REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

1. REPORT DATE (DD-MM-YYYY) 2/26/08	2. REPORT TYPE Final Performance Report	3. DATES COVERED (From - To) 15 AUG 2006 - 30 NOV 2007
4. TITLE AND SUBTITLE Self Assembly of Carbon Nanotubes by Ionic Charge Interaction		5a. CONTRACT NUMBER
		5b. GRANT NUMBER FA9550-06-1-0535
		5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S) Nemat-Nasser, Sia Tor, Yitzhak		5d. PROJECT NUMBER
		5e. TASK NUMBER
		5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) UC San Diego Department of MAE 9500 Gilman Drive La Jolla CA 92093-0416 The Regents of the University of California Contracts and Grants 9500 Gilman Drive La Jolla Ca 92093-5004		8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) AFOSR Roland P. Howard 875 N. Randolph Street Roland.howard@afosr.mil Room 3112 Arlington, VA 22203		10. SPONSOR/MONITOR'S ACRONYM(S) AFOSR/PKR2
		11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT

Distribution Statement A: Approved for public release; distribution unlimited.

AFRL-SR-AR-TR-08-0143

13. SUPPLEMENTARY NOTES

14. ABSTRACT Carbon nanotubes of proper length can be functionalized to self-assemble into a three-dimensional structure. We have calculated the required length of single-walled carbon nanotubes and have purified, chemically cut to proper size, and functionalized, to test the basic concept. During this research period we have been able to demonstrate the fact that carbon nanotubes can indeed be functionalized and all the indications are is that they do self-assemble in a suitable environment.

15. SUBJECT TERMS Carbon nanotubes

16. SECURITY CLASSIFICATION OF:	17. LIMITATION OF ABSTRACT UU	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON

Title: Self-assembling of Carbon Nanotubes by Ionic Charge Interaction

Authors: Professor's Sia Nemat-Nasser and Yitzhak Tor

Over the past few years, under independent research (unfunded), we have sought to chemically functionalize suitably-sized CNTs such that they would spontaneously self-assemble into three-dimensional nano-networks or form nano-clusters, depending on the average and the maximum length of the tubes and on the chemistry of functionalization, all of which can be controlled. The seed funding, via this grant, provided an opportunity to continue the work and obtain very promising results.

Significant Work Accomplished:

As a guide to experimentally verifying the possibility of self-assembly, we have first estimated the maximum length of single-walled carbon nanotubes (SWCNTs) so that the ionic interaction forces could overcome the van der Waals forces when each end site of the tubes terminates through an appropriate chemical linker with a carboxylate which is then neutralized by a suitable cation, e.g., Na^+. In addition, assuming a self-assembled nano-network consisting of CNTs interconnecting the ionic clusters, we have estimated the average size of the clusters by balancing the osmotic and the electrostatic forces within each cluster.

Guided by these estimates, the as-received SWCNTs are chemically purified, cut, and filtered, selecting a sample of CNTs of lengths within the estimated range for creating a nano-network, and another in the range for creating isolated nano-clusters. Both samples are subjected to the same functionalization process, and then their final microstructure is characterized by a scanning electron microscope (SEM). It is discovered that the functionalized tubes do indeed self-assemble as was predicted. Figure 1 exemplifies some of our preliminary results of successfully creating self-assembled networks (left), and self-assembled nano-clusters (right).

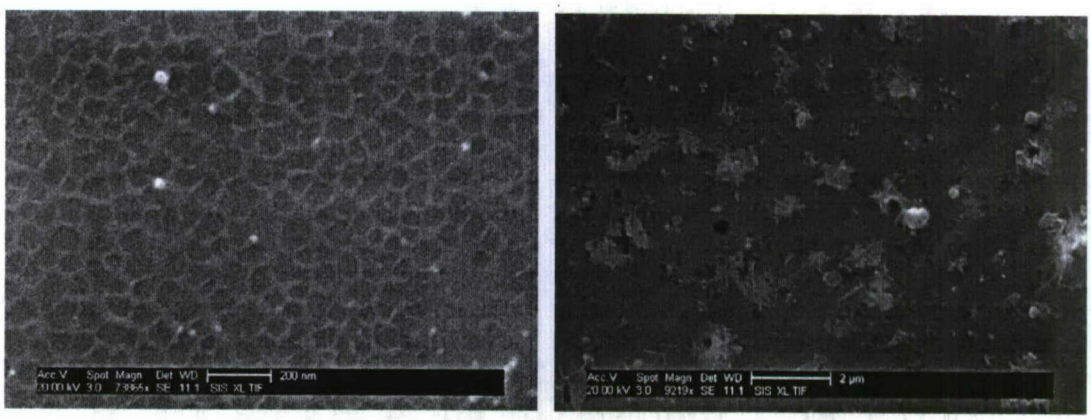

Figure 1. Functionalizing CNTs to form nano-networks (left) and self-assembled nano-clusters (right).