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**DYNAMIC PROPERTIES OF MATERIALS**

**PART I. POLYMERS**

**BOSTON UNIVERSITY**

**PREPARED FOR**

**ARMY MATERIALS AND MECHANICS RESEARCH CENTER**

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FOREWORD

This report describes the work performed by the Department of Aerospace Engineering, Boston University, for the Army Materials and Mechanics Research Center (AMMRC), Watertown, Massachusetts, under Contract No. DAAG-46-73-C-0181. The Contracting Officer Representative at AMMRC was Dr. S. C. Chou. The program was supervised by Professor M. M. Chen at Boston University.

## Dynamic Properties of Polymers

by

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### ABSTRACT

A survey of literature on the mechanical behavior of polymers subject to dynamic loads in a wide temperature range has been made. The data showing the variation of yield strength, and elongation with strain rates and temperatures were tabulated and plotted; the results obtained from tension and compression modes of loading are graphed separately. A comprehensive reference section is provided.

It is observed that the behavior of polymers under dynamic loading is different from static loading. The yield strengths are generally higher under dynamic loading than the static ones and they decrease with an increase of temperature.

### INTRODUCTION

In the advent of recent advancement in plastic technology, various polymeric materials are being introduced into industrial and military use. Consequently, the precise knowledge

about their mechanical properties is highly desirable. The purpose of this survey is to obtain the experimental data on mechanical properties of polymers available in the literature, including the effects of strain rate and temperature. The pertinent data are compiled, converted if necessary, and plotted. This study is not intended as a critical review, but merely serves as a source of information on the dynamic properties of polymers.

The dynamic properties of polymers are highly dependent on strain rate and temperature. They have been studied, primarily in terms of the variance of yield strengths with strain rate. The general behavior of polymers may be classified in four distinct modes as shown in Fig. A and the yield strengths for each mode are as follows:

- a) Brittle Modes - Brittle failure sets in before yielding (OF) - The yield stress is the failure load divided by the initial cross-sectional area.
- b) Brittle-Ductile Mode - The yield stress is taken as the peak or maximum stress on the stress-strain curve. In this mode, the failure follows shortly after yielding ( $AF_1$ ).
- c) Ductile Mode - There are two yielding levels ( $AF_2$ ). The yield stress is taken as the maximum stress on the stress-strain curve.
- d) Homogeneous Mode - There is no typical yielding characteristic ( $AF_3$ ). This mode seems to occur at high temperatures and in the region of glass transition

temperature for some materials (e.g., see L-2)\*. In this case, the yield stress, B, is the stress obtained at the intersection of a 2% strain line parallel to the initial slope of the stress-strain curve (e.g., L-1).

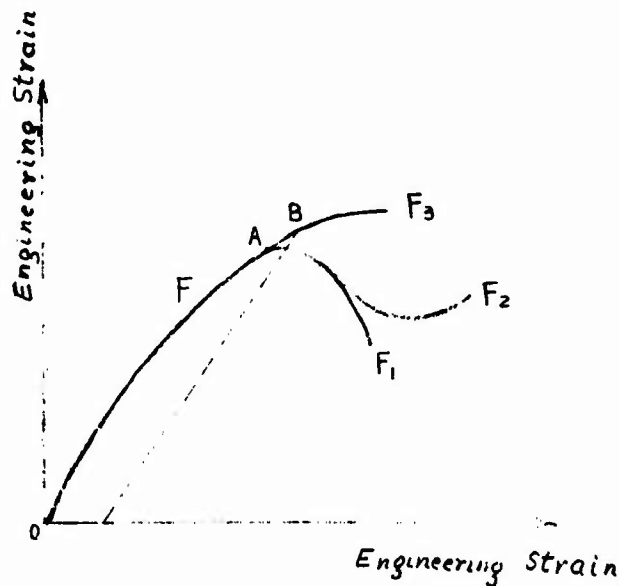


Figure A

In the tables of experimental results, the above four definitions were used when the yield stress was taken from the stress-strain curves. The method of measuring strain rate is identified in the remarks column whenever it is available. It should be noted that most of the tests conducted in this survey were at temperatures between  $-50^{\circ}$  and  $150^{\circ}$ F.

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\* Letter and number in the parenthesis indicates the reference number.

It is observed that in general, the yield strength,  $\sigma_y$ , varies linearly with  $\log \dot{\epsilon}$ , and that the slope of  $\sigma_y - \log \dot{\epsilon}$  curve varies with the temperature. The interdependence of strain rate and temperature is often expressed as a "shift factor",  $a_T$ . The factor  $a_T$  implies the horizontal shift of the data points which represent the plot of yield strength versus strain rate at a temperature corresponding to the data points at reference temperature. The shift factor given by the Williams, Landel and Ferry (WLF) equation\* in its modified form is:

$$\log a_T = - \frac{8.86 (T - T_S)}{101.6 + T - T_S} \quad (1)$$

where  $T_S$  denotes reference temperature and  $T_g$  is the glass transition temperature ( $T_S = T_g + 50^\circ \text{C}$ ). Equation (1) is applicable for the temperature range between  $T_g$  and  $T_g + 100^\circ \text{C}$ . Outside this region, the shift factor of glassy and highly crystalline polymers is calculated from an equation of the Arrhenius form:

$$\log a_T = \frac{H_a}{R} \left( \frac{1}{T} - \frac{1}{T_0} \right) \quad (2)$$

---

\* See, e.g., Ferry, J.D., Viscoelastic Properties of Polymers, John Wiley & Sons, Inc., New York, 1961.

where  $H_a$  is the activation energy for the particular transition of interest,  $\bar{R}$  is universal gas constant, and  $T_0$  is the temperature selected arbitrarily as reference. The Arrhenius equation is not used in the glass transition region because in this region, the activation energy is a strong function of temperature. When the rigidity of the molecular backbone reaches some limit, a new superposition procedure is needed which involves a vertical shift.

Using the shift factor,  $a_T$ , the major portion of the curve showing the relationship of the yield stress versus strain rate times a temperature dependent constant may be represented by an equation of the form:

$$\sigma_Y = K_1 + K_2 \ln[(\dot{\epsilon}/\dot{\epsilon}_1)a_T] \quad (3)$$

where  $\sigma_Y$ ,  $\dot{\epsilon}$ , and  $a_T$  are yield strength, strain rate and shift factor, respectively,  $K_1$  and  $K_2$  are constants which depend on the type of material and on the reference temperature, and  $\dot{\epsilon}_1$  is equal to 1 in/in/min.

### RESULTS AND DISCUSSION

In this report, the test results obtained from tension, compression, and torsion modes of loading are, in most cases, plotted separately. The data are not only influenced by the mode of loading, but also are affected by the type apparatus used for the test. Properties may vary with specimen preparation such as heat treatment and the environment of testing

such as humidity, etc. It should be noted that the treatment of test results in the literature are generally not standardized. It was also shown that different data were obtained by different investigators for a similar test arrangement and material. This is partly due to the high degree of sensitivity exhibited by many plastics to the rate of strain and to their environmental conditions.

The elongation in tension tests is reported as the percentage of elongation at break. The experimental data listed in the tables, give both tension and compression as positive values.

For most data collected, the strain rate is held constant during the tests. However, when the strain rate is specified by any other method, the information is provided in the tables. If the strain rates are calculated from the cross-head speed, then the approximate strain rate is obtained by dividing the cross-head speed by the gage length. This approximation has been used for a maximum engineering strain of 20% (C-2).

In general, the dynamic yielding strengths are higher than the yielding strength under the static loads. They also decrease with an increase in temperature.

The List of Investigations summarizes the pertinent information obtained from the survey. Tables 1-9 provide the dynamic properties for various polymers and Figures 1-10 show the variation of yield strength vs. strain rate for a wide temperature range. Literature whose data were not used in the tabulation are listed in the Bibliography.

It is expected that this report be used as a source for quantitative information for design purposes and future research.

LIST OF INVESTIGATIONS

<u>Material</u>	<u>T (°F)</u>	<u><math>\dot{\epsilon}</math> (/sec)</u>	<u>Type of Test</u>	<u>Ref.</u>	<u>Date</u>
PC (Makrolon Bayer)	70.7-284	$8.3 \times 10^{-6} - 2.1 \times 10^{-1}$	tension	B-2	1969
PC (Makrolon Bayer)	212-311	$8.3 \times 10^{-6} - 2.1 \times 10^{-1}$	tension	B-3	1969
PC (Makrolon Bayer)	-220-73.4	$4.16 \times 10^{-5} - 2.1 \times 10^{-1}$	tension	B-4	1972
PC (Makrolon Bayer)	-193-257	$4.16 \times 10^{-3}$	tension	B-4	1972
PC (Makrolon Bayer)	-193-257	$4.16 \times 10^{-3}$	compression	B-4	1972
CAB (cellulose acetate butyrate) Lexan PC resin	72 73.4-302	$2 \times 10^{-4} - 1.05 \times 10^3$ $1.67 \times 10^{-2}, 1.67 \times 10^{-1}$	compression tension	C-2 G-2	1972 1963
PC	room	$8.3 \times 10^{-1}, 8.3 \times 10^1$	tension	P-2	1963
PC (Zelux)	room	$2 \times 10^{-3} - 1.03 \times 10^3$	compression	T-1	1963
PE	74.3	$3.3 \times 10^{-4} - 1.43 \times 10^2$	tension	A-1	1960
PE (linear)	74.3	$3.3 \times 10^{-4} - 6.7 \times 10^{-1}$	tension	A-1	1960
Amorphous PE terephthalate	74.3	$1.67 \times 10^{-4} - 3.3 \times 10^{-1}$	tension	A-1	1960
Mylar C Polyester	74.3	$3.3 \times 10^{-4} - 1.54 \times 10^2$	tension	A-1	1960
Mylar, Saran-coated	74.3	$3.3 \times 10^{-4} - 1.58 \times 10^2$	tension	A-1	1960
PE (linear)	-166- -76	$5.25 \times 10^{-2} - 8.86 \times 10^2$	torsion	B-1	1970
PE (high density)	-40--4	$5.25 \times 10^{-2} - 8.86 \times 10^2$	torsion	B-1	1970
PE (branched) (low density)	-166-75.2	$1.05 \times 10^{-1} - 8.86 \times 10^2$	torsion	B-1	1970
PE (type I-A)	70	$3.3 \times 10^{-2} - 7.3 \times 10^2$	tension	D-1	1963
PE (type I-P)	70	$3.3 \times 10^{-2} - 6.5 \times 10^2$	tension	D-1	1963
PE (type-II-A)	70	$4.17 \times 10^2 - 8.17 \times 10^2$	tension	D-1	1963
PE (type II-P)	70	$2.83 \times 10^2 - 6.38 \times 10^2$	tension	D-1	1963

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u>Type of Test</u>	<u>Ref.</u>	<u>Date</u>
PE (Bakelite DYNH 1-3)	-58-158	$3.33 \times 10^{-4}$ - $2.67 \times 10^1$	tension	E-1	1958
PE (Dupont Surlyn A)	-65-70	$8.5 \times 10^{-3}$ - $4.58 \times 10^{-2}$	tension	J-1	1969
PE (high density)	room	$1.67 \times 10^{-4}$ - $1.67 \times 10^{-1}$	tension	K-2	1973
PE (low density)	room	$1.67 \times 10^{-3}$	tension	K-2	1973
PE (mylar terephthalate)	-34.6-266	$4.16 \times 10^{-5}$ - $5.33 \times 10^{-2}$	tension	L-2	1965
PE film	room	$4.27 \times 10^0$ - $8.67 \times 10^1$	tension	P-1	1961
PE (linear) (Marlex 50-Tape 40)	73.4	$3.3 \times 10^{-3}$ - $3.3 \times 10^1$	tension	S-1	1964
PE (low density) (Monsanto 406)	73.4	$3.3 \times 10^{-3}$ - $3.3 \times 10^1$	tension	S-1	1964
PE (high density)	73.4	$3.3 \times 10^{-3}$ - $3.3 \times 10^1$	tension	S-1	1964
PE (high density)	room	$2.7 \times 10^{-3}$ - $1 \times 10^2$	tension	W-1	1970
PE (low density)	room	$2.7 \times 10^{-3}$ - $1 \times 10^2$	tension	W-1	1970
PEMA	95-176	$7.5 \times 10^{-6}$ - $1.2 \times 10^1$	tension	R-2	1965
ABS	-40-140	$4.17 \times 10^{-3}$ - $4.17 \times 10^{-1}$	tension	I-1	1970
ABS (lustran 461)	room	$4.5 \times 10^{-1}$ - $2.08 \times 10^1$	tension	L-4	1963
PMMA (commercial I.C.I. Perspex)	-53,71.6,158	$2.5 \times 10^{-4}$ - $1.6 \times 10^{-2}$	compression	B-5	1970
PMMA	72	$2 \times 10^{-4}$ - $7.6 \times 10^2$	compression	C-2	1972
PMMA (Plexiglas)	104	$4.17 \times 10^{-4}$ - $3.3 \times 10^{-3}$	tension	D-2	1948
Commercial Methyl Methacrylate	room	$5.14 \times 10^{-3}$ - $3.15 \times 10^0$	compression	D-2	1948

<u>Material</u>	<u>T(° F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u>Type of Test</u>	<u>Ref.</u>	<u>Date</u>
Commercial Methyl Methacrylate	room	$4.23 \times 10^{-4} - 5.73 \times 10^{-3}$	tension	D-2	1948
PMMA (plexiglas IA-UVA)	76	$5 \times 10^{-5} - 1.83 \times 10^1$	tension	E-1	1958
PMMA (Commercial Plexiglas II)	32-239	$4.8 \times 10^{-5} - 7.6 \times 10^3$	compression	H-3	1963
PMMA	-58-167	$1.67 \times 10^{-5} - 1.67 \times 10^{-2}$	tension	K-1	1955
PMMA-G (Plexiglass G)	-68-239	$1.67 \times 10^{-4} - 5 \times 10^0$	tension	L-2	1965
PMMA (Plexiglass UVA II)	-58-194	$4.83 \times 10^{-5} - 4.83 \times 10^{-2}$	tension	L-3	1963
PMMA (Rohm & Haas Plexiglas)	74.8-185.5	$3.3 \times 10^{-3}$	tension	M-1	1972
PMMA	32-122	$1.67 \times 10^{-5} - 1.67 \times 10^{-2}$	tension	M-2	1952
PMMA	86-194	$8.4 \times 10^{-7} - 2.9 \times 10^0$	tension	R-1	1965
Lucite (Methyl Methacrylate)	room	$0 - 5.9 \times 10^2$	compression	T-1	1963
PS	74.3	$1.67 \times 10^{-2} - 1.67 \times 10^{-1}$	tension	A-1	1960
PS (Atactic PS)	-350-71.6	$2.1 \times 10^{-4} - 1.2 \times 10^{-2}$	compression	A-2	1968
PS (Amorphous Polystyrene)	68-176	$1.9 \times 10^{-4} - 5 \times 10^{-2}$	compression	B-5	1970
PS (Atactic PS)	104-176	$6.7 \times 10^{-5} - 6.7 \times 10^{-2}$	compression	B-6	1971
PS	73.4, 125.6	$1.67 \times 10^{-5} - 5.6 \times 10^{-2}$	tension	C-1	1952
PS	room	$1.67 \times 10^{-4} - 1.67 \times 10^{-2}$	tension	D-2	1948
PS (Lustron)	room	$3.3 \times 10^{-5} - 7.5 \times 10^{-3}$	tension	D-2	1948
Heat-resistant PS (lustrex)	room	$4 \times 10^{-5} - 5.8 \times 10^{-3}$	tension	D-2	1948
GP-PS	-168-149	$1 \times 10^{-5} - 1 \times 10^{-3}$	compression	H-2	1971

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u>Type of Test</u>	<u>Ref.</u>	<u>Date</u>
PS	77	$1.19 \times 10^{-5}$ - $7.12 \times 10^{-4}$	compression	H-4	1951
High Impact PS (Styron 475s)	-40-104	$4.17 \times 10^{-3}$ - $4.17 \times 10^{-2}$	tension	I-1	1970
PS	-34.6-203	$1.1 \times 10^{-4}$ - $5 \times 10^0$	tension	L-2	1965
Rubber-modified PS (Lustrex HT 88-1)	room	$4.8 \times 10^{-1}$ - $2.33 \times 10^1$	tension	L-4	1963
PP (Atactic PP)	-148- -4	$5.25 \times 10^{-1}$ - $8.88 \times 10^2$	torsion	B-1	1970
PP	72	$2 \times 10^{-4}$ - $1.5 \times 10^3$	compression	C-2	1972
Isotactic PP	20-96	$3.3 \times 10^{-4}$ - $4.9 \times 10^2$	tension	H-1	1961
Isotactic PP	50-230	$7 \times 10^{-6}$ - $1 \times 10^1$	tension	R-3	1966
Crystalline PP (Profax)	73.4	$3.3 \times 10^{-3}$ - $3.3 \times 10^1$	tension	S-1	1964
PVC (Solvic 227)	-58-158	$8.33 \times 10^{-6}$ - $2.08 \times 10^{-1}$	tension	B-2	1969
" "	122-185	$2.08 \times 10^{-5}$ - $2.08 \times 10^{-1}$	tension	B-3	1969
PVC-rubber blends (Geon 103 Ep)	-40-140	$4.16 \times 10^{-3}$ - $4.16 \times 10^{-1}$	tension	I-1	1970
PVC	-34.6-149	$5.83 \times 10^{-5}$ - $5 \times 10^0$	tension	L-2	1965
PVC	room	$8.33 \times 10^{-1}$ - $8.33 \times 10^1$	tension	P-2	1963
PVC (rigid) Type I	room	$2.7 \times 10^{-3}$ - $1 \times 10^2$	tension	W-1	1968
PVC Type II	room	$2.7 \times 10^{-3}$ - $1 \times 10^2$	tension	W-1	1968
PVC Type "1 1/2"	room	$2.7 \times 10^{-3}$ - $1 \times 10^2$	tension	W-1	1968
PVC Type I Special	room	$2.7 \times 10^{-3}$ - $1 \times 10^2$	tension	W-1	1968
PVC (hard) (Halvic 239)	-34.6-149	$8 \times 10^{-5}$ - $8.5 \times 10^{-2}$	tension	Z-1	1970
Nylon 6-6	72	$2 \times 10^{-3}$ - $1.25 \times 10^3$	compression	C-2	1972
Nylon-6(A)	-184-311	$5.5 \times 10^{-3}$ - $2.3 \times 10^2$	tension	G-1	1971

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u>Type of Test</u>	<u>Ref.</u>	<u>Date</u>
Nylon-6(E)	-184-311	$5.5 \times 10^{-3}, 2.3 \times 10^2$	tension	G-1	1971
Amorphous nylon (Dupont Zytel 63)	room	$1.43 \times 10^{-2}, 7.48 \times 10^{-2}$	tension	J-1	1969
Nylon(Dupont Type 101)	-148-302	$5 \times 10^{-4} - 5 \times 10^{-1}$	tension	L-1	1965
Nylon	room	$2 \times 10^{-3} - 8.6 \times 10^2$	compression	T-1	1963

TABLE 1 DYNAMIC PROPERTIES OF ACRYLONITRILE-BUTADIENE-STYRENE (ABS)

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_Y</math>(psi)</u>	<u>Elong. (%)</u>	<u>Ref.</u>	<u>Remarks</u>
ABS	-40	$4.17 \times 10^{-3}$	6910	27.3	I-1	Read from ( $\sigma_Y$ , Tension $\tau$ ) curves
		$4.17 \times 10^{-2}$	7440	19.3		
		$4.17 \times 10^{-1}$	7460	18.2		
	-4	$4.17 \times 10^{-3}$	6490	34.1		
		$4.17 \times 10^{-2}$	6910	20.5		
		$4.17 \times 10^{-1}$	7110	18.6		
	32	$4.17 \times 10^{-3}$	5780	54.8		
		$4.17 \times 10^{-2}$	6230	35.7		
		$4.17 \times 10^{-1}$	6630	30.		
	68	$4.17 \times 10^{-3}$	5030	29.5		
		$4.17 \times 10^{-2}$	5400	53.4		
		$4.17 \times 10^{-1}$	5780	41.1		
	104	$4.17 \times 10^{-3}$	4380	12.5		
		$4.17 \times 10^{-2}$	4730	23.9		
		$4.17 \times 10^{-1}$	4850	50.		
140	$4.17 \times 10^{-3}$	3140	30.			
	$4.17 \times 10^{-2}$	3650	44.3			
	$4.17 \times 10^{-1}$	4100	58.			
ABS	room	$4.5 \times 10^{-1}$	7330	17.6	L-4	Read from ( $\sigma_Y$ , Tension $\dot{\epsilon}$ ) curve Lustran 461
		$4.5 \times 10^0$	8050	15.3		
		$2.08 \times 10^1$	8950	15.8		

TABLE 2 DYNAMIC PROPERTIES OF NYLON

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_Y</math>(psi)</u>	<u>Elong.</u>	<u>Ref.</u>	<u>Remarks</u>
Nylon 6-6	72	$2 \times 10^{-3}$	10200		C-2 Comp.	2% offset Read from ( $\sigma, \epsilon$ ) curves (true stress)
		$2 \times 10^{-2}$	11100			
		$2 \times 10^{-1}$	13200			
		$3 \times 10^0$	13700			
		$5 \times 10^1$	14600			
		$1.25 \times 10^3$	21900			
Nylon-6	-184	$5.5 \times 10^{-3}$	27600		G-1 Tension	Hyrosoluble content 1.5 wt% (A) Read from ( $\sigma, \epsilon$ ) curves Polycaprolactam All specimens were obtained by injection molding at a mold temp. 176°F, oven conditioned in vacuo at 140°F for 48 hrs. & stored in vacuo over CaCl <sub>2</sub> at 77°F
	-148	$5.5 \times 10^{-3}$	23900			
	-112	$5.5 \times 10^{-3}$	22500			
		$2.3 \times 10^2$	29900			
	-76	$5.5 \times 10^{-3}$	20800			
		$2.3 \times 10^2$	28400			
	-58	$5.5 \times 10^{-3}$	19900			
	-40	$5.5 \times 10^{-3}$	18800			
		$2.3 \times 10^2$	26800			
	-22	$5.5 \times 10^{-3}$	17650			
	-4	$5.5 \times 10^{-3}$	17050			
		$2.3 \times 10^2$	23800			
	32	$5.5 \times 10^{-3}$	15350			
		$2.3 \times 10^2$	21600			
	73.4	$5.5 \times 10^{-3}$	13080			
		$2.3 \times 10^2$	18200			
	104	$5.5 \times 10^{-3}$	10800			
		$2.3 \times 10^2$	15800			
122	$5.5 \times 10^{-3}$	7550				
140	$5.5 \times 10^{-3}$	5700				
	$2.3 \times 10^2$	11680				
176	$5.5 \times 10^{-3}$	3990				
	$2.3 \times 10^2$	7900				
212	$5.5 \times 10^{-3}$	3390				
	$2.3 \times 10^2$	5220				
248	$2.3 \times 10^2$	3670				
311	$2.3 \times 10^2$	2830				

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_y</math>(psi)</u>	<u>Elong.</u>	<u>Ref.</u>	<u>Remarks</u>
Nylon-6	-166	$5.5 \times 10^{-3}$	25400		G-1 Tension curve	Read from ( $\sigma, \epsilon$ ) Hydrosoluble content 8.8 wt% (E)
	-130	$5.5 \times 10^{-3}$	23000			
	-101.2	$5.5 \times 10^{-3}$	21170			
	-40	$5.5 \times 10^{-3}$	17500			
		$2.3 \times 10^2$	25150			
	-4	$5.5 \times 10^{-3}$	15650			
		$2.3 \times 10^2$	22300			
	32	$5.5 \times 10^{-3}$	11900			
		$2.3 \times 10^2$	21600			
	73.4	$5.5 \times 10^{-3}$	7550			
		$2.3 \times 10^2$	18200			
	104	$5.5 \times 10^{-3}$	6250			
		$2.3 \times 10^2$	15900			
	140	$5.5 \times 10^{-3}$	3840			
		$2.3 \times 10^2$	11400			
	176	$2.3 \times 10^2$	7550			
212	$5.5 \times 10^{-3}$	2850				
	$2.3 \times 10^2$	5400				
248	$2.3 \times 10^2$	3550				
311	$2.3 \times 10^2$	2770				
Amorphous Nylon	room	$1.4 \times 10^{-2}$	20000		J-1 Tension curve	Read from ( $\sigma, \epsilon$ ) Dupont Zytel 63 (2% effect)
		$3.6 \times 10^{-2}$	27000			
		$7.5 \times 10^{-2}$	31000			
Nylon	-148	$5 \times 10^{-4}$	23300		L-1 Tension (master curves)	Read from curves
		$5 \times 10^{-3}$	23400			
		$5 \times 10^{-2}$	25780			
		$5 \times 10^{-1}$	23300			
	-103	$5 \times 10^{-4}$	20400			
		$5 \times 10^{-3}$	21740			
		$5 \times 10^{-2}$	22200			
		$5 \times 10^{-1}$	24700			
	-58	$5 \times 10^{-4}$	16500			
		$5 \times 10^{-3}$	17200			
		$5 \times 10^{-2}$	22570			
		$5 \times 10^{-1}$	20740			

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_Y</math>(psi)</u>	<u>Elong.</u>	<u>Ref.</u>	<u>Remarks</u>
	-13	$5 \times 10^{-4}$	13570			
		$5 \times 10^{-3}$	14350			
		$5 \times 10^{-2}$	15650			
		$5 \times 10^{-1}$	16700			
	32	$5 \times 10^{-4}$	3700			
		$5 \times 10^{-3}$	10600			
		$5 \times 10^{-2}$	12000			
		$5 \times 10^{-1}$	12830			
	77	$5 \times 10^{-4}$	4000			
		$5 \times 10^{-3}$	5500			
		$5 \times 10^{-2}$	7170			
		$5 \times 10^{-1}$	6900			
	122	$5 \times 10^{-4}$	2960			
		$5 \times 10^{-3}$	3550			
		$5 \times 10^{-2}$	3740			
		$5 \times 10^{-1}$	4600			
	212	$5 \times 10^{-4}$	2350			
		$5 \times 10^{-3}$	2700			
		$5 \times 10^{-2}$	3090			
		$5 \times 10^{-1}$	3650			
	302	$5 \times 10^{-4}$	1950			
		$5 \times 10^{-3}$	2300			
		$5 \times 10^{-2}$	2650			
		$5 \times 10^{-1}$	3100			
Nylon	room	$2 \times 10^{-3}$	13900		T-1	Read from curves
		$5 \times 10^2$	18900		Comp.	( $\sigma, \epsilon$ )
		$8.6 \times 10^2$	23900			2% offset
						(Polyamide)
						$\dot{\epsilon}$ = mean strain rate

TABLE 3 DYNAMIC PROPERTIES OF POLYCARBONATE (PC)

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_Y</math>(psi)</u>	<u>Elong.</u> (%)	<u>Ref.</u>	<u>Remarks</u>
PC	70.7	$8.3 \times 10^{-6}$	8060		B-2	Read from ( $\sigma_Y$ , Tension $\dot{\epsilon}$ ) curves Makrolon Bayer $\dot{\epsilon}$ is calculated from crosshead speed
		$2.1 \times 10^{-5}$	8170			
		$4.2 \times 10^{-5}$	8380			
		$8.3 \times 10^{-5}$	8380			
		$2.1 \times 10^{-4}$	8620			
		$4.2 \times 10^{-4}$	8730			
		$8.3 \times 10^{-4}$	8920			
		$2.1 \times 10^{-3}$	8980			
		$4.2 \times 10^{-3}$	9080			
		$8.3 \times 10^{-3}$	9270			
		$2.1 \times 10^{-2}$	9460			
		$4.2 \times 10^{-2}$	9560			
		$8.3 \times 10^{-2}$	9700			
		$2.1 \times 10^{-1}$	9770			
	104	$8.3 \times 10^{-6}$	7280			
		$2.1 \times 10^{-5}$	7390			
		$4.2 \times 10^{-5}$	7440			
		$8.3 \times 10^{-5}$	7560			
		$2.1 \times 10^{-4}$	7680			
		$4.2 \times 10^{-4}$	7820			
		$8.3 \times 10^{-4}$	7920			
		$2.1 \times 10^{-3}$	8100			
		$4.2 \times 10^{-3}$	8110			
		$8.3 \times 10^{-3}$	8460			
		$2.1 \times 10^{-2}$	8460			
		$4.2 \times 10^{-2}$	8470			
		$8.3 \times 10^{-2}$	8740			
140	$2.1 \times 10^{-1}$	8900				
	$8.3 \times 10^{-6}$	6260				
	$2.1 \times 10^{-5}$	6490				
	$4.2 \times 10^{-5}$	6430				
	$8.3 \times 10^{-5}$	6740				
	$2.1 \times 10^{-4}$	6700				

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_Y</math>(psi)</u>	<u>Elong.</u> <u>(%)</u>	<u>Ref.</u>	<u>Remarks</u>
		$4.2 \times 10^{-4}$	6830			
		$8.3 \times 10^{-4}$	7030			
		$2.1 \times 10^{-3}$	7190			
		$4.2 \times 10^{-3}$	7310			
		$8.3 \times 10^{-3}$	7460			
		$2.1 \times 10^{-2}$	7640			
		$4.2 \times 10^{-2}$	7870			
		$8.3 \times 10^{-2}$	7910			
		$2.1 \times 10^{-1}$	8020			
	176	$8.3 \times 10^{-6}$	5420			
		$2.1 \times 10^{-5}$	5560			
		$4.2 \times 10^{-5}$	5560			
		$8.3 \times 10^{-5}$	5850			
		$2.1 \times 10^{-4}$	5990			
		$4.2 \times 10^{-4}$	6020			
		$8.3 \times 10^{-4}$	6280			
		$2.1 \times 10^{-3}$	6480			
		$4.2 \times 10^{-3}$	6480			
		$8.3 \times 10^{-3}$	6710			
		$2.1 \times 10^{-2}$	6880			
		$4.2 \times 10^{-2}$	6960			
		$8.3 \times 10^{-2}$	7240			
		$2.1 \times 10^{-1}$	7290			
	212	$2.1 \times 10^{-5}$	4390			
		$4.2 \times 10^{-5}$	4450			
		$8.3 \times 10^{-5}$	4500			
		$2.1 \times 10^{-4}$	4680			
		$4.2 \times 10^{-4}$	5080			
		$8.3 \times 10^{-4}$	5180			
		$2.1 \times 10^{-3}$	5300			
		$4.2 \times 10^{-3}$	5530			
		$8.3 \times 10^{-3}$	5730			
		$2.1 \times 10^{-2}$	6010			
		$4.2 \times 10^{-2}$	6180			
		$8.3 \times 10^{-2}$	6260			
		$2.1 \times 10^{-1}$	6350			

<u>Material</u>	<u>T(°F)</u>	<u>Ė(/sec)</u>	<u>σ<sub>Y</sub>(psi)</u>	<u>Elong. (%)</u>	<u>Ref.</u>	<u>Remarks</u>
PC	248	2.1x10 <sup>-3</sup>	4520			
		4.2x10 <sup>-3</sup>	4810			
		8.3x10 <sup>-3</sup>	4960			
		2.1x10 <sup>-2</sup>	5140			
		4.2x10 <sup>-2</sup>	5530			
		8.3x10 <sup>-2</sup>	5530			
	284	2.1x10 <sup>-1</sup>	5680			
		4.2x10 <sup>-2</sup>	4360			
		8.3x10 <sup>-2</sup>	4600			
	212	2.1x10 <sup>-1</sup>	4640			
		8.3x10 <sup>-6</sup>	4240			B-3 Read from (σ <sub>Y</sub> , Tension, Ė ) curves Makrolon Bayer Max stress = σ <sub>Y</sub> Ė is calculated from crosshead speed
		2.1x10 <sup>-5</sup>	4520			
		4.2x10 <sup>-5</sup>	4670			
		8.3x10 <sup>-5</sup>	4730			
		2.1x10 <sup>-4</sup>	4940			
		4.2x10 <sup>-4</sup>	5300			
		8.3x10 <sup>-4</sup>	5350			
		2.1x10 <sup>-3</sup>	5560			
		4.2x10 <sup>-3</sup>	5790			
		8.3x10 <sup>-3</sup>	6090			
		2.1x10 <sup>-2</sup>	6250			
		4.2x10 <sup>-2</sup>	6480			
		8.3x10 <sup>-2</sup>	6610			
		2.1x10 <sup>-1</sup>	6700			
248		8.3x10 <sup>-6</sup>	2790			
		2.1x10 <sup>-5</sup>	2900			
		4.2x10 <sup>-5</sup>	3150			
	8.3x10 <sup>-5</sup>	3230				
	2.1x10 <sup>-4</sup>	3730				
	4.2x10 <sup>-4</sup>	3860				
	8.3x10 <sup>-4</sup>	4180				
	2.1x10 <sup>-3</sup>	4840				
	4.2x10 <sup>-3</sup>	5030				
	8.3x10 <sup>-3</sup>	5160				
	2.1x10 <sup>-2</sup>	5390				
	4.2x10 <sup>-2</sup>	5660				

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_y</math>(psi)</u>	<u>Elong.</u> (%)	<u>Ref.</u>	<u>Remarks</u>
		$8.3 \times 10^{-2}$	5750			
		$2.1 \times 10^{-1}$	5840			
	284	$8.3 \times 10^{-6}$	490			
		$2.1 \times 10^{-5}$	770			
		$4.2 \times 10^{-5}$	1060			
		$8.3 \times 10^{-5}$	1170			
		$2.1 \times 10^{-4}$	2150			
		$4.2 \times 10^{-4}$	2250			
		$8.3 \times 10^{-4}$	2560			
		$2.1 \times 10^{-3}$	2920			
		$4.2 \times 10^{-3}$	3470			
		$8.3 \times 10^{-3}$	3800			
		$2.1 \times 10^{-2}$	4130			
		$4.2 \times 10^{-2}$	4500			
		$8.3 \times 10^{-2}$	4810			
		$2.1 \times 10^{-1}$	4940			
	293	$4.2 \times 10^{-4}$	590			
		$8.3 \times 10^{-4}$	780			
		$2.1 \times 10^{-3}$	1190			
		$4.2 \times 10^{-3}$	1580			
		$8.3 \times 10^{-3}$	1940			
		$2.1 \times 10^{-2}$	2570			
		$4.2 \times 10^{-2}$	2780			
		$8.3 \times 10^{-2}$	3230			
		$2.1 \times 10^{-1}$	3570			
	302	$4.2 \times 10^{-3}$	380			
		$8.3 \times 10^{-3}$	510			
		$2.1 \times 10^{-2}$	750			
		$4.2 \times 10^{-2}$	1000			
		$8.3 \times 10^{-2}$	1440			
		$2.1 \times 10^{-1}$	2000			
	311	$2.1 \times 10^{-2}$	180			
		$4.2 \times 10^{-2}$	230			
		$8.3 \times 10^{-2}$	480			
		$2.1 \times 10^{-1}$	960			

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_Y</math>(psi)</u>	<u>Elong.</u> (%)	<u>Ref.</u>	<u>Remarks</u>
		$4.2 \times 10^{-4}$	14600			
		$8.3 \times 10^{-4}$	14500			
		$2.1 \times 10^{-3}$	14800			
		$4.2 \times 10^{-3}$	15400			
		$8.3 \times 10^{-3}$	15200			
		$2.1 \times 10^{-2}$	15700			
		$4.2 \times 10^{-2}$	16300			
		$8.3 \times 10^{-2}$	16600			
		$2.1 \times 10^{-1}$	16700			
	-58	$4.2 \times 10^{-5}$	11500			
		$4.2 \times 10^{-4}$	12700			
		$4.2 \times 10^{-3}$	12700			
		$4.2 \times 10^{-2}$	13100			
		$2.1 \times 10^{-1}$	13600			
	73.4	$4.2 \times 10^{-5}$	8420			
		$4.2 \times 10^{-4}$	8690			
		$4.2 \times 10^{-3}$	9510			
		$4.2 \times 10^{-2}$	9520			
		$2.1 \times 10^{-1}$	10000			
	-193	$4.2 \times 10^{-3}$	14900			
	-148	$4.2 \times 10^{-3}$	14700			
	-103	$4.2 \times 10^{-3}$	14200			
	-58	$4.2 \times 10^{-3}$	13000			
	-13	$4.2 \times 10^{-3}$	11800			
	32	$4.2 \times 10^{-3}$	10700			
	77	$4.2 \times 10^{-3}$	9600			
	122	$4.2 \times 10^{-3}$	8300			

B-4 Read from ( $\sigma_Y$ ,  
Tension  $\tau$ ) curve  
Tension  
Makrolon Bayer  
Max stress =  $\sigma_Y$   
 $\dot{\epsilon}$  is calculated  
from crosshead  
speed

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_Y</math>(psi)</u>	<u>Elong.</u> (%)	<u>Ref.</u>	<u>Remarks</u>
PC	-220	$4.2 \times 10^{-4}$	19900		B-4	Read from ( $\sigma_Y$ , Tension $\dot{\epsilon}$ ) curves (Tension) Makrolon Bayer Max stress = $\sigma_Y$ $\dot{\epsilon}$ is calculated from crosshead speed
		$8.3 \times 10^{-4}$	20100			
		$2.1 \times 10^{-3}$	20200			
		$4.2 \times 10^{-3}$	20200			
		$8.3 \times 10^{-3}$	20400			
		$2.1 \times 10^{-2}$	20500			
		$4.2 \times 10^{-2}$	21100			
		$8.3 \times 10^{-2}$	21000			
		$2.1 \times 10^{-1}$	21000			
		-193	$4.2 \times 10^{-5}$	16900		
	$8.3 \times 10^{-5}$		17500			
	$2.1 \times 10^{-4}$		18000			
	$4.2 \times 10^{-4}$		17700			
	$8.3 \times 10^{-4}$		18000			
	$2.1 \times 10^{-3}$		17700			
	$4.2 \times 10^{-3}$		18400			
	$8.3 \times 10^{-3}$		18700			
	$2.1 \times 10^{-2}$		19200			
	$4.2 \times 10^{-2}$		19900			
	-166	$8.3 \times 10^{-2}$	19600			
		$2.1 \times 10^{-1}$	19600			
		$4.2 \times 10^{-5}$	15500			
		$8.3 \times 10^{-5}$	15800			
		$2.1 \times 10^{-4}$	15800			
		$4.2 \times 10^{-4}$	15800			
		$8.3 \times 10^{-4}$	16500			
		$2.1 \times 10^{-3}$	16600			
		$4.2 \times 10^{-3}$	17500			
		$8.3 \times 10^{-3}$	17900			
	-130	$2.1 \times 10^{-2}$	17700			
$4.2 \times 10^{-2}$		18000				
$8.3 \times 10^{-2}$		17800				
$2.1 \times 10^{-1}$		18600				
$4.2 \times 10^{-5}$		14500				
$8.3 \times 10^{-5}$		14500				
	$2.1 \times 10^{-4}$	14600				

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_Y</math>(psi)</u>	<u>Elong. (%)</u>	<u>Ref.</u>	<u>Remarks</u>
	167	$4.2 \times 10^{-3}$	7200			
	212	$4.2 \times 10^{-3}$	6200			
	257	$4.2 \times 10^{-3}$	5000			
	-193	$4.2 \times 10^{-3}$	30900		B-4	Read from ( $\sigma_Y$ , T) curves
	-148	$4.2 \times 10^{-3}$	25800		Comp.	Compression
	-103	$4.2 \times 10^{-3}$	20400			Makrolon Bayer
	-58	$4.2 \times 10^{-3}$	17400			Max stress = $\sigma_Y$
	-13	$4.2 \times 10^{-3}$	15300			$\dot{\epsilon}$ is calculated from crosshead speed
	32	$4.2 \times 10^{-3}$	13600			
	77	$4.2 \times 10^{-3}$	12500			
	122	$4.2 \times 10^{-3}$	10800			
	167	$4.2 \times 10^{-3}$	9500			
	212	$4.2 \times 10^{-3}$	7820			
	257	$4.2 \times 10^{-3}$	6220			
PC	72	$2 \times 10^{-4}$	4000		C-2	Read from ( $\sigma$ , E) curves
		$2 \times 10^{-3}$	5000		Comp.	(True Stress)
		$2 \times 10^{-2}$	5300			(Max stress = $\sigma_Y$ )
		$2 \times 10^{-1}$	6880			
		4	8000			
		4x10	9780			
		$1.05 \times 10^{+3}$	15000			
Lexan PC Resin	73.4	$1.67 \times 10^{-2}$	8850		G-2	Read from ( $\sigma_Y$ , Tension T) curves
		$1.67 \times 10^{-1}$	9850			strain rate = loading speed/ gage length
	122	$1.67 \times 10^{-2}$	7860			
		$1.67 \times 10^{-1}$	8700			
	194	$1.67 \times 10^{-2}$	6300			

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_Y</math>(psi)</u>	<u>Elong.</u> <u>(%)</u>	<u>Ref.</u>	<u>Remarks</u>
		$1.67 \times 10^{-1}$	6800			
	212	$1.67 \times 10^{-2}$	6280			
		$1.67 \times 10^{-1}$	6800			
	230	$1.67 \times 10^{-2}$	6230			
		$1.67 \times 10^{-1}$	6760			
	248	$1.67 \times 10^{-2}$	6050			
		$1.67 \times 10^{-1}$	6690			
	257	$1.67 \times 10^{-2}$	5750			
		$1.67 \times 10^{-1}$	6300			
	284	$1.67 \times 10^{-2}$	5550			
		$1.67 \times 10^{-1}$	6420			
	302	$1.67 \times 10^{-2}$	4380			
		$1.67 \times 10^{-1}$	5740			
PC	room	$8.31 \times 10^{-1}$	9800	59.5	P-2	Strain rate = Tension speed/jaw separation
		$83.3 \times 10^1$	11200	43.7		
PC	room	$2 \times 10^{-3}$	12000		T-1	Read from ( $\sigma$ , Comp. $\epsilon$ ) curves (Zelux) $\dot{\epsilon}$ = mean strain rate
		$4.85 \times 10^2$	17200			
		$6.93 \times 10^2$	18400			
		$1.028 \times 10^3$	18800			

TABLE 4 DYNAMIC PROPERTIES OF POLYETHYLENE (PE)

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_Y</math>(psi)</u>	<u>Elong.</u> <u>(%)</u>	<u>Ref.</u>	<u>Remarks</u>
PE	74.3	$3.3 \times 10^{-4}$	930		A-1	50% R.H. Tension
		$1.67 \times 10^{-4}$	1000			
		$1.67 \times 10^{-2}$	1100	260		
		$8.3 \times 10^{-2}$	1400	290		
		$3.33 \times 10^1$		220		
		$6.67 \times 10^1$		210		
		$1.43 \times 10^3$		210		
PE(linear)	74.3	$3.3 \times 10^{-4}$	1500			
		$1.67 \times 10^{-3}$	1800			
		$1.67 \times 10^{-2}$	2100	550		
		$1.67 \times 10^{-1}$	2800	480		
		$3.3 \times 10^{-1}$	3400	590		
		$6.7 \times 10^{-1}$		10		
Amorphous PE terephthalate	74.3	$1.7 \times 10^{-4}$	7000			
		$1.67 \times 10^{-3}$	7700	390		
		$1.67 \times 10^{-2}$	7800	460		
		$8.3 \times 10^{-2}$	7600	5		
		$1.67 \times 10^{-1}$		5		
		$3.3 \times 10^{-1}$		10		
Mylar	74.3	$3.3 \times 10^{-4}$	11800	70	A-1	Mylar C poly- Tensionester Film 50% R.H.
		$1.67 \times 10^{-3}$	12600	100		
		$1.67 \times 10^{-2}$	13700	90		
		$8.3 \times 10^{-2}$	14200	90		

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_Y</math>(psi)</u>	<u>Elong. (%)</u>	<u>Ref.</u>	<u>Remarks</u>
		$1.67 \times 10^{-1}$	15600	80		
		$3.3 \times 10^{-1}$		120		
		$7.7 \times 10^1$		110		
		$1.54 \times 10^2$		130		
Mylar	74.3	$3.3 \times 10^{-4}$	9200	120		Mylar, Saran-coated 50% R.H.
		$1.67 \times 10^{-3}$	9700	130		
		$1.67 \times 10^{-2}$	10400	110		
		$8.3 \times 10^{-2}$	11200	120		
		$1.67 \times 10^{-1}$	11300	140		
		$1.33 \times 10^0$		110		
		$1.58 \times 10^2$		100		
PE(linear)	-166	$5.25 \times 10^{-1}$	5870			
		$3.36 \times 10^0$	6130			
		$2.4 \times 10^1$	6350			
		$1.1 \times 10^2$	6720			
		$8.86 \times 10^2$	8250			
	-148	$5.25 \times 10^{-1}$	5440			
		$3.36 \times 10^0$	5770			
		$2.39 \times 10^1$	6000			
		$1.10 \times 10^2$	6530			
		$8.86 \times 10^2$	8080			
	-112	$5.25 \times 10^{-1}$	4810			
		$3.36 \times 10^0$	5150			
		$2.39 \times 10^1$	5440			
		$1.10 \times 10^2$	6130			
		$8.86 \times 10^2$	7830			

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_y</math>(psi)</u>	<u>Elong.</u> <u>(%)</u>	<u>Ref.</u>	<u>Remarks</u>
	-94	$5.25 \times 10^{-1}$	4550			
		$3.36 \times 10^0$	4800			
		$2.39 \times 10^1$	5180			
		$1.10 \times 10^2$	5830			
		$8.86 \times 10^2$	7440			
	-76	$5.25 \times 10^{-1}$	4240			
		$3.36 \times 10^0$	4500			
		$2.39 \times 10^1$	4890			
		$1.10 \times 10^2$	5440			
		$8.86 \times 10^2$	7160			
PE(high density)	-40	$5.25 \times 10^{-1}$	3730			
		$3.36 \times 10^0$	4070			
		$2.39 \times 10^1$	4460			
		$1.10 \times 10^2$	5070			
		$8.86 \times 10^2$	6680			
	-4	$5.25 \times 10^{-1}$	3370			
		$3.36 \times 10^0$	3660			
		$2.39 \times 10^1$	3870			
		$1.10 \times 10^2$	4820			
		$8.86 \times 10^2$	5890			
PE(branched) (low density)	-166	$1.05 \times 10^{-1}$	4090			B-1 Torsion Read from ( $\sigma_y$ , $\dot{\epsilon}$ ) curves effective strain rate
		$5.25 \times 10^{-1}$	4250			
		$3.36 \times 10^0$	4680			
		$2.39 \times 10^1$	5270			
		$1.10 \times 10^2$	5700			

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_y</math>(psi)</u>	<u>Elong.</u> <u>(%)</u>	<u>Ref.</u>	<u>Remarks</u>
		$8.86 \times 10^2$	6060			
	-130	$1.05 \times 10^{-1}$	3890			
		$5.25 \times 10^{-1}$	4000			
		$3.36 \times 10^0$	4390			
		$2.39 \times 10^1$	4880			
		$1.10 \times 10^2$	5350			
		$8.86 \times 10^2$	6000			
	-76	$1.05 \times 10^{-1}$	3200			
		$5.25 \times 10^{-1}$	3350			
		$3.36 \times 10^0$	3740			
		$2.39 \times 10^1$	4000			
		$1.10 \times 10^2$	4350			
		$8.86 \times 10^2$	4970			
	-22	$1.05 \times 10^{-1}$	2390			
		$5.25 \times 10^{-1}$	2400			
		$3.36 \times 10^0$	2670			
		$2.39 \times 10^1$	2900			
		$1.10 \times 10^2$	3250			
		$8.86 \times 10^2$	3640			
	-4	$1.05 \times 10^{-1}$	2090			
		$5.25 \times 10^{-1}$	2130			
		$3.36 \times 10^0$	2340			
		$2.39 \times 10^1$	2630			
		$1.10 \times 10^2$	2850			
		$8.86 \times 10^2$	3250			
	32	$1.05 \times 10^{-1}$	1780			
		$5.25 \times 10^{-1}$	1770			

<u>Material</u>	<u>T(° F)</u>	<u>Ė(/sec)</u>	<u>σ<sub>Y</sub>(psi)</u>	<u>Elong. (%)</u>	<u>Ref.</u>	<u>Remarks</u>
		3.36x10 <sup>0</sup>	1850			
		2.39x10 <sup>1</sup>	2020			
		1.10x10 <sup>2</sup>	2260			
		8.86x10 <sup>2</sup>	2420			
	75.2	1.05x10 <sup>-1</sup>	1310			
		5.25x10 <sup>-1</sup>	1440			
		3.36x10 <sup>0</sup>	1490			
		2.39x10 <sup>1</sup>	1620			
		1.10x10 <sup>2</sup>	1840			
		8.86x10 <sup>2</sup>	2000			
PE (Type I-A)	70	3.3x10 <sup>-2</sup>	15000			D-1 Type I-A is the Tension sample produced by special process and cut in axial direction
		3.33x10 <sup>2</sup>	18500			
		5x10 <sup>2</sup>	20500			
		5.17x10 <sup>2</sup>	22500			
		5.67x10 <sup>2</sup>	24000			
		6.33x10 <sup>2</sup>	28000			
		6.5x10 <sup>2</sup>	24500			
		7x10 <sup>2</sup>	28000			
		7.2x10 <sup>2</sup>	26000			
		7.33x10 <sup>2</sup>	27000			
PE (Type I-P)	70	3.33x10 <sup>-2</sup>	4800			D-1 Type I-P is the Tension sample produced by special process and cut in perpendicular direction
		3.58x10 <sup>2</sup>	7200			
		5.17x10 <sup>2</sup>	8800			
		5.33x10 <sup>2</sup>	11600			
		6.17x10 <sup>2</sup>	10400			
		6.5x10 <sup>2</sup>	11000			

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_y</math>(psi)</u>	<u>Elong.</u> (%)	<u>Ref.</u>	<u>Remarks</u>
PE(Type II-A)	70	$4.17 \times 10^2$	6200		D-1 Tension	Type II-A is the sample produced by conventional proc. and cut in axial direction
		$6.9 \times 10^2$	6200			
		$8.17 \times 10^2$	8800			
PE(Type II-P)	70	$2.83 \times 10^2$	5000		D-1 Tension	Type II-P is the sample produced by conv. process and cut perpendicular direction
		$5 \times 10^2$	5700			
		$6.38 \times 10^2$	9000			
PE	-58	$3.3 \times 10^{-4}$	5620		E-1 Tension	Read from ( $\sigma_y$ , $\dot{\epsilon}$ ) curves All specimens were dried 48 hrs. at 122°F & stored in a desiccator until used (max. strength) (Bakelite DYNH 1-3) Strain rate=cross-head velocity/gage length
		$1.67 \times 10^{-2}$	6000			
		$8.3 \times 10^{-2}$	6000			
	-40	$3.3 \times 10^{-4}$	5100			
		$3.3 \times 10^{-3}$	5600			
		$1.67 \times 10^{-2}$	5000			
		$8.3 \times 10^{-2}$	5600			
		$3.3 \times 10^{-1}$	6330			
		$4.33 \times 10^0$	7000			
	-4	$2.67 \times 10^1$	7320			
		$3.3 \times 10^{-4}$	3800			
		$1.67 \times 10^{-2}$	4000			
	32	$4.33 \times 10^0$	4770			
		$2.667 \times 10^1$	5200			
		$3.3 \times 10^{-4}$	3050			
$1.67 \times 10^{-2}$		3200				
$8.3 \times 10^{-2}$		3300				
$4.33 \times 10^0$		3700				
76	$2.667 \times 10^1$	4170				
	$3.3 \times 10^{-4}$	2200	68			

<u>Material</u>	<u>T(°F)</u>	<u>ε(/sec)</u>	<u>σ<sub>y</sub>(psi)</u>	<u>Elong. (%)</u>	<u>Ref.</u>	<u>Remarks</u>
		3.3x10 <sup>-3</sup>	2160	73		
		1.67x10 <sup>-2</sup>	2160	73		
		8.3x10 <sup>-2</sup>	2300	70		
		3.3x10 <sup>-1</sup>	2400	72		
		4.33x10 <sup>0</sup>	2600	68		
		2.667x10 <sup>1</sup>	2800	66		
PE	122	3.3x10 <sup>-4</sup>	1500			
		3.33x10 <sup>-3</sup>	1550			
		1.67x10 <sup>-2</sup>	1600			
		8.33x10 <sup>-2</sup>	1700			
		3.33x10 <sup>-1</sup>	1840			
		4.33x10 <sup>0</sup>	2000			
		2.67x10	2150			
	158	3.3x10 <sup>-4</sup>	1210			
		1.67x10 <sup>-2</sup>	1210			
		4.3x10 <sup>0</sup>	1230			
		2.67x10 <sup>1</sup>	1500			
PE	-65	8.5x10 <sup>-3</sup>	5140		J-1	(Dupont Surllyn A)
	-40	8.5x10 <sup>-3</sup>	4610		Tension	46% R.H.
	-20	8.5x10 <sup>-3</sup>	3490			Read from ( σ ,
	0	8.5x10 <sup>-3</sup>	2950			ε ) curves
	70	8.5x10 <sup>-3</sup>	2440			Max stress = σ <sub>y</sub>
		1.85x10 <sup>-2</sup>	2670			
		4.58x10 <sup>-2</sup>	2950			
PE(high density)	room	1.67x10 <sup>-4</sup>	2750		K-2	Sample according to
		1.67x10 <sup>-3</sup>	3500		Tension	ASTM D638 .935g/cm <sup>3</sup>
		1.67x10 <sup>-2</sup>	4230			H.T. 302 °F, 15 min.
						1 atm.
						Read from tables

<u>Material</u>	<u>T(°F)</u>	<u>Ė(/sec)</u>	<u>σ<sub>Y</sub>(psi)</u>	<u>Elong. (%)</u>	<u>Ref.</u>	<u>Remarks</u>
		1.67x10 <sup>-3</sup>	>3800	800		H.T. 306°F, 15 min, 1500 psi
		1.67x10 <sup>-3</sup>	>1000			H.T. 306°F, 15 min, 1 atm, .957 g/cm <sup>3</sup>
PE(low density)	room	1.67x10 <sup>-3</sup>	1520	475	K-2	
		1.67x10 <sup>-3</sup>	1675	418	Tension	H.T. 271°F, 5 min, 1atm
PE(linear)	73.4	3.3x10 <sup>-3</sup>	3200	200	S-1	Marlex 50-Type 40
		3.3x10 <sup>-2</sup>	3560	200	Tension	strain rate is app. by deformation speed divided by gauge length. sample cooled from moulding temp.
		3.3x10 <sup>-1</sup>	3820	17.3		
		3.3x10 <sup>0</sup>	4180	14.3		Read from table
		3.3x10 <sup>1</sup>	4500	14.0		
PE(low density)		3.3x10 <sup>-3</sup>	1075	200		Monsanto 406, cooled from moulding temp.
		3.3x10 <sup>-2</sup>	1250	200		
		3.3x10 <sup>-1</sup>	1360	200		
		3.3x10 <sup>0</sup>	1630	200		
		3.3x10 <sup>1</sup>	1640	200		
PE(high density)		3.3x10 <sup>-3</sup>	3150			
		1.67x10 <sup>0</sup>	4275	20		
		3.3x10 <sup>1</sup>	4500	27		
PE Tereph- thalate (Mylar)	-34.6	1.3x10 <sup>-4</sup>	19600		L-2	Read from curves
		5.3x10 <sup>-4</sup>	20000		Tension	(master curve)
		5.3x10 <sup>-3</sup>	21400			The molds were held at 140°F for 24 hrs. & at 230°F for 48 hrs.
		5.3x10 <sup>-2</sup>	22500			
	-3.2	3.5x10 <sup>-4</sup>	17260			
		9.8x10 <sup>-4</sup>	18000			
		9.8x10 <sup>-3</sup>	19000			
		9.8x10 <sup>-2</sup>	19400			

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_Y</math>(psi)</u>	<u>Elong.</u> (%)	<u>Ref.</u>	<u>Remarks</u>
	32.	$7.5 \times 10^{-5}$	15400			
		$2.9 \times 10^{-4}$	15540			
		$2.9 \times 10^{-3}$	16000			
		$2.9 \times 10^{-2}$	18000			
	77	$1.3 \times 10^{-3}$	13000			
		$8.3 \times 10^{-3}$	13750			
		$5 \times 10^{-3}$	14150			
		$3.3 \times 10^{-2}$	15200			
		$8.33 \times 10^{-2}$	15080			
		$4.2 \times 10^{-1}$	16400			
		$1.67 \times 10^0$	17600			
		$5 \times 10^0$	18400			
	122	$7.1 \times 10^{-5}$	10650			
		$3.3 \times 10^{-4}$	10500			
		$3.3 \times 10^{-3}$	11500			
		$3.3 \times 10^{-2}$	13000			
	167	$6.7 \times 10^{-5}$	7700			
		$5 \times 10^{-4}$	7650			
		$5 \times 10^{-3}$	8500			
		$4.2 \times 10^{-2}$	10000			
	194	$3.3 \times 10^{-5}$	5150			
		$2.8 \times 10^{-4}$	5400			
		$2.8 \times 10^{-3}$	6800			
		$2.8 \times 10^{-2}$	8030			
	212	$1.67 \times 10^{-4}$	4060			
		$5 \times 10^{-3}$	5000			
		$4.41 \times 10^{-2}$	5800			

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_Y</math>(psi)</u>	<u>Elong.</u> (%)	<u>Ref.</u>	<u>Remarks</u>
	230	$7.1 \times 10^{-5}$	3300			
		$5.4 \times 10^{-4}$	4000			
		$5 \times 10^{-3}$	4400			
		$5 \times 10^{-2}$	5250			
	248	$6 \times 10^{-5}$	3200			
		$4.3 \times 10^{-4}$	3200			
		$4.3 \times 10^{-3}$	4950			
		$4.3 \times 10^{-2}$	4150			
	266	$4.2 \times 10^{-5}$	2750			
		$3.3 \times 10^{-4}$	3000			
		$3.3 \times 10^{-3}$	3250			
		$3.3 \times 10^{-2}$	3600			
PE Film	room	$4.3 \times 10^0$	1780	513	P-1	Ave. value
		$8.7 \times 10^0$	1500	639	Tension	
		$3.4 \times 10^1$	1930	504		
		$8.6 \times 10^1$	1900	509		
PE(high density)	room	$2.7 \times 10^{-3}$	4220	32	W-1	Read from ( $\sigma_Y$ ,
		$6.7 \times 10^{-3}$	4890	28	Tension $\epsilon$ )	curves
		$2.7 \times 10^{-2}$	5020	23.5		
		$1.7 \times 10^{-1}$	5940	19.5		
		$1.64 \times 10^0$	6890	15		
		$1.68 \times 10^1$	8330	12.5		
		$1 \times 10^2$	8710	12		
PE(low density)	room	$2.7 \times 10^{-3}$	3310	50		
		$6.7 \times 10^{-3}$	3620	49		
		$2.7 \times 10^{-2}$	4050	47.8		

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_Y</math>(psi)</u>	<u>Elong.</u> (%)	<u>Ref.</u>	<u>Remarks</u>
		$1.7 \times 10^{-1}$	4650	46.8		
		$1.64 \times 10^0$	5490	45		
		$1.68 \times 10^1$	6280	43.3		
		$1 \times 10^2$	7010	42		

TABLE 5 DYNAMIC PROPERTIES OF POLYETHYL METHACRYLATE (PEMA)

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_Y</math>(psi)</u>	<u>Elong.</u> (%)	<u>Ref.</u>	<u>Remarks</u>
PEMA	95	$7.5 \times 10^{-6}$	3400		R-2	Read from ( $\sigma_Y$ , Tension $\dot{\epsilon}$ ) curves Max stress = $\sigma_Y$
		$3.86 \times 10^{-5}$	4120			
		$1.87 \times 10^{-4}$	4610			
	104	$7.5 \times 10^{-6}$	2360			
		$3.86 \times 10^{-5}$	2820			
		$1.87 \times 10^{-4}$	3290			
		$7.66 \times 10^{-4}$	4220			
		$7.5 \times 10^{-6}$	1460			
	122	$3.86 \times 10^{-5}$	1570			
		$1.87 \times 10^{-4}$	2010			
		$9.15 \times 10^{-4}$	2720			
		$3.06 \times 10^{-3}$	3370			
		$1.19 \times 10^{-2}$	3900			
		$2.04 \times 10^{-2}$	4210			
		$2.95 \times 10^{-2}$	4800			
		$5.38 \times 10^{-2}$	4690			
		140	$7.5 \times 10^{-6}$	560		
			$3.86 \times 10^{-5}$	800		
	$1.87 \times 10^{-4}$		1130			
	$9.15 \times 10^{-4}$		1700			
	$3.46 \times 10^{-3}$		2220			
	$1.19 \times 10^{-2}$		2790			
	$1.75 \times 10^{-2}$		3000			
	$3.53 \times 10^{-2}$		3500			
$5.83 \times 10^{-2}$	3850					
$1.44 \times 10^{-1}$	4440					
158	$2.95 \times 10^{-1}$	5060				
	$9.15 \times 10^{-4}$	570				
	$3.46 \times 10^{-3}$	1210				
	$5.12 \times 10^{-3}$	1210				
	$8.71 \times 10^{-3}$	1200				
	$1.75 \times 10^{-2}$	1580				

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma</math>(psi)</u>	<u>Elong.</u> <u>(%)</u>	<u>Ref.</u>	<u>Remarks</u>
		$5.38 \times 10^{-2}$	1940			
		$1.7 \times 10^{-1}$	2800			
		$2.42 \times 10^{-1}$	3480			
		$3.98 \times 10^{-1}$	3520			
		$6.31 \times 10^{-1}$	3880			
		$1 \times 10^0$	4340			
		$1.305 \times 10^0$	4700			
		$2.03 \times 10^0$	5000			
		$2.51 \times 10^0$	5170			
	176	$5.1 \times 10^{-3}$	260			
		$1.75 \times 10^{-2}$	510			
		$2.04 \times 10^{-2}$	570			
		$5.38 \times 10^{-2}$	980			
		$1.44 \times 10^{-1}$	1510			
		$2.95 \times 10^{-1}$	1970			
		$6.31 \times 10^{-1}$	2240			
		$1 \times 10^0$	2560			
		$1.305 \times 10^0$	2680			
		$2.03 \times 10^0$	2860			
		$1 \times 10^1$	4470			
		$1.2 \times 10^1$	5130			

TABLE 6 DYNAMIC PROPERTIES OF POLYMETHYL METHACRYLATE (PMMA)

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_Y</math>(psi)</u>	<u>Elong.</u> <u>(%)</u>	<u>Ref.</u>	<u>Remarks</u>	
PMMA	-58	$2.5 \times 10^{-4}$	36400		B-5 Comp.	Read from ( $\sigma_Y$ , $\dot{\epsilon}$ ) curves Annealed for a day at 230°F then cooled to room temp. slowly (Commercial I.C.I. Perspex)	
		$5 \times 10^{-4}$	39400				
		$1 \times 10^{-3}$	39400				
		$1.1 \times 10^{-3}$	39800				
		$2.2 \times 10^{-3}$	40100				
		$3.2 \times 10^{-3}$	41600				
		$4.2 \times 10^{-3}$	42000				
		$8.3 \times 10^{-3}$	45400				
		$1.35 \times 10^{-2}$	45450				
	71.6	$2.5 \times 10^{-4}$	17100				
		$5 \times 10^{-4}$	17980				
		$1.1 \times 10^{-3}$	19300				
		$2.2 \times 10^{-3}$	20200				
		$4.2 \times 10^{-3}$	21000				
		$8.3 \times 10^{-3}$	22100				
		158	$2.5 \times 10^{-4}$	8520			
			$5 \times 10^{-4}$	8000			
			$1.1 \times 10^{-3}$	10000			
$2.2 \times 10^{-3}$	10500						
$4.2 \times 10^{-3}$	11360						
$8.3 \times 10^{-3}$	11700						
$1.6 \times 10^{-2}$	12400						
PMMA	72		$2 \times 10^{-4}$	8750		C-2 Comp.	Read from ( $\sigma$ , $\epsilon$ ) curves Max stress = $\sigma_Y$
			$2 \times 10^{-3}$	10000			
		$2 \times 10^{-2}$	10900				
		$2 \times 10^{-1}$	14000				
		$3 \times 10^0$	16500				
		$4.5 \times 10^1$	20500				
		$7.6 \times 10^2$	30300				
PMMA	104	$4.2 \times 10^{-4}$	5460		D-2 Tension	Read from ( $\sigma$ , $\epsilon$ ) curves Data of Ref. 7 in D-2; strain rate= speed/gage length (Plexiglas)	
		$8.3 \times 10^{-4}$	6000				
		$1.7 \times 10^{-3}$	6400	6.8			
		$3.3 \times 10^{-3}$	7100	6.5			

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_y</math>(psi)</u>	<u>Elong.</u> (%)	<u>Ref.</u>	<u>Remarks</u>	
Commercial Methyl Metha- crylate	room	$5.1 \times 10^{-3}$	11500		D-2 Comp.	Read from ( $\sigma$ , $\epsilon$ ) curves Compression Max stress = $\sigma_y$	
		$2.5 \times 10^{-2}$	12600				
		$1.2 \times 10^{-1}$	14400				
		$9.6 \times 10^{-1}$	17100				
		$3.15 \times 10^0$	18800				
		$4.2 \times 10^{-4}$	6500				
		$5.7 \times 10^{-3}$	10000				
		$5 \times 10^{-5}$	7900				
		$1.3 \times 10^{-4}$	8250				
		$3 \times 10^{-4}$	8300				
PMMA	76	$4.5 \times 10^{-4}$	9200		E-1 Tension	Read from ( $\sigma_y$ , $\dot{\epsilon}$ ) curves All specimens were dried 48 hrs. at 122°F & stored in a desiccator until used (Plexiglas IA-UVA)	
		$3 \times 10^{-3}$	10500				
		$1.33 \times 10^{-2}$	11500				
		$6.83 \times 10^{-2}$	13000				
		$3 \times 10^{-1}$	14000				
		$1 \times 10^0$	14500				
		$1.83 \times 10^1$	16500				
		$5 \times 10^{-5}$	21900				
		$5 \times 10^{-4}$	25800				
		$5 \times 10^{-2}$	34000				
PMMA	32	$5 \times 10^{-5}$	21900		H-3 Comp.	Read from ( $\sigma_y$ , $\dot{\epsilon}$ ) curves (Commerc. Plexiglass II) Max stress = $\sigma_y$	
		$5 \times 10^{-4}$	25800				
		$5 \times 10^{-2}$	34000				
		$5 \times 10^{-5}$	17500				
		$5 \times 10^{-4}$	20630				
	71.6	$5 \times 10^{-2}$	25100				
		$5 \times 10^{-1}$	31300				
		$8 \times 10^0$	35000				
		122	$5 \times 10^{-5}$	13130			
			$5 \times 10^{-4}$	15000			
$5 \times 10^{-2}$	16500						
$8 \times 10^0$	30000						
$7.6 \times 10^3$	36000						
179	$5 \times 10^{-5}$	7500					
	$5 \times 10^{-4}$	8800					
	$5 \times 10^{-2}$	13130					
	$8 \times 10^0$	17900					

<u>Material</u>	<u>T(°F)</u>	<u>ε̇(/sec)</u>	<u>σ<sub>y</sub>(psi)</u>	<u>Elong. (%)</u>	<u>Ref.</u>	<u>Remarks</u>
	239	5x10 <sup>-5</sup>	3000			
		5x10 <sup>-4</sup>	5000			
		5x10 <sup>-2</sup>	6300			
		1.5x10 <sup>3</sup>	8630			
PMMA	-58	1.7x10 <sup>-5</sup>	12900		K-1	Read from table
		1.7x10 <sup>-4</sup>	14900			True strain rate
		1.7x10 <sup>-3</sup>	16000			Tension True stress
		1.7x10 <sup>-2</sup>	18500			
	-13	1.7x10 <sup>-5</sup>	13000			
		1.7x10 <sup>-4</sup>	15400			
		1.7x10 <sup>-3</sup>	16800			
		1.7x10 <sup>-2</sup>	16600			
	32	1.7x10 <sup>-5</sup>	12000			
		1.7x10 <sup>-4</sup>	11800			
		1.7x10 <sup>-3</sup>	15000			
		1.7x10 <sup>-2</sup>	16100			
	77	1.7x10 <sup>-5</sup>	7200			
		1.7x10 <sup>-4</sup>	9200			
		1.7x10 <sup>-3</sup>	11100			
		1.7x10 <sup>-2</sup>	14000			
	122	1.7x10 <sup>-5</sup>	5400			
		1.7x10 <sup>-4</sup>	6000			
		1.7x10 <sup>-3</sup>	7300			
		1.7x10 <sup>-2</sup>	9360			
	167	1.7x10 <sup>-5</sup>	2630			
		1.7x10 <sup>-4</sup>	3400			
		1.7x10 <sup>-3</sup>	4340			
		1.7x10 <sup>-2</sup>	5850			
PMMA-G	-68	3x10 <sup>-4</sup>	18000		L-2	Read from (master
		8.3x10 <sup>-4</sup>	19000			Tension curve) curves
		8.3x10 <sup>-3</sup>	19100			(Plexiglass G)
						ASTM D-638
	-4	9.2x10 <sup>-5</sup>	15850			
		7x10 <sup>-4</sup>	16750			
		7.5x10 <sup>-3</sup>	18350			
	50	1.7x10 <sup>-4</sup>	10380			
		4.2x10 <sup>-4</sup>	12700			
		4.2x10 <sup>-3</sup>	13200			

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_y</math>(psi)</u>	<u>Elong.</u> <u>(%)</u>	<u>Ref. Remarks</u>
		$4.2 \times 10^{-2}$	16100		
	77	$1.3 \times 10^{-3}$	11200		
		$5 \times 10^{-3}$	12500		
		$3.3 \times 10^{-2}$	13600		
		$5.8 \times 10^{-2}$	13600		
		$8.3 \times 10^{-2}$	14400		
		$4.2 \times 10^{-1}$	15300		
		$1.67 \times 10^0$	16300		
		$5 \times 10^0$	17000		
	104	$1.7 \times 10^{-4}$	8000		
		$1.3 \times 10^{-3}$	9000		
		$1.3 \times 10^{-2}$	10400		
		$1.3 \times 10^{-1}$	11700		
	149	$1.2 \times 10^{-4}$	5460		
		$2.5 \times 10^{-4}$	6340		
		$2.5 \times 10^{-3}$	7050		
		$2.5 \times 10^{-2}$	8400		
	176	$3.8 \times 10^{-4}$	4250		
		$3.8 \times 10^{-3}$	5100		
		$3.8 \times 10^{-2}$	6100		
	194	$5 \times 10^{-4}$	3150		
		$5 \times 10^{-3}$	4200		
		$5 \times 10^{-2}$	5250		
	203	$1 \times 10^{-4}$	1800		
		$6 \times 10^{-3}$	3000		
		$6 \times 10^{-2}$	4450		
	212	$9 \times 10^{-5}$	1000		
		$6 \times 10^{-4}$	1550		
		$6 \times 10^{-3}$	2850		
		$6 \times 10^{-2}$	4100		
	221	$1.7 \times 10^{-4}$	350		
		$1 \times 10^{-2}$	1680		
		$1 \times 10^{-1}$	2350		
	230	$6.3 \times 10^{-3}$	500		
		$6.3 \times 10^{-2}$	1500		
	239	$6.7 \times 10^{-4}$	1000		

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_y</math>(psi)</u>	<u>Elong.</u> (%)	<u>Ref.</u>	<u>Remarks</u>
PMMA	-58	$4.17 \times 10^0$	2500		L-3 ASTM-D-638 Tension Specimen Read from ( $\sigma_y$ , $\epsilon$ ) curves (Plexiglass UVA II)	
		$4.8 \times 10^{-5}$	15000			
		$4.8 \times 10^{-4}$	17300			
		$4.8 \times 10^{-3}$	18700			
	-13	$4.8 \times 10^{-2}$	19300			
		$4.8 \times 10^{-5}$	13300			
		$4.8 \times 10^{-4}$	15100			
		$4.8 \times 10^{-3}$	15400			
	32	$4.8 \times 10^{-2}$	18100			
		$4.8 \times 10^{-5}$	10700			
		$4.8 \times 10^{-4}$	12300			
		$4.8 \times 10^{-3}$	14700			
	71.6	$4.8 \times 10^{-2}$	16000			
		$4.8 \times 10^{-5}$	9100			
		$4.8 \times 10^{-4}$	10700			
		$4.8 \times 10^{-3}$	12100			
	122	$4.8 \times 10^{-2}$	14100			
		$4.8 \times 10^{-5}$	4900			
		$4.8 \times 10^{-4}$	6400			
		$4.8 \times 10^{-3}$	7300			
158	$4.8 \times 10^{-2}$	9000				
	$4.8 \times 10^{-4}$	4000				
	$4.8 \times 10^{-3}$	5100				
	$4.8 \times 10^{-2}$	6300				
194	$4.8 \times 10^{-5}$	2100				
	$4.8 \times 10^{-4}$	3100				
	$4.8 \times 10^{-3}$	4000				
	$4.8 \times 10^{-2}$	5300				
PMMA	75	$3.3 \times 10^{-3}$	10800	6	M-1 Strain Rate= elon- Tension gation rate/gauge length Read from ( $\sigma$ , $\epsilon$ ) curves (Rohm & Haas Plexi- glas)	
	98	$3.3 \times 10^{-3}$	9900	7.5		
	100	$3.3 \times 10^{-3}$	9400	12.4		
	129	$3.3 \times 10^{-3}$	7100			
	186	$3.3 \times 10^{-3}$	4000			

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_y</math>(psi)</u>	<u>Elong.</u> <u>(%)</u>	<u>Ref.</u>	<u>Remarks</u>			
PMMA	32	$1.7 \times 10^{-5}$	10650		M-2	Read from ( $\sigma_y$ , Tension $\dot{\epsilon}$ ) curves			
		$1.7 \times 10^{-4}$	11750						
		$1.7 \times 10^{-2}$	14050						
	76	$1.7 \times 10^{-5}$	6500						
		$1.7 \times 10^{-4}$	8500						
		$1.7 \times 10^{-3}$	10050						
	122	$1.7 \times 10^{-2}$	12000						
		$1.7 \times 10^{-5}$	3940						
		$1.7 \times 10^{-4}$	4700						
	PMMA	86	$1.7 \times 10^{-3}$	5900				R-1	Read from ( $\sigma_y$ , Tension $\dot{\epsilon}$ ) curves Max stress = $\sigma_y$
			$1.7 \times 10^{-2}$	8250					
			$8.4 \times 10^{-6}$	7600					
104		$4.1 \times 10^{-5}$	8050						
		$1.7 \times 10^{-4}$	9030						
		$8.4 \times 10^{-6}$	6500						
122		$4.1 \times 10^{-5}$	7200						
		$1.7 \times 10^{-4}$	7870						
		$8.4 \times 10^{-6}$	5700						
		$4.1 \times 10^{-5}$	6220						
		$1.7 \times 10^{-4}$	6870						
		$2.4 \times 10^{-3}$	7890						
		$7.4 \times 10^{-3}$	9050						
		$1 \times 10^{-2}$	9050						
		$4.9 \times 10^{-2}$	10500						
140		$1 \times 10^{-1}$	10900						
		$2.4 \times 10^{-1}$	12200						
		$8.4 \times 10^{-6}$	4450						
		$4.1 \times 10^{-5}$	5260						
		$1.7 \times 10^{-4}$	5650						
		$2.9 \times 10^{-3}$	7080						
	$7 \times 10^{-3}$	7500							
	$1.7 \times 10^{-2}$	7660							
	$3.5 \times 10^{-2}$	8140							
	$1 \times 10^{-1}$	9240							
	$2.4 \times 10^{-1}$	10400							
	$1.3 \times 10^0$	11900							

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_Y</math>(psi)</u>	<u>Elong.</u> <u>(%)</u>	<u>Ref.</u>	<u>Remarks</u>
	158	$8.4 \times 10^{-6}$	3300			
		$4.1 \times 10^{-5}$	3900			
		$1.7 \times 10^{-4}$	4400			
		$3.5 \times 10^{-3}$	5470			
		$1 \times 10^{-2}$	6200			
		$4.9 \times 10^{-2}$	7150			
		$1 \times 10^{-1}$	7900			
		$6.4 \times 10^{-1}$	9470			
		$1.02 \times 10^0$	9900			
		$2.9 \times 10^0$	11300			
	176	$8.4 \times 10^{-6}$	2540			
		$4.1 \times 10^{-5}$	2940			
		$1.7 \times 10^{-4}$	3550			
		$2.4 \times 10^{-3}$	4200			
		$4.1 \times 10^{-3}$	4570			
		$1 \times 10^{-2}$	5330			
		$1.7 \times 10^{-2}$	5580			
		$4.9 \times 10^{-2}$	6140			
		$1 \times 10^{-1}$	6500			
		$1.9 \times 10^{-1}$	7260			
		$2.4 \times 10^{-1}$	7700			
		$6.4 \times 10^{-1}$	8370			
		$1.017 \times 10^0$	8830			
		$1.3 \times 10^0$	8880			
		$2.4 \times 10^0$	9640			
	194	$8.4 \times 10^{-6}$	1566			
		$4.1 \times 10^{-5}$	2090			
		$1.7 \times 10^{-4}$	2700			
		$4.6 \times 10^{-3}$	3700			
		$6 \times 10^{-3}$	3800			
		$8.4 \times 10^{-3}$	3860			
		$1.5 \times 10^{-2}$	4300			
		$3.5 \times 10^{-2}$	4440			
		$7.5 \times 10^{-2}$	4700			
		$1 \times 10^{-1}$	5530			
		$3.8 \times 10^{-1}$	5850			

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_y</math>(psi)</u>	<u>Elong.</u> (%)	<u>Ref.</u>	<u>Remarks</u>
		$5.8 \times 10^0$	6160			
		$8 \times 10^0$	6730			
		$9.2 \times 10^1$	7200			
		$1.2 \times 10^0$	7830			
		$3.84 \times 10^0$	8460			
		$8.5 \times 10^0$	9450			
Lucite	room	0.	15060		T-1	Read from ( $\sigma$ ,
		$1.5 \times 10^2$	21250		Comp.	$\epsilon$ ) curves
		$2.9 \times 10^2$	26250			(Methyl Methacry-
		$4.8 \times 10^2$	30500	5		late)
		$5.9 \times 10^2$	40000	4		$\dot{\epsilon}$ = mean strain
						rate

TABLE 7 DYNAMIC PROPERTIES OF POLYPROPYLENE (PP)

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_Y</math>(psi)</u>	<u>Elong.</u> (%)	<u>Ref.</u>	<u>Remarks</u>
PP	-148	$5.3 \times 10^{-1}$	8460		B-1	Atactic PP Torsion Read from ( $\sigma_Y$ , $\dot{\epsilon}$ ) curves Effective strain rate
		$3.4 \times 10^0$	8200			
		$2.4 \times 10^1$	7030			
		$1.1 \times 10^2$	5740			
		$8.88 \times 10^2$	6780			
	-112	$5.3 \times 10^{-1}$	8200			
		$3.4 \times 10^0$	7800			
		$2.4 \times 10^1$	6900			
		$1.1 \times 10^2$	5820			
		$8.88 \times 10^2$	7000			
	-76	$5.3 \times 10^{-1}$	7850			
		$3.36 \times 10^0$	7280			
		$2.4 \times 10^1$	6700			
		$1.1 \times 10^2$	6400			
		$8.88 \times 10^2$	5900			
	-40	$5.3 \times 10^{-1}$	6730			
		$3.36 \times 10^0$	6520			
		$2.4 \times 10^1$	6000			
		$1.10 \times 10^2$	5460			
		$8.88 \times 10^2$	5690			
-4	$5.3 \times 10^{-1}$	5150				
	$3.4 \times 10^0$	5750				
	$2.4 \times 10^1$	5320				
	$1.10 \times 10^2$	4600				
	$8.88 \times 10^2$	4540				
PP	72	$2 \times 10^{-4}$	4830		C-2	Read from ( $\sigma$ , Comp. $\epsilon$ ) curves Max stress = $\sigma_Y$
		$2 \times 10^{-3}$	6350			
		$2 \times 10^{-2}$	6830			
		$2 \times 10^{-1}$	7350			
		$4 \times 10^0$	8500			
		$5 \times 10^1$	10000			
		$1.5 \times 10^3$	16500			

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_Y</math>(psi)</u>	<u>Elong.</u> <u>(%)</u>	<u>Ref.</u>	<u>Remarks</u>	
PP	20	$6.5 \times 10^{-4}$	7300	32.3	H-1	Read from ( $\sigma_Y$ , Tension $\dot{\epsilon}$ ) curves (Isotactic PP)	
	32	$6.5 \times 10^{-4}$	6950	36			
	52	$6.5 \times 10^{-4}$	5920	52.5			
	68	$3.3 \times 10^{-4}$	5000	58.7			
		$6.5 \times 10^{-4}$	5250	57			
		$2 \times 10^{-3}$	6300	61			
		$4.5 \times 10^{-3}$	6780	59.5			
		$4 \times 10^{-2}$	7090	37.7			
		$2.5 \times 10^{-1}$	7590	24			
		$3 \times 10^0$	8100	21			
		$3.5 \times 10^1$	7900	19			
		$7 \times 10^1$	8400	18.8			
		$1.4 \times 10^2$	9090	20			
		$3 \times 10^2$	10200	19			
		$4.9 \times 10^2$	10440	17.8			
		96	$6.5 \times 10^{-4}$	3780			74.6
	IPP	50	$2 \times 10^{-4}$	5480			
		$8 \times 10^{-4}$	5950				
		$1.2 \times 10^{-2}$	6750				
		$2.3 \times 10^{-2}$	6500				
		$1.5 \times 10^{-1}$	7300				
		$2.8 \times 10^{-1}$	7450				
		$6 \times 10^{-1}$	7870				
		$1.64 \times 10^0$	7850				
		$6.45 \times 10^0$	8560				
86		$7 \times 10^{-6}$	3000				
		$3.7 \times 10^{-5}$	3480				
		$2 \times 10^{-4}$	3890				
		$8.7 \times 10^{-4}$	4280				
		$6.4 \times 10^{-3}$	4760				
		$1 \times 10^{-2}$	4760				
		$1.8 \times 10^{-2}$	5240				
		$3.2 \times 10^{-2}$	5240				
	$4.7 \times 10^{-2}$	5360					
	$3.5 \times 10^{-1}$	6100					

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_Y</math>(psi)</u>	<u>Elong.</u> <u>(%)</u>	<u>Ref.</u>	<u>Remarks</u>
		$1 \times 10^0$	6380			
		$4.4 \times 10^0$	7000			
		$6.5 \times 10^0$	7020			
		$1 \times 10^1$	7020			
	122	$7 \times 10^{-6}$	2340			
		$3.7 \times 10^{-5}$	2590			
		$2 \times 10^{-4}$	2760			
		$8.7 \times 10^{-4}$	3060			
		$4 \times 10^{-3}$	3250			
		$1 \times 10^{-2}$	3260			
		$1.8 \times 10^{-2}$	3800			
		$1 \times 10^{-1}$	3850			
		$3.5 \times 10^{-1}$	4500			
		$1 \times 10^0$	4950			
		$1.6 \times 10^0$	4950			
		$6.5 \times 10^0$	5430			
		$1 \times 10^1$	5450			
	158	$7 \times 10^{-6}$	1890			
		$3.7 \times 10^{-5}$	2030			
		$2 \times 10^{-4}$	2200			
		$8.7 \times 10^{-4}$	2360			
		$8.4 \times 10^{-3}$	2490			
		$2 \times 10^{-2}$	2400			
		$3.3 \times 10^{-2}$	2500			
		$9.1 \times 10^{-2}$	2530			
		$3.5 \times 10^{-1}$	3250			
		$6 \times 10^{-1}$	3450			
		$1 \times 10^0$	3600			
		$2.8 \times 10^0$	3750			
		$6.5 \times 10^0$	4450			
		$1 \times 10^1$	4340			
	194	$7 \times 10^{-6}$	1320			
		$3.7 \times 10^{-5}$	1420			
		$2 \times 10^{-4}$	1500			

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_y</math>(psi)</u>	<u>Elong.</u> (%)	<u>Ref.</u>	<u>Remarks</u>
		$8.7 \times 10^{-4}$	1610			
		$4 \times 10^{-3}$	1800			
		$1.8 \times 10^{-2}$	1830			
		$4.5 \times 10^{-2}$	2020			
		$9.1 \times 10^{-2}$	2120			
		$3.5 \times 10^{-1}$	2310			
		$6 \times 10^{-1}$	2540			
		$1 \times 10^0$	2800			
		$1.64 \times 10^0$	2720			
		$2.7 \times 10^0$	3040			
		$6.5 \times 10^0$	3040			
		$1 \times 10^1$	3340			
	230	$2 \times 10^{-4}$	1070			
		$8.7 \times 10^{-4}$	1280			
		$2.3 \times 10^{-2}$	1390			
		$3.8 \times 10^{-2}$	1390			
		$4.7 \times 10^{-1}$	1520			
		$1 \times 10^0$	1800			
		$6.5 \times 10^0$	2300			
Crystalline PP	73.4	$3.3 \times 10^{-3}$	4340	200	S-1	Annealed at 275°F
		$3.3 \times 10^{-2}$	4640	200		Tension for 3 hrs. in a
		$3.3 \times 10^{-1}$	4570	14.7		vacuum oven (Profax)
		$3.3 \times 10^0$	5120	12.9		Strain rate=speed/ gage length
		$3.3 \times 10^1$	5590	15.8		

TABLE 8 DYNAMIC PROPERTIES OF POLYSTYRENE (PS).

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_y</math>(psi)</u>	<u>Elong.</u> (%)	<u>Ref.</u>	<u>Remarks</u>	
PS	74.3	$1.7 \times 10^{-2}$	11240	6	A-1	50% R.H. Tension (oriented)	
		$8.3 \times 10^{-2}$	9200	5			
		$1.7 \times 10^{-1}$	4900	6			
PS	-350	$3 \times 10^{-3}$	28400		A-2	Read from ( $\sigma$ , $\epsilon$ ) curves (Atactic PS) Max stress = $\sigma_y$	
		$3 \times 10^{-3}$	24000				
		$3 \times 10^{-3}$	20000				
		$2 \times 10^{-4}$	12800				
		$3 \times 10^{-3}$	13000				
	71.6	$1.2 \times 10^{-2}$	14900				
		$2 \times 10^{-4}$	10200				
		$2 \times 10^{-3}$	11200				
		$1.2 \times 10^{-2}$	12800				
		$3.6 \times 10^{-4}$	13560				
PS	68	$1.9 \times 10^{-4}$	11800		B-5	Read from ( $\sigma_y$ , $\dot{\epsilon}$ ) curves & ( $\sigma$ , $\epsilon$ ) Annealed for a day at 212°F, then cooled slowly to room temp. (Amorphous poly- styrene)	
		$70$	$1.9 \times 10^{-4}$	11800			
		$3.5 \times 10^{-4}$	12800				
		$3.6 \times 10^{-4}$	11600				
		$7 \times 10^{-4}$	12500				
		$1.5 \times 10^{-3}$	12400				
		$2 \times 10^{-3}$	13700				
		$3 \times 10^{-3}$	13200				
		$5.5 \times 10^{-3}$	14200				
		$6 \times 10^{-3}$	13700				
		$1.25 \times 10^{-2}$	14300				
		$2.5 \times 10^{-2}$	14500				
		86	$3.6 \times 10^{-4}$	12500			
		104	$3.6 \times 10^{-4}$	11500			
		122	$3.6 \times 10^{-4}$	10500			
		131	$3.6 \times 10^{-4}$	9830			
		140	$3.6 \times 10^{-4}$	8700			
		149	$3.6 \times 10^{-4}$	7380			
		158	$2 \times 10^{-4}$	6300			
			$3.6 \times 10^{-4}$	6450			
	$4 \times 10^{-4}$	7100					
	$7 \times 10^{-4}$	7400					
	$1.5 \times 10^{-3}$	8380					

<u>Material</u>	<u>T(°F)</u>	<u>Ė(/sec)</u>	<u>σ<sub>y</sub>(psi)</u>	<u>Elong. (%)</u>	<u>Ref.</u>	<u>Remarks</u>
		3x10 <sup>-3</sup>	9500			
		6x10 <sup>-3</sup>	9200			
		1.25x10 <sup>-2</sup>	9750			
		2.5x10 <sup>-2</sup>	10000			
		5x10 <sup>-2</sup>	11000			
	167	1.9x10 <sup>-4</sup>	5100			
		3.6x10 <sup>-4</sup>	5500			
		1.5x10 <sup>-3</sup>	7580			
	176	1.9x10 <sup>-4</sup>	1610			
		2x10 <sup>-4</sup>	1770			
		3.6x10 <sup>-4</sup>	2340			
		5x10 <sup>-4</sup>	2220			
		7.3x10 <sup>-4</sup>	2900			
		9x10 <sup>-4</sup>	2980			
		5x10 <sup>-3</sup>	3710			
		2x10 <sup>-3</sup>	3630			
		3.5x10 <sup>-3</sup>	4680			
PS	104	6.7x10 <sup>-5</sup>	8800		B-6	Read from ( σ <sub>y</sub> , Ė ) curves
		6.7x10 <sup>-4</sup>	10500		Comp.	APS ideal quenched from 221°F through T <sub>g</sub> (Atactic polystyrene)
		6.7x10 <sup>-3</sup>	12000			σ <sub>y</sub> = peak load/true area at notch
		6.7x10 <sup>-2</sup>	14500			Ė = crosshead speed/ length at the peak load
	140	6.7x10 <sup>-5</sup>	5800			
		6.7x10 <sup>-4</sup>	7200			
		6.7x10 <sup>-3</sup>	9500			
		6.7x10 <sup>-2</sup>	11500			
	176	6.7x10 <sup>-5</sup>	1670			
		6.7x10 <sup>-4</sup>	2330			
		6.7x10 <sup>-3</sup>	4200			
		6.7x10 <sup>-2</sup>	6670			
PS	104	6.7x10 <sup>-5</sup>	13200			Quenched from 221°F and reannealed 6 days at 167°F (Atactic Polystyrene)
		6.7x10 <sup>-4</sup>	13500			
		6.7x10 <sup>-3</sup>	14000			
		6.7x10 <sup>-2</sup>	14500			
	140	6.7x10 <sup>-5</sup>	9300			
		6.7x10 <sup>-4</sup>	11000			
		6.7x10 <sup>-3</sup>	12400			

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_Y</math>(psi)</u>	<u>Elong.</u> (%)	<u>Ref.</u>	<u>Remarks</u>
		$6.7 \times 10^{-2}$	13200			
	176	$6.7 \times 10^{-5}$	4400			
		$6.7 \times 10^{-4}$	6200			
		$6.7 \times 10^{-3}$	8300			
		$6.7 \times 10^{-2}$	10000			
PS	73.4	$1.7 \times 10^{-5}$	5330		C-1	Read from ( $\sigma$ , Tension $\epsilon$ ) curves Annealed
		$1.7 \times 10^{-4}$	5500			Fracture stress = $\sigma_Y$
		$1.7 \times 10^{-3}$	6250			
		$1.7 \times 10^{-2}$	6600			
PS	room	$1.7 \times 10^{-4}$	5700		D-2	Read from ( $\sigma_Y$ , Tension $\epsilon$ ) curves Ref. 16 & 17 in Ref. D-2
		$1.7 \times 10^{-3}$	6500			
		$1.7 \times 10^{-2}$	7400			
PS	room	$3.3 \times 10^{-5}$	7400			
		$4 \times 10^{-4}$	8540			
		$7.5 \times 10^{-3}$	10100			
Heat-resis- tant PS	room	$4 \times 10^{-5}$	8100			
		$4 \times 10^{-4}$	9060			
		$6 \times 10^{-3}$	11200			
PS	-168	$1 \times 10^{-5}$	21800		H-2	Read from ( $\sigma_Y$ , Comp. $\epsilon$ ) curves (GP PS)
		$1 \times 10^{-4}$	22200			
		$1 \times 10^{-3}$	22600			
	77	$1 \times 10^{-5}$	10000			
		$1 \times 10^{-4}$	10600			
		$1 \times 10^{-3}$	11500			
	149	$1 \times 10^{-5}$	3550			
		$1 \times 10^{-4}$	4820			
		$1 \times 10^{-3}$	6080			
PS	77	$1.2 \times 10^{-5}$	10400		H-4	Read from ( $\sigma$ , Comp. $\epsilon$ ) curves Max stress = $\sigma_Y$
		$4.8 \times 10^{-5}$	11200			
		$2 \times 10^{-4}$	12400			
		$7 \times 10^{-4}$	13200			
PS	-40	$4.2 \times 10^{-3}$	5870	15.2	I-1	Read from ( $\sigma_Y$ , Tension $\tau$ ) curves (High-impact poly- styrene) (Styron 475S)
		$4.2 \times 10^{-2}$	6430	13.8		
		$4.2 \times 10^{-1}$	6900	11.3		

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_Y</math>(psi)</u>	<u>Elong.</u> <u>(%)</u>	<u>Ref.</u>	<u>Remarks</u>
PS	-4	$4.2 \times 10^{-3}$	4880	15.9		
		$4.2 \times 10^{-2}$	5550	14.1		
		$4.2 \times 10^{-1}$	5900	12.5		
	0	$4.2 \times 10^{-3}$	4050	38.6		
		$4.2 \times 10^{-2}$	4720	29.5		
		$4.2 \times 10^{-1}$	5470	16.8		
	68	$4.2 \times 10^{-3}$	3480	54.8		
		$4.2 \times 10^{-2}$	4150	38.6		
		$4.2 \times 10^{-1}$	4580	27.7		
	104	$4.2 \times 10^{-3}$	3160	62.3		
		$4.2 \times 10^{-2}$	3480	45.5		
	-34.6	$4.3 \times 10^{-3}$	7780			L-2 Read from master Tension curve Molds were held at 140°F for 24 hrs. & at 230°F for 48 hrs.
		$4.3 \times 10^{-2}$	7110			
	-3.2	$3.3 \times 10^{-3}$	7110			
		$1 \times 10^{-2}$	7330			
		$1 \times 10^{-1}$	7780			
	51.8	$1.6 \times 10^{-3}$	5780			
		$1 \times 10^{-2}$	5780			
		$1 \times 10^{-1}$	6670			
	15.2	$1.1 \times 10^{-4}$	5000			
		$6.7 \times 10^{-4}$	5600			
		$3.3 \times 10^{-2}$	6400			
		$6.7 \times 10^{-2}$	7000			
		$9.2 \times 10^{-2}$	7200			
	$5 \times 10^{-1}$	7600				
	$1.67 \times 10^0$	6400				
	$2.1 \times 10^0$	7800				
	$5 \times 10^0$	8000				
107.6	$1 \times 10^{-3}$	4440				
	$3.3 \times 10^{-3}$	4880				
	$3.3 \times 10^{-2}$	5780				
154.6	$3.3 \times 10^{-3}$	3560				
	$3.3 \times 10^{-2}$	4000				
167	$1 \times 10^{-1}$	2670				
176	$1 \times 10^{-4}$	890				
	$1 \times 10^{-3}$	1780				

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_Y</math>(psi)</u>	<u>Elong.</u> (%)	<u>Ref.</u>	<u>Remarks</u>
		$1 \times 10^{-2}$	2890			
	185	$3.3 \times 10^{-3}$	2670			
	197	$3.3 \times 10^{-2}$	1330			
	203	$1.7 \times 10^{-2}$	440			
Rubber- modified PS (Lustrex HT 88-1)	room	$4.8 \times 10^{-1}$	3970	4.5	L-4	Read from ( $\sigma_Y,$ Tension $\dot{\epsilon}$ ) curve
		$4.8 \times 10^0$	4710	5.1		
		$2.33 \times 10^1$	5570	6.8		

TABLE 9 DYNAMIC PROPERTIES OF POLYVINYLCHLORIDE (PVC)

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_y</math>(psi)</u>	<u>Elong. (%)</u>	<u>Ref.</u>	<u>Remarks</u>	
PVC	-58	$4.2 \times 10^{-5}$	13240		B-2	Read from ( $\sigma_y$ , Tension $\dot{\epsilon}$ ) curves (Solvic 227, Solvay et Cie)	
		$4.2 \times 10^{-4}$	14820				
		$4.2 \times 10^{-3}$	15850				
		$4.2 \times 10^{-2}$	16870				
	-31	$4.2 \times 10^{-5}$	11845			$\dot{\epsilon}$ is calculated from crosshead speed	
		$2.1 \times 10^{-4}$	12540				
		$4.2 \times 10^{-4}$	12690				
		$8.3 \times 10^{-4}$	13200				
		$2.1 \times 10^{-3}$	13360				
		$4.2 \times 10^{-3}$	13750				
		$8.3 \times 10^{-3}$	14420				
		$2.1 \times 10^{-2}$	14530				
		$4.2 \times 10^{-2}$	15420				
		$8.3 \times 10^{-2}$	15750				
		32	$4.2 \times 10^{-5}$	8740			
			$8.3 \times 10^{-5}$	8830			
	$2.1 \times 10^{-4}$		9100				
	$4.2 \times 10^{-4}$		9350				
	$8.3 \times 10^{-4}$		9580				
	$2.1 \times 10^{-3}$		9870				
	$4.2 \times 10^{-3}$		10200				
	$8.3 \times 10^{-3}$		10650				
	73.4	$2.1 \times 10^{-2}$	10770				
		$8.3 \times 10^{-2}$	11600				
$2.1 \times 10^{-1}$		11800					
$8.3 \times 10^{-6}$		6050					
$2.1 \times 10^{-5}$		6310					
$4.2 \times 10^{-5}$		6580					
$8.3 \times 10^{-5}$		6810					
$2.1 \times 10^{-4}$		7100					
$4.2 \times 10^{-4}$		7350					
$8.3 \times 10^{-4}$		7480					
$2.1 \times 10^{-3}$	7880						
$4.2 \times 10^{-3}$	8000						

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_y</math>(psi)</u>	<u>Elong.</u> (%)	<u>Ref.</u>	<u>Remarks</u>
		$8.3 \times 10^{-3}$	8340			
		$2.1 \times 10^{-2}$	8560			
		$4.2 \times 10^{-2}$	8890			
		$8.3 \times 10^{-2}$	9010			
		$2.1 \times 10^{-1}$	9280			
	86	$8.3 \times 10^{-6}$	5490			
		$2.1 \times 10^{-5}$	5720			
		$4.2 \times 10^{-5}$	6010			
		$8.3 \times 10^{-5}$	6150			
		$2.1 \times 10^{-4}$	6430			
		$4.2 \times 10^{-4}$	6530			
		$8.3 \times 10^{-4}$	6770			
		$2.1 \times 10^{-3}$	7050			
		$4.2 \times 10^{-3}$	7380			
		$8.3 \times 10^{-3}$	7610			
		$2.1 \times 10^{-2}$	7990			
		$4.2 \times 10^{-2}$	8150			
		$8.3 \times 10^{-2}$	8460			
		$2.1 \times 10^{-1}$	8720			
	104	$8.3 \times 10^{-6}$	4640			
		$2.1 \times 10^{-5}$	4760			
		$4.2 \times 10^{-5}$	5000			
		$8.3 \times 10^{-5}$	5200			
		$2.1 \times 10^{-4}$	5440			
		$4.2 \times 10^{-4}$	5800			
		$8.3 \times 10^{-4}$	5900			
		$2.1 \times 10^{-3}$	6290			
		$4.2 \times 10^{-3}$	6480			
		$8.3 \times 10^{-3}$	6670			
		$2.1 \times 10^{-2}$	7120			
		$4.2 \times 10^{-2}$	7300			
		$8.3 \times 10^{-2}$	7510			
		$2.1 \times 10^{-1}$	7790			
	122	$2.1 \times 10^{-4}$	4350			
		$4.2 \times 10^{-4}$	4710			
		$8.3 \times 10^{-4}$	4980			

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_y</math>(psi)</u>	<u>Elong.</u> <u>(%)</u>	<u>Ref.</u>	<u>Remarks</u>
		$2.1 \times 10^{-3}$	5400			
		$4.2 \times 10^{-3}$	5570			
		$8.3 \times 10^{-3}$	5880			
		$2.1 \times 10^{-2}$	6170			
		$4.2 \times 10^{-2}$	6520			
		$8.3 \times 10^{-2}$	6600			
		$2.1 \times 10^{-1}$	6820			
	140	$2.1 \times 10^{-3}$	3980			
		$4.2 \times 10^{-3}$	4620			
		$8.3 \times 10^{-3}$	4740			
		$2.1 \times 10^{-2}$	5030			
		$4.2 \times 10^{-2}$	5360			
		$8.3 \times 10^{-2}$	5550			
		$2.1 \times 10^{-1}$	5700			
	158	$4.2 \times 10^{-3}$	3540			
		$2.1 \times 10^{-2}$	4110			
		$4.2 \times 10^{-2}$	4310			
		$8.3 \times 10^{-2}$	4630			
		$2.1 \times 10^{-1}$	4940			
PVC	122	$2.1 \times 10^{-5}$	3460			
		$4.2 \times 10^{-5}$	3840			
		$8.3 \times 10^{-5}$	4010			
		$2.1 \times 10^{-4}$	4390			
		$4.2 \times 10^{-4}$	4690			
		$8.3 \times 10^{-4}$	4910			
		$2.1 \times 10^{-3}$	5280			
		$4.2 \times 10^{-3}$	5530			
		$8.3 \times 10^{-3}$	5720			
		$2.1 \times 10^{-2}$	6120			
		$4.2 \times 10^{-2}$	6410			
		$8.3 \times 10^{-2}$	6630			
		$2.1 \times 10^{-1}$	6870			
	140	$2.1 \times 10^{-5}$	2410			
		$4.2 \times 10^{-5}$	2600			
		$8.3 \times 10^{-5}$	2810			
		$2.1 \times 10^{-4}$	3130			

B-3 Read from ( $\sigma_y$ ,  
Tension  $\dot{\epsilon}$ ) curves  
(Solvic 227, Solvay  
et Cie)  
 $\dot{\epsilon}$  is calculated  
from crosshead speed

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_y</math>(psi)</u>	<u>Elong.</u> <u>(%)</u>	<u>Ref.</u>	<u>Remarks</u>
		$4.2 \times 10^{-4}$	3440			
		$8.3 \times 10^{-4}$	3900			
		$2.1 \times 10^{-3}$	4210			
		$4.2 \times 10^{-3}$	4620			
		$8.3 \times 10^{-3}$	4850			
		$2.1 \times 10^{-2}$	4900			
		$4.2 \times 10^{-2}$	5380			
		$8.3 \times 10^{-2}$	5500			
		$2.1 \times 10^{-1}$	5710			
	158	$2.1 \times 10^{-5}$	1210			
		$4.2 \times 10^{-5}$	1360			
		$8.3 \times 10^{-5}$	1720			
		$2.1 \times 10^{-4}$	1930			
		$4.2 \times 10^{-4}$	2160			
		$8.3 \times 10^{-4}$	2820			
		$2.1 \times 10^{-3}$	3180			
		$4.2 \times 10^{-3}$	3500			
		$8.3 \times 10^{-3}$	3770			
		$2.1 \times 10^{-2}$	4300			
		$4.2 \times 10^{-2}$	4470			
		$8.3 \times 10^{-2}$	4640			
		$2.1 \times 10^{-1}$	4970			
	167	$8.3 \times 10^{-5}$	350			
		$2.1 \times 10^{-4}$	750			
		$4.2 \times 10^{-4}$	1050			
		$8.3 \times 10^{-4}$	1330			
		$2.1 \times 10^{-3}$	1730			
		$4.2 \times 10^{-3}$	2100			
		$8.3 \times 10^{-3}$	2500			
		$2.1 \times 10^{-2}$	2790			
		$4.2 \times 10^{-2}$	3150			
		$8.3 \times 10^{-2}$	3490			
		$2.1 \times 10^{-1}$	3960			
	176	$4.2 \times 10^{-4}$	500			
		$8.3 \times 10^{-3}$	620			
		$2.1 \times 10^{-2}$	880			

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_y</math>(psi)</u>	<u>Elong.</u> <u>(%)</u>	<u>Ref.</u>	<u>Remarks</u>
PVC	185	$4.2 \times 10^{-2}$	1260			
		$8.3 \times 10^{-2}$	1480			
		$2.1 \times 10^{-1}$	2140			
		$8.3 \times 10^{-2}$	370			
		$2.1 \times 10^{-1}$	810			
		$4.2 \times 10^{-3}$	15100	37	I-1 Read from ( $\sigma_y$ , Tension $T$ ) curves (Geon 103 Ep)	
	$4.2 \times 10^{-2}$	16200	24			
	$4.2 \times 10^{-3}$	13450	53			
	$4.2 \times 10^{-2}$	14900	27			
	$4.2 \times 10^{-3}$	11160	63			
	$4.2 \times 10^{-2}$	12470	47			
	$4.2 \times 10^{-1}$	14900	22			
	68	$4.2 \times 10^{-3}$	9160	90		
		$4.2 \times 10^{-2}$	10300	61		
		$4.2 \times 10^{-1}$	12200	26		
	104	$4.2 \times 10^{-3}$	7020	230		
		$4.2 \times 10^{-2}$	7800	117		
		$4.2 \times 10^{-1}$	9200	43		
140	$4.2 \times 10^{-3}$	3640	270			
	$4.2 \times 10^{-2}$	4830	240			
	$4.2 \times 10^{-1}$	6320	43			
PVC	77	$1.3 \times 10^{-3}$	9200			L-2 Read from master Tension curve Molds were held at 140°F for 24 hrs. & at 230°F for 24 hrs.
		$5 \times 10^{-3}$	10160			
		$3.3 \times 10^{-2}$	11300			
		$5.8 \times 10^{-2}$	10860			
		$8.3 \times 10^{-2}$	11400			
	$4.2 \times 10^{-1}$	12350				
	$1.67 \times 10^0$	13640				
	$5 \times 10^0$	14150				
	-34.6	$3.3 \times 10^{-4}$	15500			
		$1.3 \times 10^{-3}$	16270			
		$1.3 \times 10^{-2}$	17700			
		$1.3 \times 10^{-1}$	19800			
	3.2	$1.7 \times 10^{-4}$	13000			
		$9.2 \times 10^{-4}$	13580			
		$9.2 \times 10^{-3}$	15180			

<u>Material</u>	<u>T(°F)</u>	<u>ε̇(/sec)</u>	<u>σ<sub>y</sub>(psi)</u>	<u>Elong. (%)</u>	<u>Ref.</u>	<u>Remarks</u>
		9.2x10 <sup>-2</sup>	16000			
	50	1.5x10 <sup>-4</sup>	10500			
		6.2x10 <sup>-4</sup>	11350			
		6.2x10 <sup>-3</sup>	12500			
		6.2x10 <sup>-2</sup>	13580			
	107.6	2.6x10 <sup>-4</sup>	6300			
		1.24x10 <sup>-3</sup>	7000			
		1.24x10 <sup>-2</sup>	8500			
		1.24x10 <sup>-1</sup>	10000			
	122	2.5x10 <sup>-4</sup>	5000			
		4.2x10 <sup>-3</sup>	6300			
		5.8x10 <sup>-2</sup>	7050			
	131	1.5x10 <sup>-3</sup>	2960			
		1.5x10 <sup>-2</sup>	4500			
		1.5x10 <sup>-1</sup>	4530			
	140	5.8x10 <sup>-5</sup>	1000			
		5.8x10 <sup>-4</sup>	2500			
		5.8x10 <sup>-2</sup>	3600			
	149	1.3x10 <sup>-2</sup>	430			
		1.5x10 <sup>-1</sup>	1930			
PVC	room	8.3x10 <sup>-1</sup>	10500	20.3	P-2	Strain Rate-speed/ Tension jaw separation average value
		8.33x10 <sup>1</sup>	14130			
PVC (Rigid)	room	2.7x10 <sup>-3</sup>	7300	200	W-1	Read from ( σ <sub>y</sub> , Tension ε ) curves
		6.7x10 <sup>-3</sup>	8130	53		Type I rigid PVC extruded into 2½ in. SDR 26 pipe
		2.7x10 <sup>-2</sup>	9460	26		
		1.7x10 <sup>-1</sup>	11500	17		
		1.6x10 <sup>0</sup>	13470	20.5		
		1.68x10 <sup>1</sup>	15700	21		
		1x10 <sup>2</sup>	17570	20		
PVC	room	2.7x10 <sup>-3</sup>	4630			Type II PVC Material from 2½ DSR 26 pipe
		6.7x10 <sup>-3</sup>	5380			
		2.7x10 <sup>-2</sup>	6300	100		
		1.7x10 <sup>-1</sup>	7670	60		
		1.6	9200	54		
		1.68x10 <sup>1</sup>	10800	56		
		1x10 <sup>2</sup>	12100	59		

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_Y</math>(psi)</u>	<u>Elong.</u> (%)	<u>Ref.</u>	<u>Remarks</u>
PVC	room	$2.7 \times 10^{-3}$	6900	230		PVC Type "1½" impact modified "1½" material
		$6.7 \times 10^{-3}$	7600	88		
		$2.7 \times 10^{-2}$	8700	41		
		$1.7 \times 10^{-1}$	10300	26		
		$1.64 \times 10^0$	12170	27		
		$1.68 \times 10^1$	14030	32		
		$1 \times 10^2$	15380	31		
PVC	room	$2.7 \times 10^{-3}$	7780	123		Type I was designed as a specialty compound for pipe application
		$6.7 \times 10^{-3}$	8780	66		
		$2.7 \times 10^{-2}$	10080	33		
		$1.7 \times 10^{-1}$	11940	23		
		$1.6 \times 10^0$	14200	25		
		$1.68 \times 10^1$	16500	27		
		$1 \times 10^2$	18380	30		
PVC	-34.6	$1 \times 10^{-4}$	15760		Z-1 Read from ( $\sigma_Y$ , Tension $\dot{\epsilon}$ ) curves (Halvic 239)	
		$3.5 \times 10^{-4}$	16260			
		$3.5 \times 10^{-3}$	17620			
	3.2	$4 \times 10^{-2}$	19570			
		$8 \times 10^{-5}$	12980			
		$5 \times 10^{-4}$	13600			
	50	$5 \times 10^{-3}$	14840			
		$5 \times 10^{-2}$	16000			
		$1.2 \times 10^{-4}$	6030			
	107.6	$8 \times 10^{-4}$	7110			
		$8.5 \times 10^{-3}$	8390			
		$8.5 \times 10^{-2}$	9830			
	122	$1.2 \times 10^{-4}$	6030			
		$8.5 \times 10^{-4}$	7260			
		$8 \times 10^{-3}$	8440			
	131	$5 \times 10^{-2}$	9890			
		$8 \times 10^{-5}$	4020			
		$3.5 \times 10^{-4}$	5100			
			$3.5 \times 10^{-3}$	6380		
		$3.5 \times 10^{-2}$	7200			
		$9 \times 10^{-5}$	2530			
		$3.5 \times 10^{-4}$	2830			

<u>Material</u>	<u>T(°F)</u>	<u><math>\dot{\epsilon}</math>(/sec)</u>	<u><math>\sigma_Y</math>(psi)</u>	<u>Elong.</u> <u>(%)</u>	<u>Ref.</u>	<u>Remarks</u>
		$2.5 \times 10^{-3}$	4640			
		$4 \times 10^{-2}$	4580			
140		$1.2 \times 10^{-4}$	310			
		$8 \times 10^{-4}$	960			
		$7 \times 10^{-3}$	2320			
		$7 \times 10^{-2}$	3760			
149		$3 \times 10^{-3}$	370			
		$3 \times 10^{-2}$	1440			

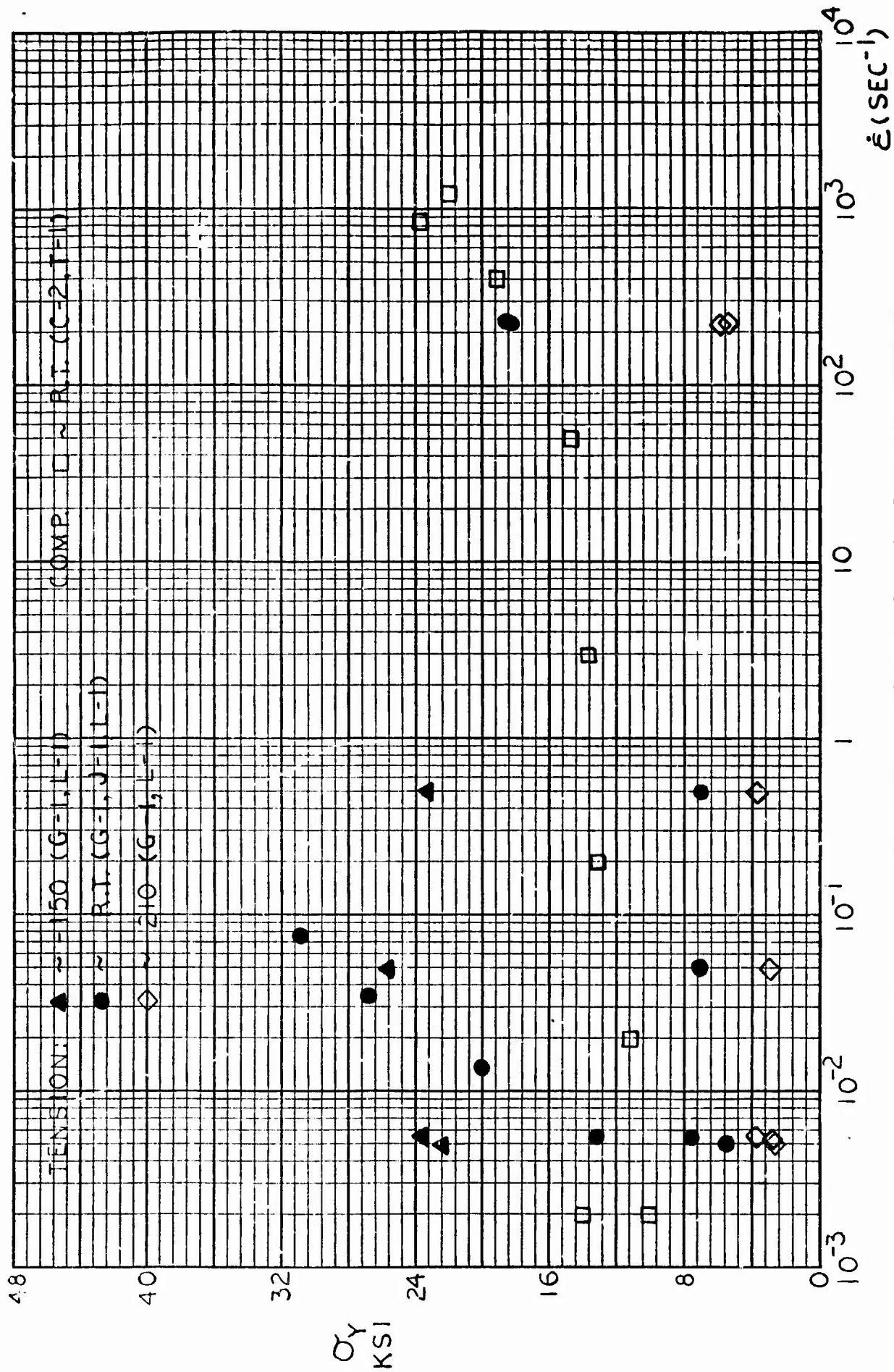


FIG. 1 Yield Strength vs. Strain Rate for NYLON

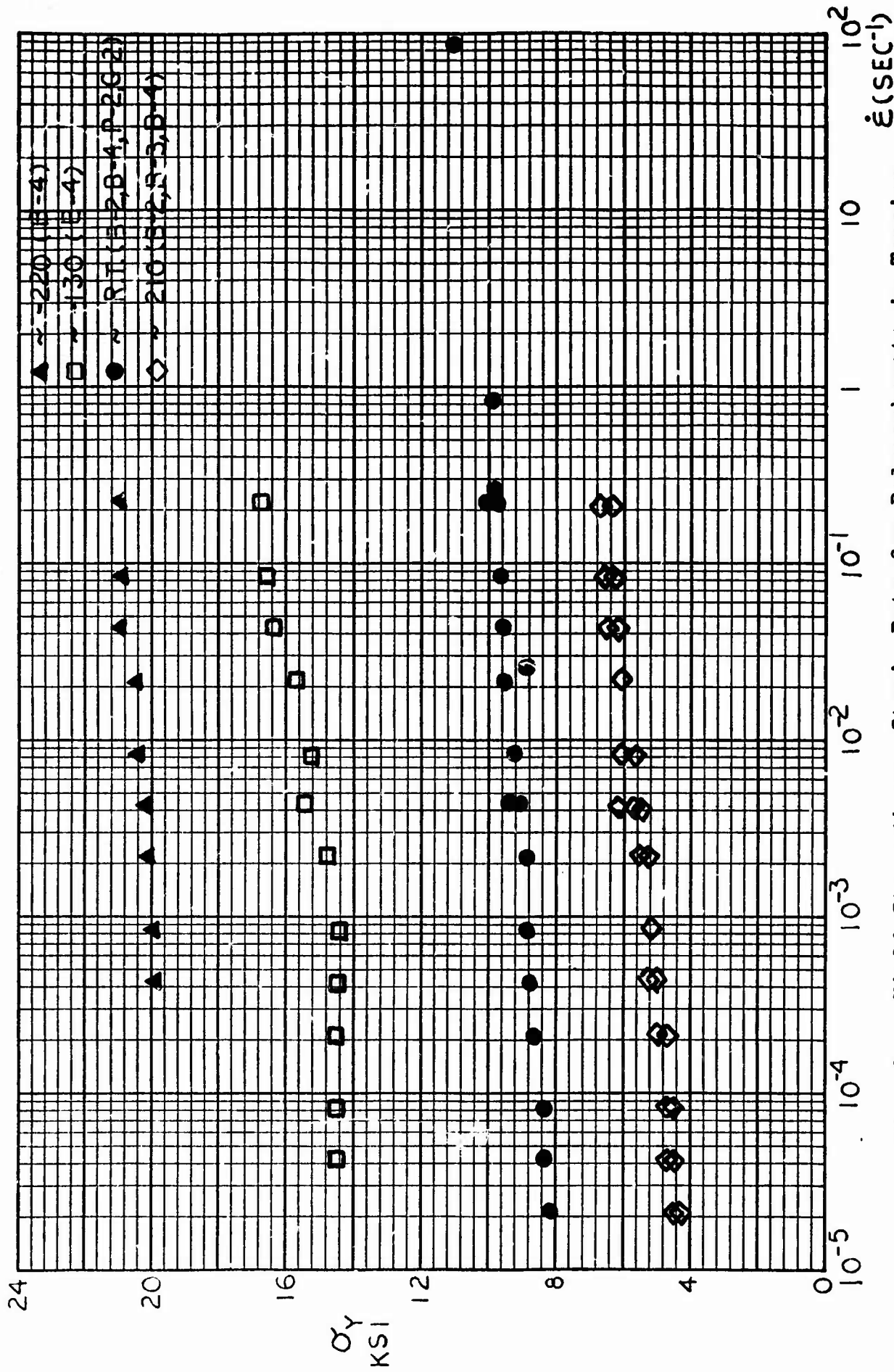


FIG. 2 Yield Strength vs. Strain Rate for Polycarbonate in Tension

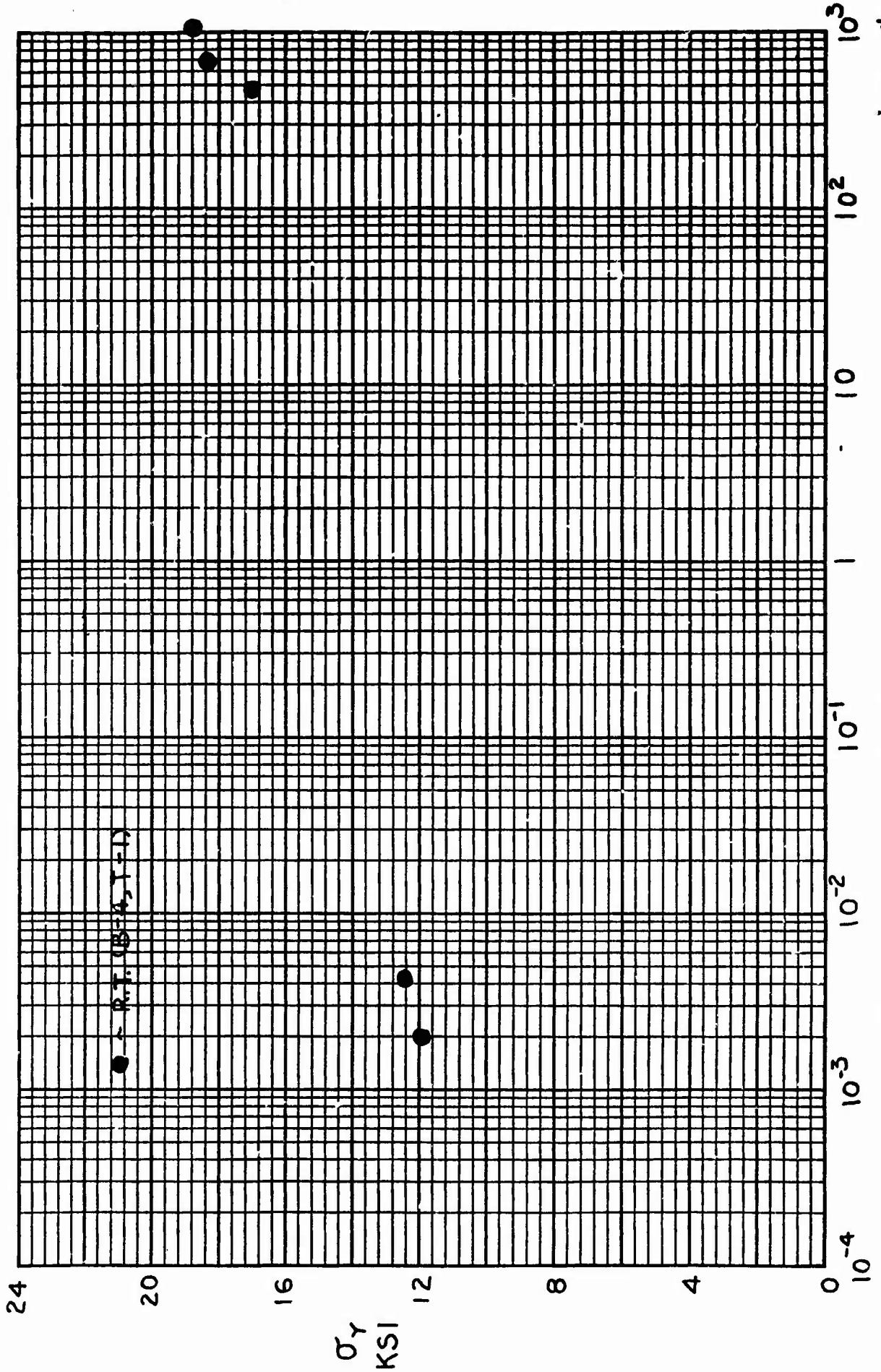


Fig. 3 Yield Strength vs. Strain Rate for Polycarbonate in Compression  $\dot{\epsilon}$ (SEC<sup>-1</sup>)

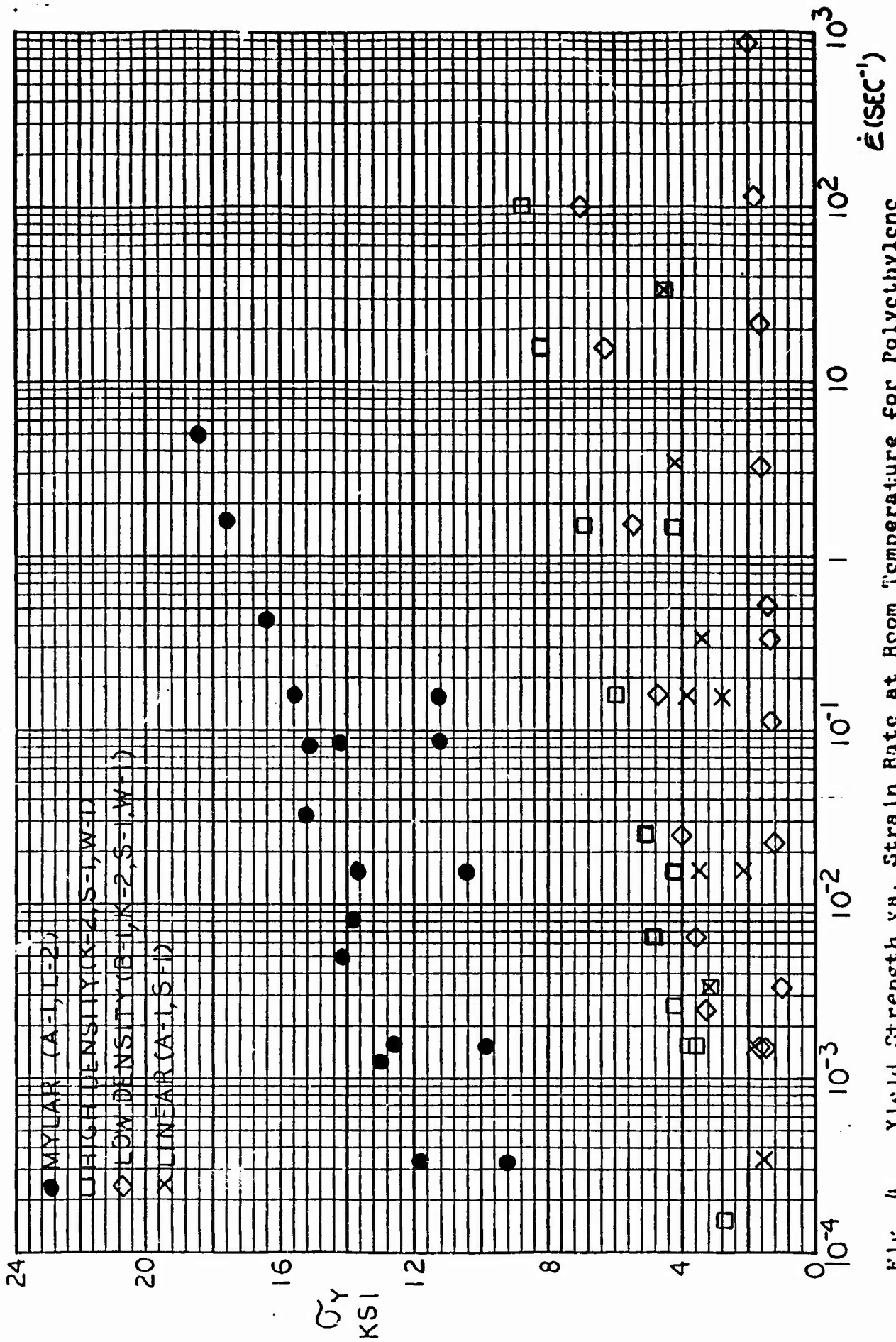


Fig. 4 Yield Strength vs. Strain Rate at Room Temperature for Polyethylene in Tension

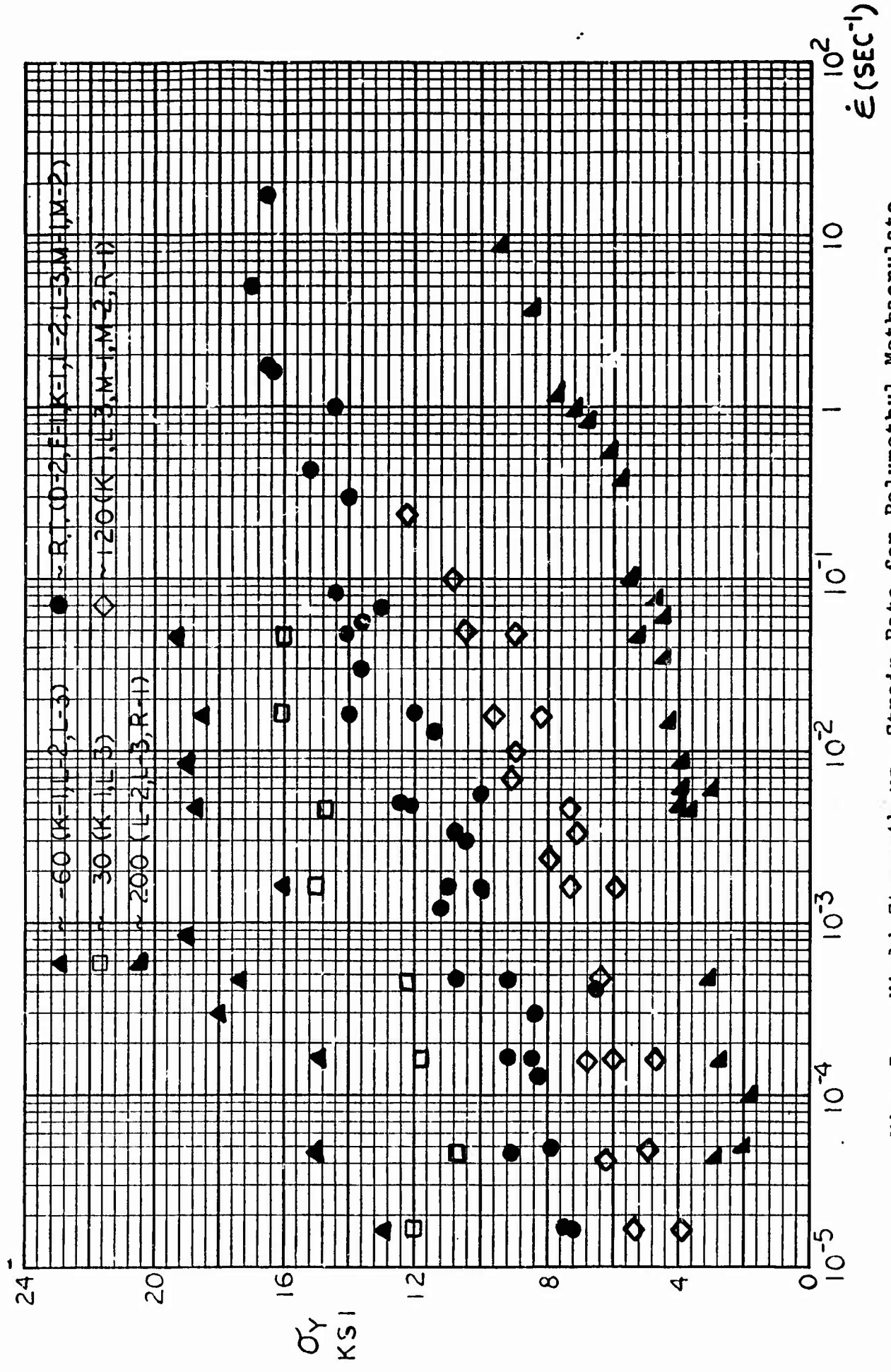


FIG. 5 Yield Strength vs. Strain Rate for Polymethyl Methacrylate in Tension

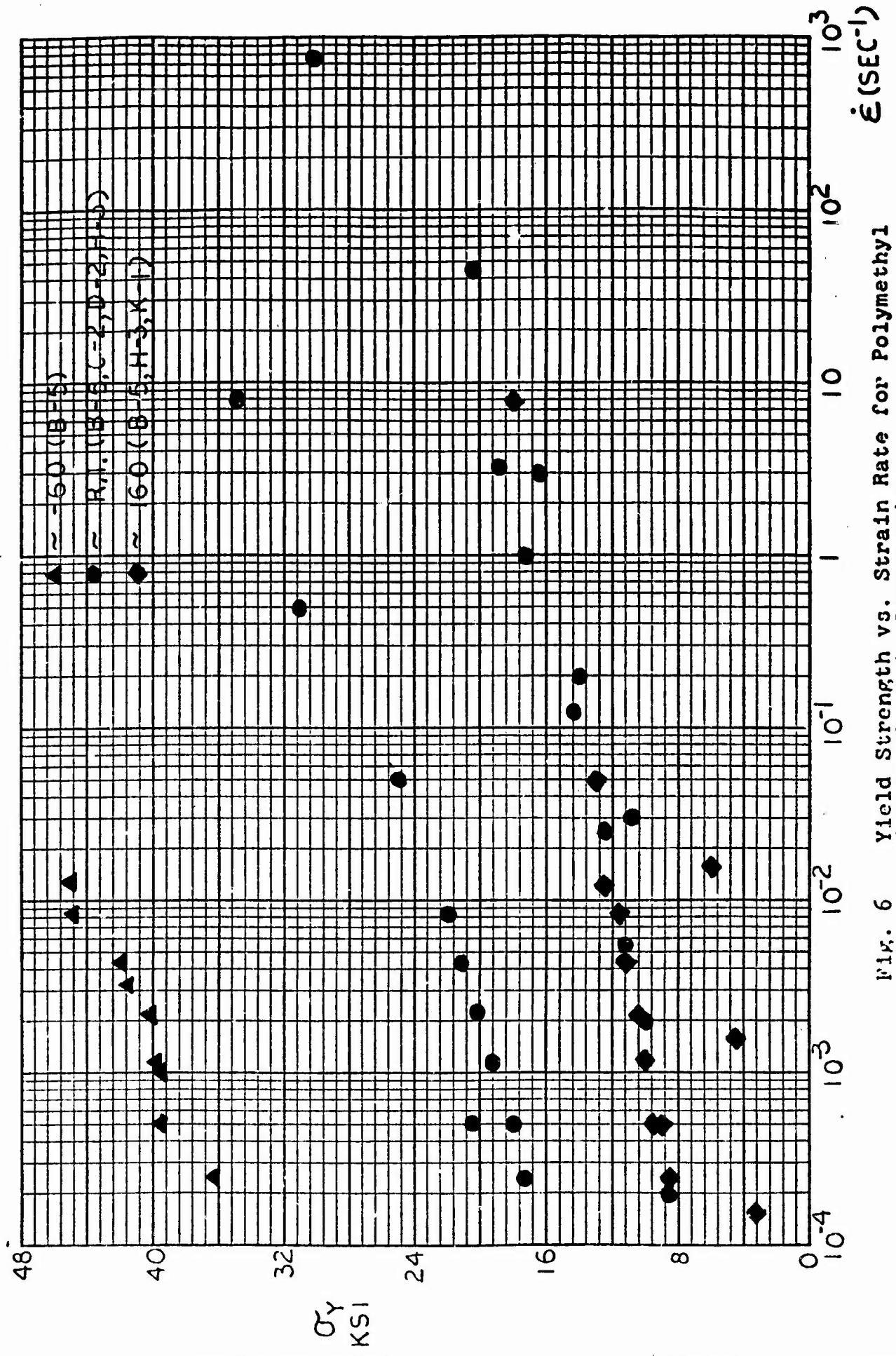


FIG. 6 Yield Strength vs. Strain Rate for Polymethyl Methacrylate in Compression

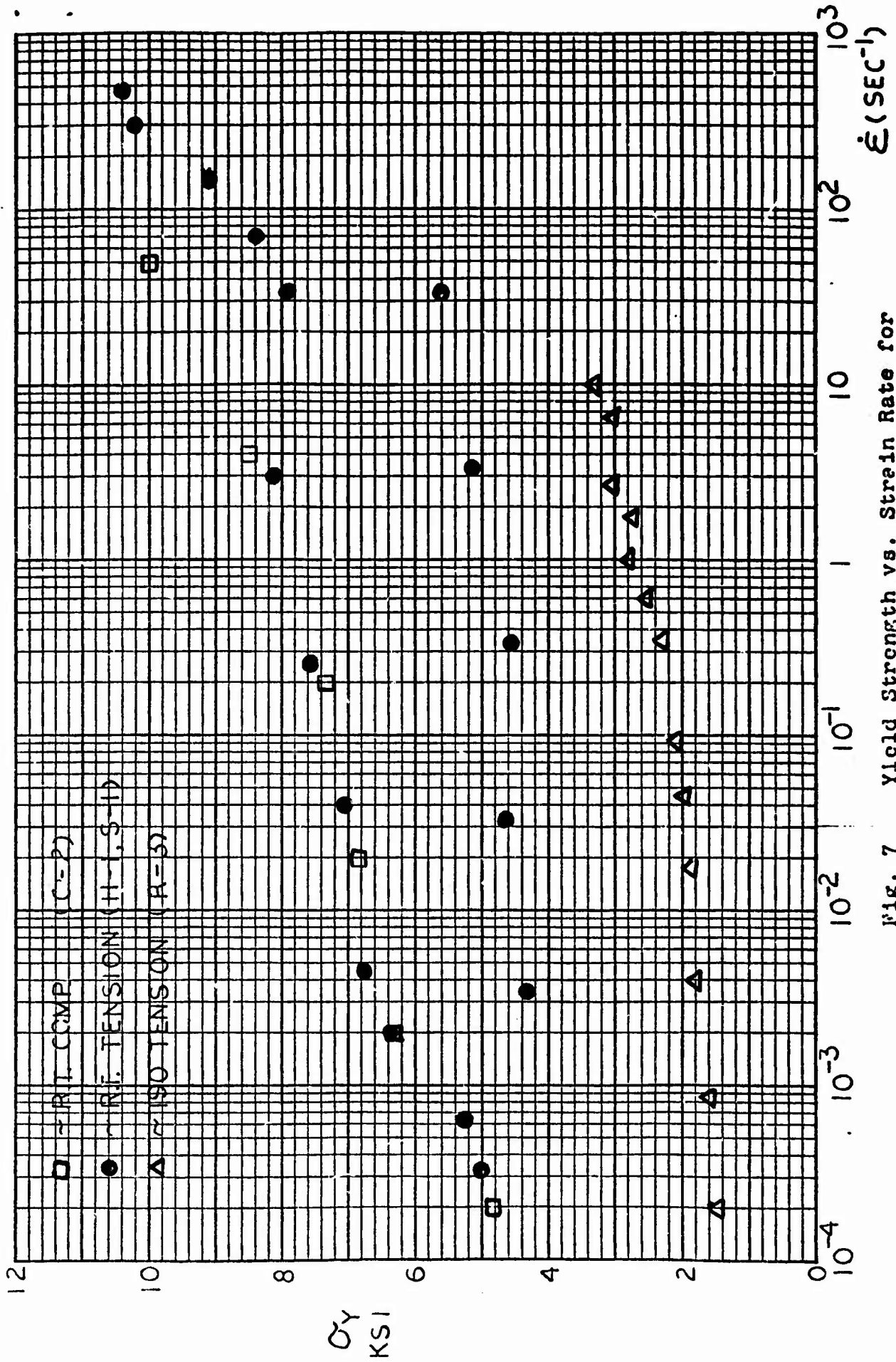


Fig. 7 Yield Strength vs. Strain Rate for Polypropylene

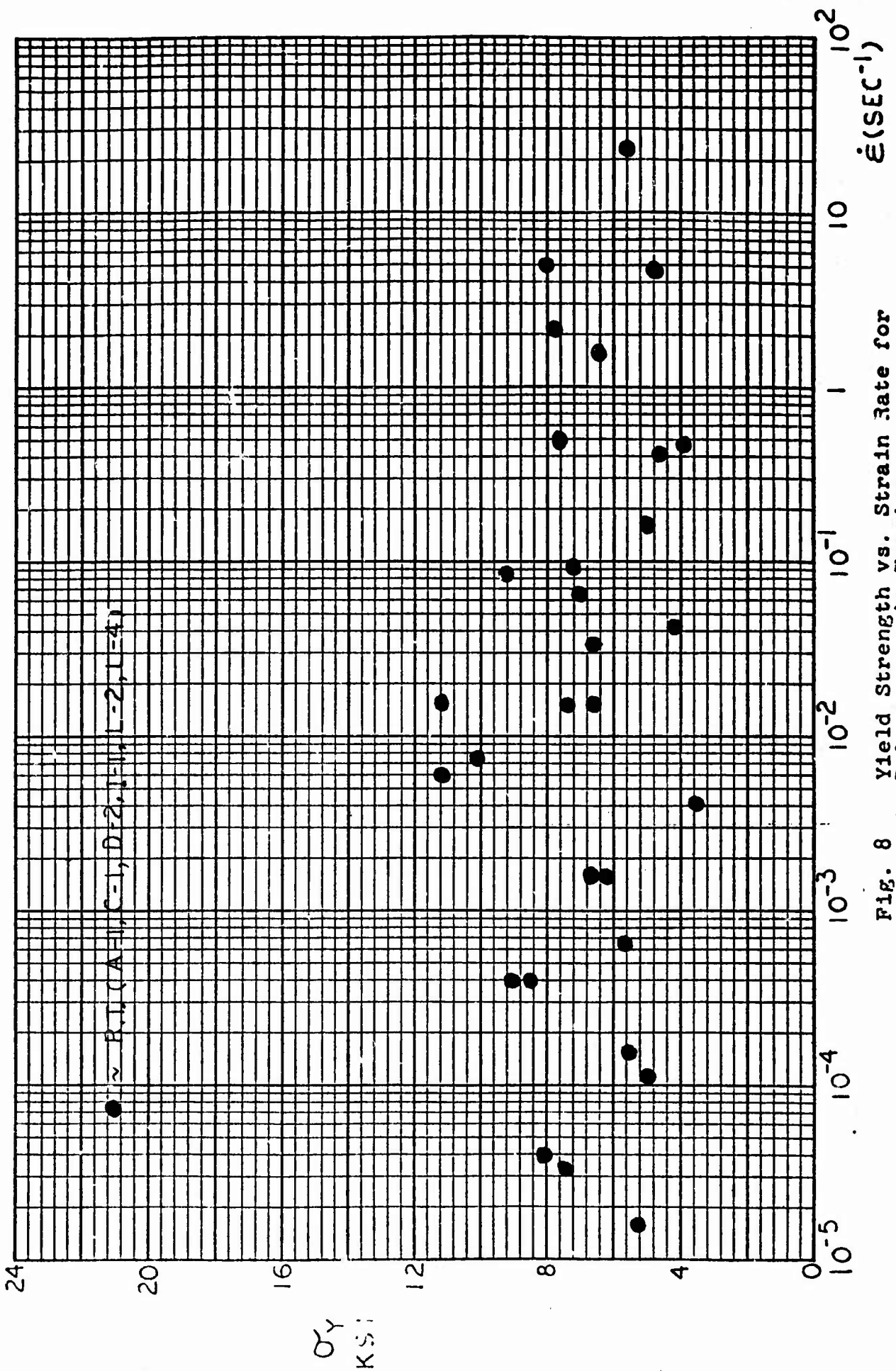


Fig. 8 Yield Strength vs. Strain Rate for Polystyrene in Tension

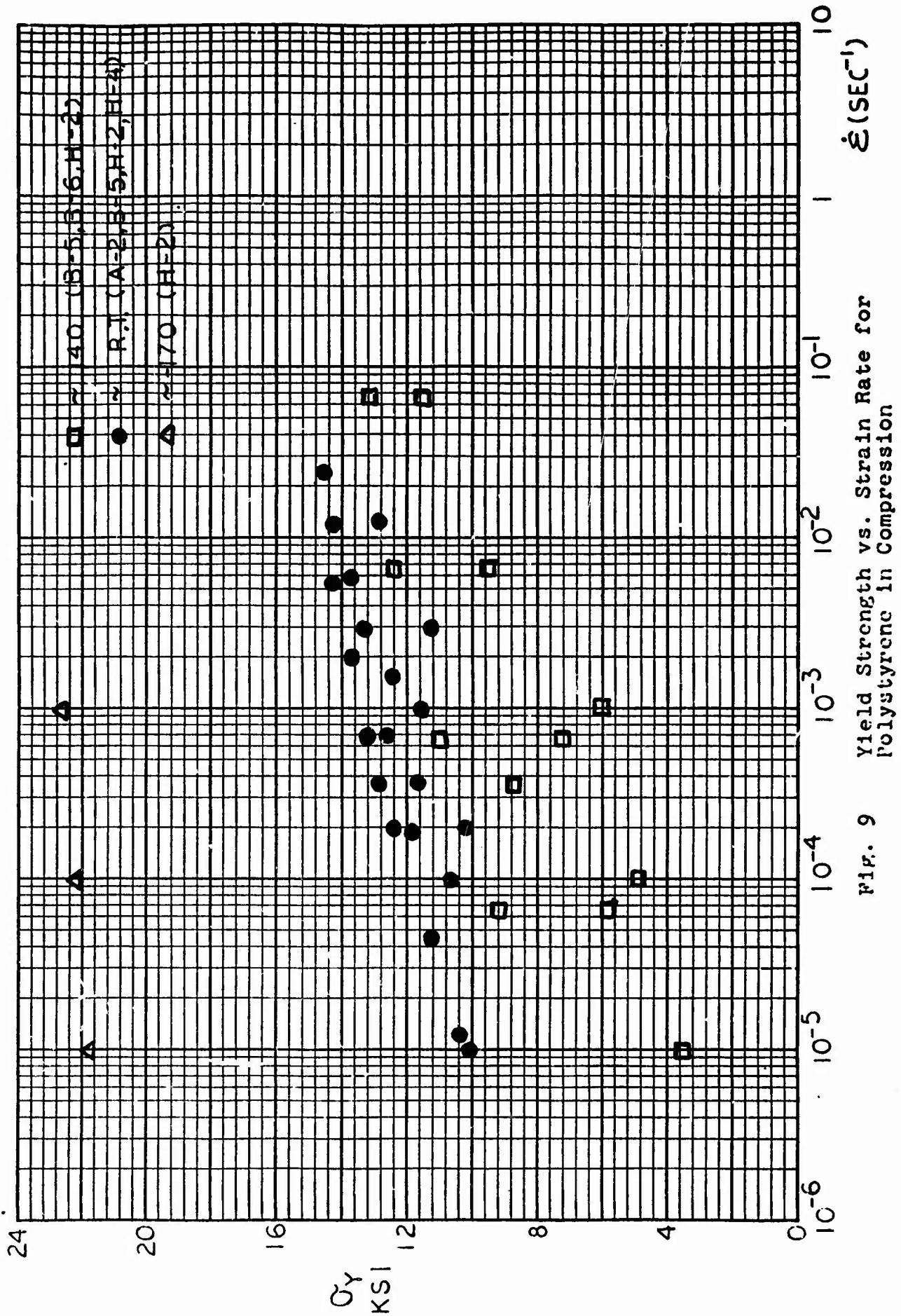


Fig. 9 Yield Strength vs. Strain Rate for Polystyrene in Compression

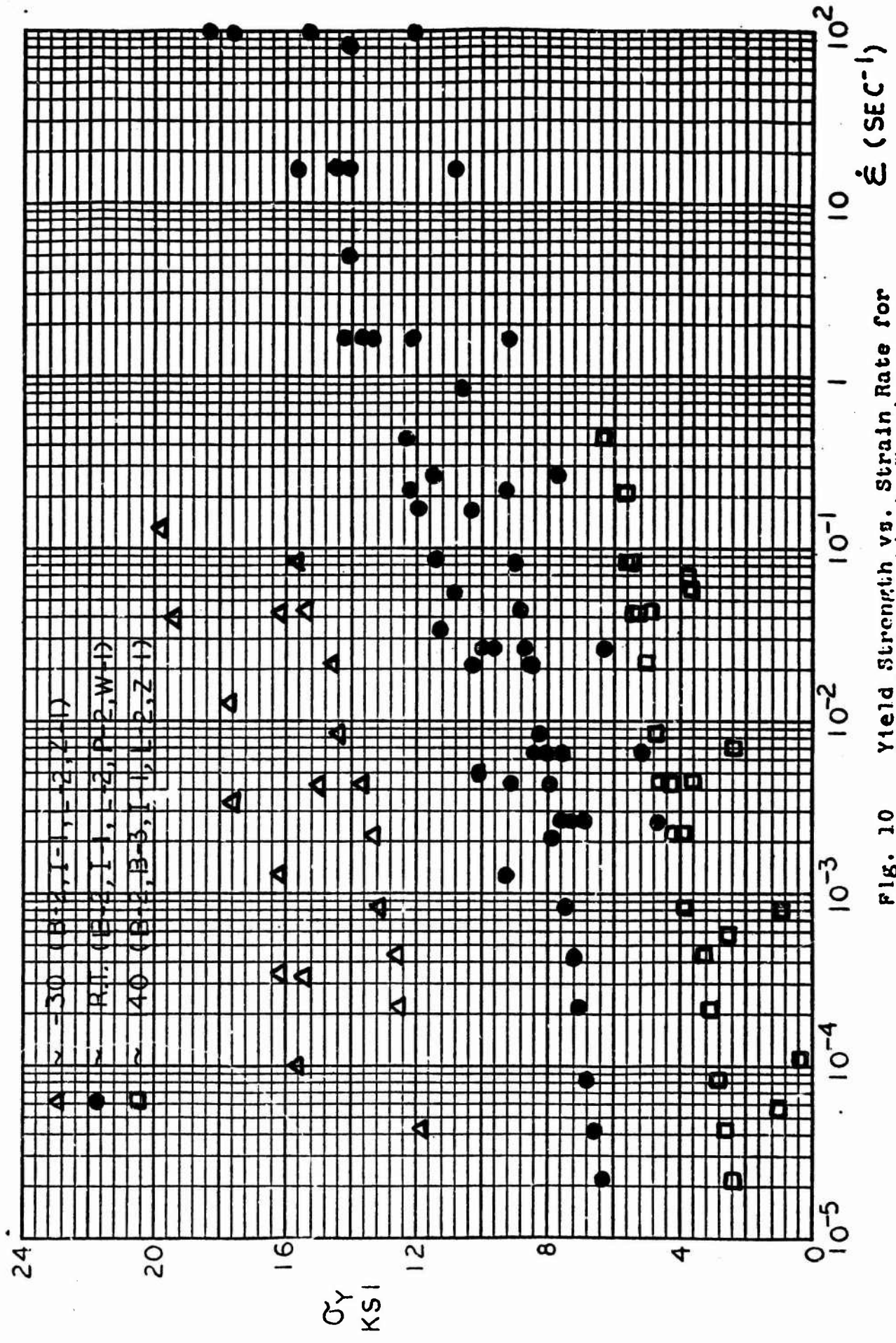


Fig. 10 Yield Strength vs. Strain Rate for Polyvinylchloride in Tension

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