OFFICE OF NAVAL RESEARCH

Grant or Contract N00014-89-J-1590

R&T Code 413m012

Technical Report No. 9

Characterization of Polymer Interphases Using Surface-Enhanced Raman Scattering

by

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Presented

at

Materials Research Society
San Francisco, CA
April 16-20, 1990

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and Engineering
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Cincinnati, OH 45221-0012

June 1, 1990

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION None	1b. RESTRICTIVE MARKINGS None
2a. SECURITY CLASSIFICATION AUTHORITY None	3. DISTRIBUTION / AVAILABILITY OF REPORT This document has been approved for public release and sale; its distribution is unlimited.
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE None	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) Technical Report #9	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION University of Cincinnati 6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION Office of Naval Research
6c. ADDRESS (City, State, and ZIP Code) Department of Materials Science Cincinnati, OH 45221-0012	7b. ADDRESS (City, State, and ZIP Code) 800 North Quincy Street Arlington, VA 22217
8a. NAME OF FUNDING / SPONSORING ORGANIZATION Office of Naval Research 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER N00014-89-J-1590
8c. ADDRESS (City, State, and ZIP Code) 800 North Quincy Street Arlington, VA 22217	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO.: N00014-89 / PROJECT NO.: J-1590 / TASK NO.: 413m012 / WORK UNIT ACCESSION NO.:

11. TITLE (Include Security Classification)
Characterization of Polymer Interphases Using Surface-Enhanced Raman Scattering

12. PERSONAL AUTHOR(S)
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13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Technical Report	FROM _____ TO _____	June 1, 1990	2

16. SUPPLEMENTARY NOTATION
Presented at Materials Research Society, San Francisco, CA, April 16-20,1990

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Polymer Interphases, Surface-Enhanced Raman Scattering, Metal Structures, Thin Films, RAIR, SERS, Polyimides, Spectroscopy (JB)

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

Surface-enhanced Raman scattering (SERS) and reflection-absorption infrared spectroscopy (RAIR) were used to determine the molecular structure of interphases between polymers and metal substrates. An interesting example was provided by pyromellitic diimide (PMDI), a model compound for polyimides, and silver substrates. Normal Raman spectra of PMDI were characterized by strong bands near 1772, 1370, 760, and 655 cm^{-1} and medium intensity bands near 1630 and 1205 cm^{-1} were weak in SERS spectra obtained from films of PMDI spin-coated onto silver island films while those near 1370 and 1205 cm^{-1} and a new band near 685 cm^{-1} were strongest. Differences between the normal Raman and SERS spectra were related to orientation effects indicating that PMDI was adsorbed onto silver with a vertical conformation in which the rings were perpendicular to the surface and one imide group was in contact with the surface. SERS spectra were independent of PMDI film

20. DISTRIBUTION / AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION Unclassified
22a. NAME OF RESPONSIBLE INDIVIDUAL Dr. Joann Milliken	22b. TELEPHONE (Include Area Code) (202)696-4410 22c. OFFICE SYMBOL

DD FORM 1473, 84 MAR 83 APR edition may be used until exhausted. All other editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE

19. Abstract (continued)

thickness due to the short range of the SERS enhancement. However, RAIR spectra obtained from PMDI films spin-coated onto thick silver films did depend on PMDI film thickness. RAIR spectra obtained from thick PMDI films were similar to transmission infrared spectra of PMDI but spectra of thin films were different, again indicating that there was a preferred orientation of the molecules closest to the surface.

DOCUMENTLESS INPUT per Dr. J. Milliken
ONR/Code 1114
TELECON 6/11/90 VG