

OFFICE OF NAVAL RESEARCH  
END-OF-THE-YEAR REPORT  
PUBLICATIONS/PATENTS/PRESENTATIONS/HONORS/STUDENTS REPORT  
for

GRANT NO: N00014-98-1-0244

PR NO: 98PR03337-00

01/01/98 - 07/06/98

Title: Polymeric Gels as an Environment for Electrochemistry.

PI: Malgorzata Ciszowska

City University of New York, Brooklyn College

Brooklyn College, CUNY  
Department of Chemistry  
2900 Bedford Ave.  
Brooklyn, NY 11210-2889

July 6, 1998

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PUBLICATIONS/PATENTS/PRESENTATIONS/HONORS REPORT

PR Number: 98PR03337-00

Contract/Grant Number: N00014-98-1-0244

Contract/Grant Title: Polymeric Gels as an Environment for Electrochemistry.

Principal Investigator: Malgorzata Ciszewska

Mailing Address: Brooklyn College, City University of New York  
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- a. Number of papers submitted to refereed journals, but not published:   0
- b. + Number of papers published in refereed journals (for each, provide a complete citation):   0
- c. + Number of books or chapters submitted, but not yet published:   0
- d. + Number of books or chapters published (for each, provide a complete citation):   0
- e. + Number of printed technical reports/non-refereed papers (for each, provide a complete citation):   0
- f. Number of patents filed:   0
- g. + Number of patents granted (for each, provide a complete citation):   0
- h. + Number of invited presentations (for each, provide a complete citation):   1    
M. Ciszewska, 193<sup>th</sup> Meeting of The Electrochemical Society, San Diego, CA, May, 1998.  
"Transport of Ions and Molecules in Polymeric Gels".
- i. + Number of submitted presentations (for each, provide a complete citation):   1    
M. D. Guillaume, M. Ciszewska, 46<sup>th</sup> Annual Undergraduate Research Symposium, New York Section of the American Chemical Society, New York, NY, May 2, 1998.  
"Voltammetry with Microelectrodes in Transport Studies in Polymeric Gels".
- j. + Honors/Awards/Prizes for contract/grant employees (list attached):   0    
(This might include Scientific Society Awards/Offices, Selection as Editors, Promotions, Faculty Awards/Offices, etc.)
- k. Total number of Full-time equivalent Graduate Students, Post-Doctoral associates and Undergraduate Students supported during this period, under this PR number:   0.4    
Graduate Students:   0.2    
Post-Doctoral Associates:   0    
Undergraduate Students:   0.2

including the number of,

Female Graduate Students:   0  

Female Post-Doctoral Associates:   0  

Female Undergraduate Students:   0.2  

the number of

Minority\* Graduate Students:   0  

Minority\* Post-Doctoral Associates:   0  

Minority\* Undergraduate Students:   0.2  

and, the number of

Asian Graduate Students:   0  

Asian Post-Doctoral Associates:   0  

1. + Other funding (list agency, grant title, amount received this year, total amount, period of performance and a brief statement regarding the relationship of that research to your ONR grant)

PSC-CUNY Award # 668623; 02/01/98 - 12/31/98; \$ 5,400; "Conformational Transitions of Ionic Polymers. Electroanalytical Studies"; no relation to the ONR grant.

+ Use the letter and an appropriate title as a heading for your list, e.g.: b. Published Papers in Refereed Journals, or, d. Books and Chapters published. Also submit the citation lists as ASCII files via email or via PC-compatible floppy disks

\* Minorities include Blacks, Aleuts, AmIndians, Hispanics, etc. NB: Asians are not considered an under-represented or minority group in science and engineering.

OFFICE OF NAVAL RESEARCH

END-OF-THE-YEAR REPORT - PART II.

- a. Principle Investigator: Dr. Malgorzata Ciszowska  
Grant No: N00014-98-1-0244
- b. Current Telephone Number: 718-951-5456; E-mail: malgcisz@brooklyn.cuny.edu
- c. ONR Program Officer: Dr. Richard T. Carlin
- d. Program Objectives: Study of : (1) transport of ions and molecules in polymeric gels; (2) volume phase transitions of gels and their influence on the transport properties of ions and molecules; (3) electrochemical generation of volume phase transitions of polymer gels.
- e. Significant Results During Last Year (note, this project has been in effect since January 1998):  
Transport of ions and molecules in polymeric gels was investigated using steady-state voltammetry at microelectrodes. The polymeric systems under study were poly(acrylic acid), PAA, agarose and iota-carrageenan, *i-car*. These neutral (agarose) and anionic polymers (PAA, *i-car*) form thermoreversible hydrogel networks. Aggregation of the polymer units to gel networks results in a dramatic changes of macroscopic viscosity. We used the neutral electroactive radical 2,2,6,6-tetramethyl-1-piperidinyloxy, TEMPO, in polymeric gels and solutions to probe the local viscosity changes during the gelation process. We have determined the diffusion coefficient of TEMPO in all gels and simple solutions without polymer. Since the PAA and *i-car* gels are negatively charged we investigated the transport of probe cations as a measure of strong attractive electrostatic interactions. We have determined diffusion coefficient for a monovalent cation,  $Tl^+$ , from transport-limited currents at mercury microelectrodes. We have correlated the transport properties of  $Tl^+$  with the charge densities of the polymers. The dependence of the transport of ions in the PAA and *i-car* gels on electrostatic interactions between the polymer network and the probe cations was investigated as a function of the concentration of the polymer, charge of probe ions, ionic strength of the gel and temperature.
- f. Summary of Plans for Next Years Work:  
In the transport studies in polymeric gels we will focus on: (1) the dependence of the transport of ions in gels on the charge of the diffusing ions and the charge density of polymers; (2) the influence of the size of molecules and ions on their transport in gels. We will synthesize thermo- and pH-responsive gels, and will establish electroanalytical procedures to study the volume phase transitions of those "smart" gels. We will also investigate the possibility of the electrochemical generation of volume phase transitions of polymeric "smart" gels.
- g. List of Students and Post-Doctoral Associates Currently Working on the Project:  
Graduate Students: Wojtek Hyk  
Undergraduate Students: Melissa D. Guillaume  
Post-Doctoral Associates: none

Dr. Malgorzata Ciszowska  
Assistant Professor  
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Department of Chemistry

July 6, 1998

Defense Technical Information Ctr  
8725 John J. Kingman Road  
STE 0944  
Ft. Belvoir, VA 22060-6218

Dear Madam/Sir:

Enclosed you will find two copies of my End-of-the-Year Report for the ONR grant  
No: N00014-98-1-0244.

Thank you for your attention.

Sincerely,

Malgorzata Ciszowska  
Assistant Professor