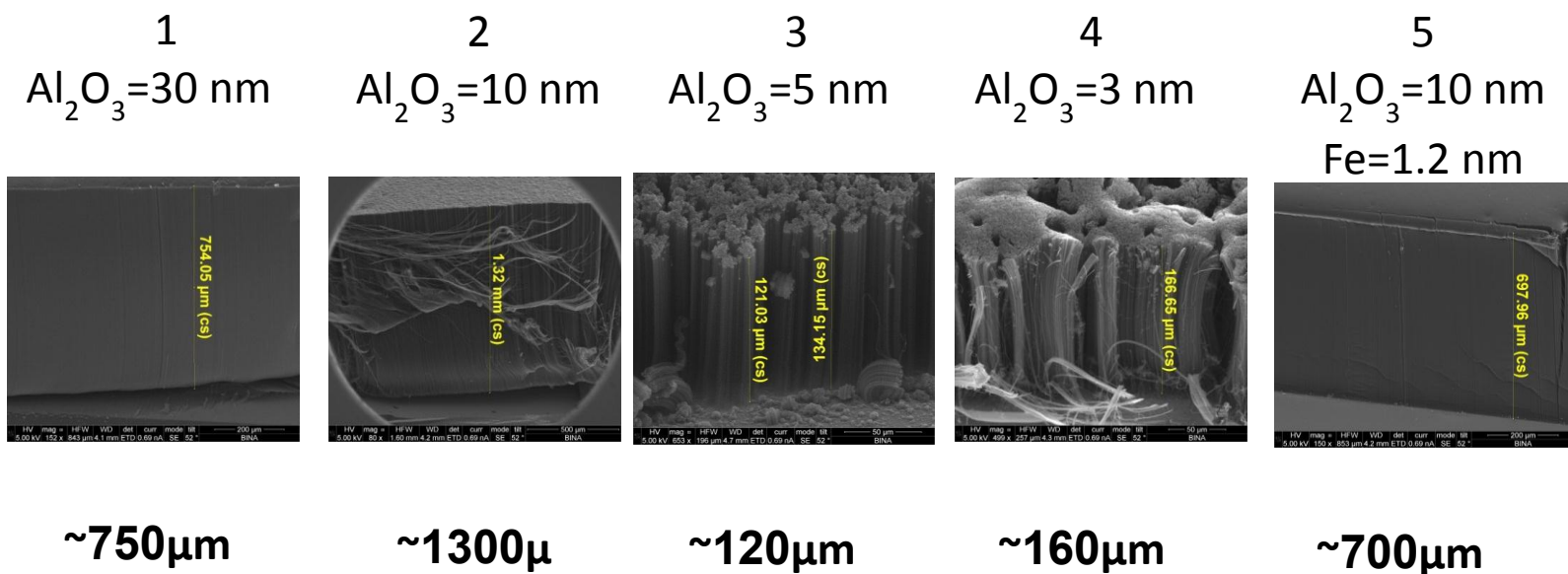


Figure 6 SEM images showing the CNT carpets for samples with and without the Fe reservoir with 5 min anneal for 15 min growth durations at 790° . (1) Fe 10 nm/ Al_2O_3 30 nm/Fe 1.2 nm (2) Fe 10 nm/ Al_2O_3 10nm/Fe 1.2 nm (3) Fe 10 nm/ Al_2O_3 5nm/Fe 1.2 nm (4) Fe 10 nm/ Al_2O_3 3nm/Fe 1.2 nm (5) Al_2O_3 3nm/Fe 1.2 nm

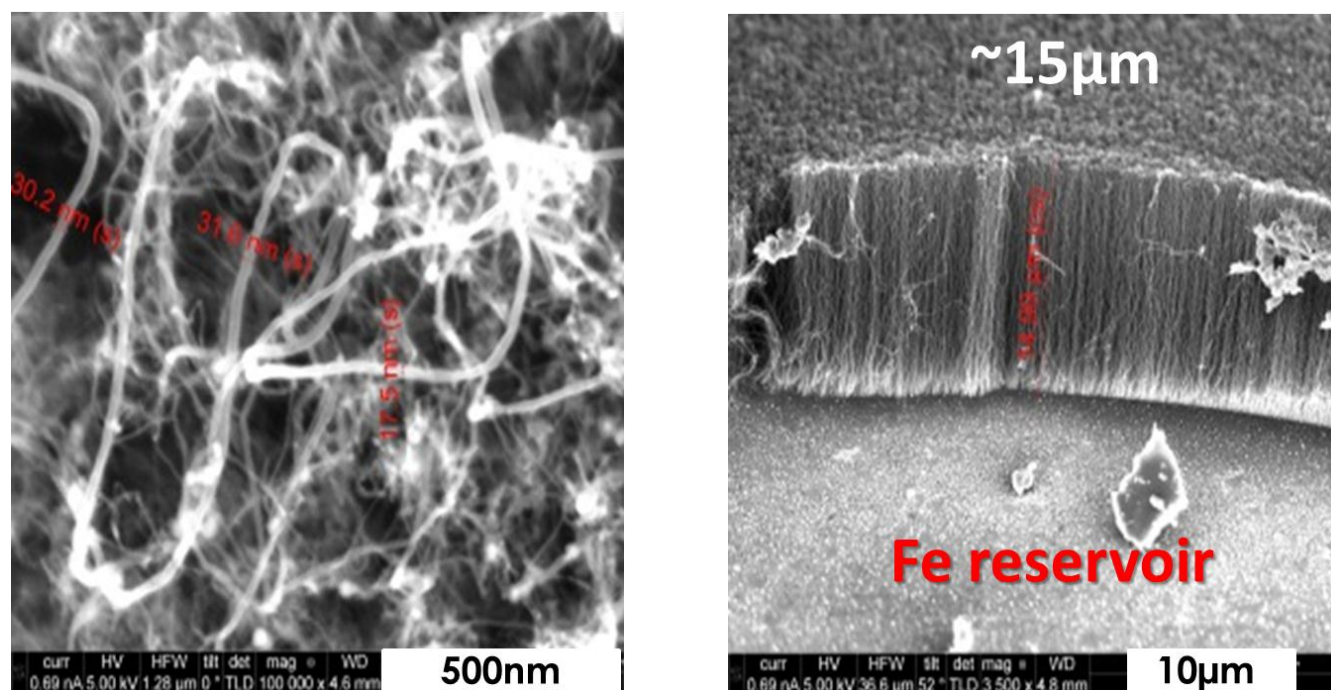


Figure 7 SEM images showing the result of a 5 minute anneal followed by a 20 second growth (at 790 °C). The sample without reservoir (left) exhibited only micron-long entangled CNTs while the sample with reservoir (right) exhibited a 15 μm-tall carpet of vertically aligned CNTs.