

REPORT DOCUMENTATION PAGE			Form Approved OMB NO. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comment regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE 4/30/98		3. REPORT TYPE AND DATES COVERED Final Report - 1/1/94 - 12/31/97
4. TITLE AND SUBTITLE Structures and Dynamics of Self-Assembled Organized Functional Polymers in Solution			5. FUNDING NUMBERS DAAH04-94-G-0053	
6. AUTHOR(S) Benjamin Chu				
7. PERFORMING ORGANIZATION NAMES(S) AND ADDRESS(ES) Chemistry Department State Univeristy of New Yrok Stony Brook, NY 11794-3400			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Research Office P.O. Box 12211 Research Triangle Park,, NC 27709-2211			10. SPONSORING / MONITORING AGENCY REPORT NUMBER ARO 32508.13-CH	
11. SUPPLEMENTARY NOTES The views, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision, unless so designated by other documentation.				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution unlimited.			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) Fruitful results were achieved by investigating the structure and dynamics of self-assembled diblock and triblock copolymers by means of a combination of physical techniques, including static and dynamic light scattering, small angle x-ray scattering, small angle neutron scattering and atomic force microscopy. The polymer colloids are able to form core-shell micelles in a closed association process, as well as flower-like and more open-structured aggregates, depending on the molecular architecture, composition and solvent selectivity of the block. A detailed study on even a few selected samples of Pluronic polyols consisting of EPE type triblock copolymers in aqueous solution has resulted in the development of a new separation medium for DNA capillary electrophoresis where E and P are, respectively, oxyethylene and oxypropylene. By taking advantage of our knowledge on colloid physics, narrow size distribution polymeric microspheres with superparamagnetic magnetite cores are being developed. The polymeric shells contain active sites which can be modified chemically, making the microspheres possible candidates as drug delivery or magnetic resonance imaging agents. Finally, we have developed a centrifuge ball viscometer capable of measuring the viscosity of polymer melts, including that of poly(tetrafluoroethylene) (also known as Teflon).				
14. SUBJECT TERMS			15. NUMBER OF PAGES	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OR REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED	20. LIMITATION OF ABSTRACT UL	

**Structures and Dynamics of Self-Assembled Organized
Functional Polymers in Solution**

Final Report

April 27, 1998

US. Army Research Office

Contract # DAAH04-94-G-0053

Chemistry Department
State University of New York at Stony Brook

Approved for Public Release;
Distribution Unlimited

THE VIEWS, OPINIONS, AND/OR FINDINGS CONTAINED IN THIS REPORT ARE THOSE
OF THE AUTHOR(S) AND SHOULD NOT BE CONSTRUED AS AN OFFICIAL
DEPARTMENT OF THE ARMY POSITION, POLICY, OR DECISION, UNLESS
DESIGNATED BY OTHER DOCUMENTATION.

DTIC QUALITY INSPECTED 2

19980519 157

FINAL REPORT

A. Statement of the Problem Studied

Investigate the structure and dynamics of block copolymers in selective solvents, including self-assembly behavior and the formation of gel-like structures at high polymer concentrations.

B. Summary of the Most Important Results

Based on fundamental knowledge gained from the project, (i) a new viscosity-adjustable and surface active separation medium has been developed for DNA capillary electrophoresis in 1xTBE buffer, and (ii) viscosity characterization of poly(terafluoroethylene) using a centrifugal ball viscometer.

C. List of All Publications:

1994. 1. Qicong Ying, James Marecek and Benjamin Chu, "Solution Behavior of Buckminsterfullerene (C_{60}) in Benzene," *J. Chem. Phys.*, **101**, 2665 (1994).
2. Zukang Zhou, Benjamin Chu and Dennis G. Peiffer, "Chain Architecture and Self-Assembly of Block Copolymers in Solution," *J. Polym. Sci., Polym. Phys.*, Rapid Communication, **32**, 2135 (1994).
3. Guangwei Wu, Qicong Ying and Benjamin Chu, "Lamellar Structure of Block Copolymer Poly(oxyethylene-oxypropylene-oxyethylene) in Xylene/Water Mixtures," *Macromolecules*, **27**, 5758 (1994).
4. Kung Linliu, Fengji Yeh, Jeffrey W. Shook, William H. Tuminello and Benjamin Chu, "Development of a Centrifuge Ball Viscometer for Polymer Melts," *Rev. Sci. Instrum.*, **65**, 3823 (1994).
5. Guangwei Wu, Benjamin Chu and Dieter K. Schneider, "Small-Angle Neutron Scattering Study of Polymeric Micellar Structures," *J. Phys. Chem.*, **98**, 12018 (1994).
1995. 6. Benjamin Chu, "Structure and Dynamics of Block Copolymer Colloids," *Langmuir*, **11**, 414 (1995).
7. Kung Linliu and Benjamin Chu, "Viscosity of Ethylene/Tetrafluoroethylene Alternating Copolymers," *Polymer*, **36**, 2265 (1995).
8. Guangwei Wu, Benjamin Chu and Dieter K. Schneider, "SANS Study of Micellar Structure of PEO-PPO-PEO Aqueous Solution," *J. Phys. Chem.*, **99**, 5094 (1995).

9. Benjamin Chu and Guangwei Wu, "Structure and Dynamics of Copoly(oxyethylene-oxypropylene-oxyethylene) in Xylene/Water Mixtures," *Macromol. Symp.*, **90**, 251 (1995).
10. Benjamin Chu and King Linliu, "Viscosity Characterization of Poly (tetrafluoroethylene) by Centrifuge Ball Viscosimetry," *Macromolecules*, **28**, 3240 (1995).
11. Zukang Zhou, Benjamin Chu and Dennis G. Peiffer, "Association Characteristics of Copolymer Micelles in a Solvent Selective for the Middle Block," *Langmuir*, **11**, 1956 (1995).
1996. 12. Zukang Zhou, Benjamin Chu, V. Mark Nace, Yung-Wei Yang and Colin Booth, "Self-Assembly Characteristics of BEB-Type Triblock Copolymers," *Macromolecules*, Communication, **29**, 3663 (1996).
13. Li-Zhi Liu, Fengji Yeh and Benjamin Chu, "Synchrotron SAXS Study of Crystallization and Microphase Separation in Compatible Mixtures of Tetrahydrofuran-Methyl Methacrylate Diblock Copolymer and Polytetrahydrofuran," *Macromolecules*, **29**, 5336 (1996).
14. Guangwei Wu, Lizhi Liu, Vinh-Bao Buu, Benjamin Chu and Dieter K. Schneider, "SANS and SAXS Studies of Pluronic L64 in Concentrated Solution," *Physica A*, **231**, 73 (1996).
15. Zukang Zhou, Yung-Wei Yang, Colin Booth and Benjamin Chu, "Association of a Triblock Ethylene Oxide (E) and Butylene Oxide (B) Copolymer ($B_{12}E_{260}B_{12}$) in Aqueous Solution," *Macromolecules*, **29**, 8357 (1996).
16. Eugene L. Sokolov, Fengji Yeh, Alexei Khokhlov and Benjamin Chu, "Nano-Scale Supramolecular Ordering in Gel-Surfactant Complexes: Sodium Alkyl Sulfates in Poly (Diallyldimethylammonium) Chloride," *Langmuir*, **12**, 6229 (1996).
1997. 17. I. A. Nyrkova, A. N. Semenov, A. R. Khokhlov, K. Linliu and B. Chu, "Motion of a Probe Ball in the Fluid Under Centrifugal Acceleration," *J. Phys. II France*, **7**, 1709 (1997).
1998. 18. Tianbo Liu, Zukang Zhou, Chunhung Wu, Vaughn M. Nace and Benjamin Chu, "Dominant Factors on the Micellization of $B_nE_mB_n$ -Type Triblock Copolymers in Aqueous Solution," *J. Phys. Chem. B*, **102**, 2875 (1998).
19. Fengji Yeh, Eugene L. Sokolov, Thomas Walter and Benjamin Chu, "Structure Studies of Poly(diallylmethylammonium chloride) Gels and Its Surfactant

Complex," *Langmuir*, submitted for publication.

Inventions

1. Benjamin Chu and Chunhung Wu, "A New Separation Medium for Capillary Electrophoresis"; new patent application filed on September 4, 1996, Research Foundation Reference: R-7142. Docket: 178-215.
2. Benjamin Chu, Pierre Dresco and Vladimir Zaitsev, "Controlled Size Polymeric Microspheres with Superparamagnetic Cores"; patent is being filed, Research Foundation Reference: R-7215. Docket: 178-230.

Scientific Personnel

Prof. Ben Chu	-	Principal Investigator (1 month -summer)
Mr. James Hanke	-	Graduate Student (M.S., 19
Mr. Pierre Dresco	-	Graduate Student (M.S., 19
Mr. Jean Rousseau	-	Graduate Student (Ph.D.,
Mr. Paul Harney	-	Graduate Student (Ph.D.
Dr. Zukang Zhou	-	Sr. Research Scientist (50%)
Ms. Jane Wainio	-	Project Staff Assistant (20%)