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FINAL REPORT

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## INTRODUCTION

A great deal of research work and significant achievements have been made on the effects of hydrostatic pressure on various aspects of physical and mechanical properties of polymers. The areas of interests included high pressure x-ray studies, high pressure DTA studies, high pressure effects on mechanical properties, pressure-volume-temperature relations, high pressure crystallization, and high pressure effects on piezoelectricity and pyroelectricity. The results of the research have been published in ONR Technical Reports and numerous journal publications as listed below.

## PERSONNEL

### Coprincipal Investigators

Professor K. D. Pae

Professor B. A. Newman

Professor J. I. Scheinbeim

### Ph. D. Students

T. P. Sham

C. H. Yoon

K. T. Chung

D. L. Questad

K. Vijayan

R. W. Renfree

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## TECHNICAL REPORTS

### Technical Report No. 1

The Structure and Properties of Crystalline Polymers at High Pressure.

### Technical Report No. 2

The Effects of Molecular Weight on the Pressure-Dependent Mechanical Properties of Polypropylene.

### Technical Report No. 3

A Pressure Calibration for the Diamond-Anvil Cell in the Range 0-15 Kbars.

### Technical Report No. 4

An X-ray Study of Polyethylene at Pressures up to 14,000 kg/sq cm at 298 K.

### Technical Report No. 5

The Macroscopic Yielding Behavior of Polymers in Multiaxial Stress Fields.

### Technical Report No. 6

High Pressure X-Ray Studies of Polymers. I.  
Pressure Calibration for the Diamond-Anvil Cell in the Range 0-15 Kbars.

### Technical Report No. 7

High Pressure X-Ray Studies of Polymers. II.  
Variations of Pressure with Temperature in the Diamond-Anvil Cell.

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Phase Transformation of Polyethylene.

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Effects of Hydrostatic Pressure on Shear Deformation of Polypropylene and Polyoxymethylene.

### Technical Report No. 10

High Pressure X-Ray Studies of Nylon 11.

### Technical Report No. 11

A High Pressure X-Ray Study of Poly(vinylidene fluoride), Phase II.

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High Pressure Crystallization of Poly(vinylidene fluoride).

### Technical Report No. 13

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Technical Report No. 16

Pressure Dependence of Glass Transition and Related Properties of Solithane 113 Elastomer.

Technical Report No. 17

Pressure-Volume-Temperature Studies of a Polyurethane Elastomer.

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The Pressure Dependence of the Pyroelectric Response of Poly(vinylidene fluoride) Films.

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Piezoelectricity in Nylon 11.

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Piezoelectric and Pyroelectric Properties of Poly(vinylidene fluoride) Films at High Hydrostatic Pressure.

Technical Report No. 22

Viscoplastic Behavior of a Glass at High Pressure.

Technical Report No. 23

The Poling Field and Draw Dependence of the Piezoelectric and Pyroelectric Response of Pressure Quenched Phase I Poly(vinylidene fluoride) Films.

Technical Report No. 24

Polarization Mechanisms in Phase II Poly(vinylidene fluoride) Films.

Technical Report No. 25

Mechanical and Physical Properties of Poly(vinylidene fluoride) at High Pressures and Temperatures.

Technical Report No. 26

High Pressure Melting and Crystallization of Nylon 11.

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4. "High Pressure X-Ray Studies of Polymers, Part II: Variation of Pressure with Temperature in the Diamond Anvil Cell," J. Mat. Sci., 12, 1697(1977) (Coauthors B. A. Newman and T. P. Sham).
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13. "The Pressure Dependence of the Pyroelectric Response of Poly(vinylidene fluoride) Films," J. Appl. Phys., 51, 5106 (Coauthors J. I. Scheinbeim, K. T. Chung, and B. A. Newman).

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