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Effect of Molecular Weight on PVC Properties

PVC polymer can be made in a wide range of chain lengths or molecular weights. For control and identification purposes, the molecular weight is characterized by the polymer's intrinsic viscosity in a solvent solution. The higher molecular weight polymers possess higher tensile strength and hardness, better resistance to flow at elevated temperatures, and improved solvent resistance, when compared to their lower molecular weight homologs.

Resin	Vygen 85	Vygen 105	Vygen 110	Vygen 120
Molecular Weight*	74,000	83,000	93,000	107,000
Intrinsic Viscosity	.80	.93	1.03	1.18
Tensile Strength, psi**	2160	2490	2730	2890
Ultimate Elongation, %**	230	300	340	350
Tensile Stress at				
100% Elongation, psi**	1290	1400	1420	1460
Shore A Hardness,				
0 Sec.	91	91	91	92
10 Sec.	80	80	81	82
Formulation	Resin — 100 parts			
	DOP — 50 parts			
	Ba-Cd Stabilizer — 2 parts			

* D. J. Mead and R. M. Fuoss, J. American Chemical Society, 64, 277, (1942).

** ASTM D-412-61T.

The table above illustrates a typical formulation using 50 parts of dioctyl phthalate (DOP) plasticizer per hundred parts of resin and resins of differing intrinsic viscosity ranging from 0.80 to 1.18. It can be seen that the tensile strength and elongation at break increase with increasing molecular weight. Figures 1 and 2 show these points graphically.

The suggestions for the use of our products are based on tests believed to be reliable. However, due to variations in consumer handling and methods of compounding, we do not guarantee the results to be obtained, nor do we assume any liability for the use by a consumer of any materials or process in violation of common law or patent rights.

FIGURE 1. EFFECT OF MOLECULAR WEIGHT ON TENSILE STRENGTH

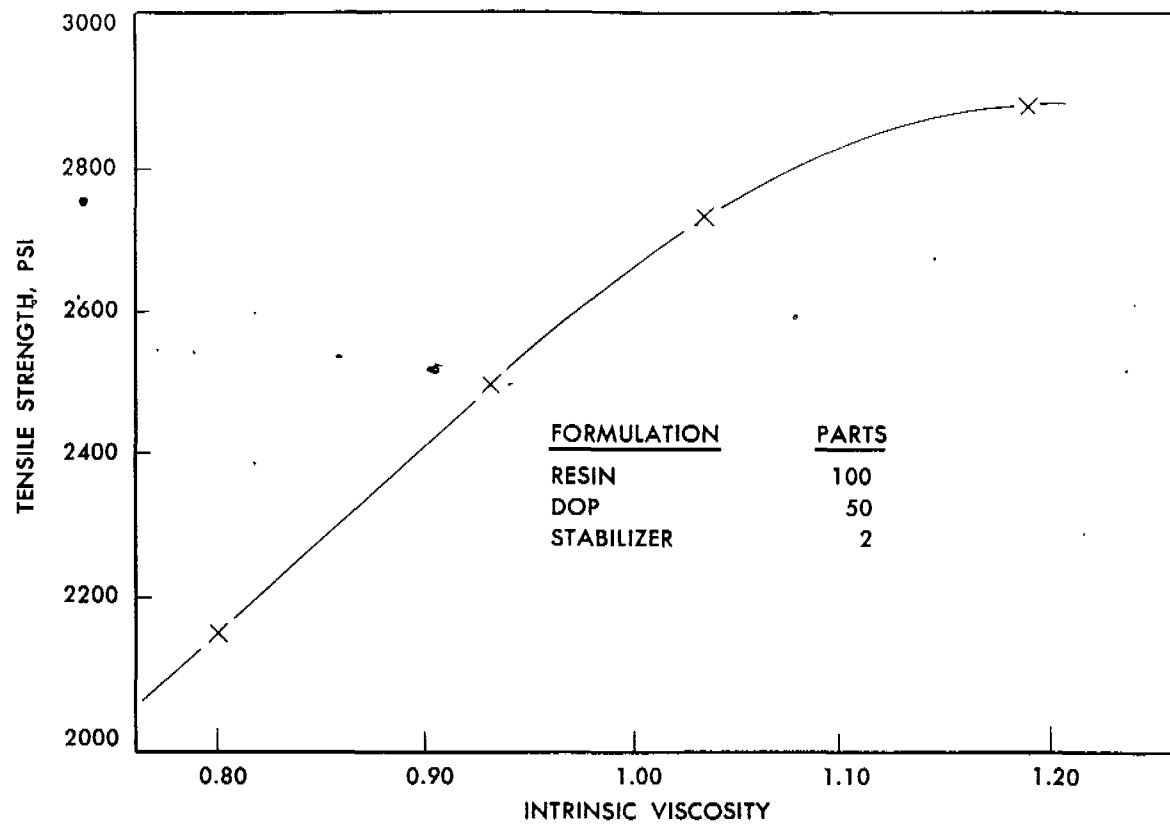
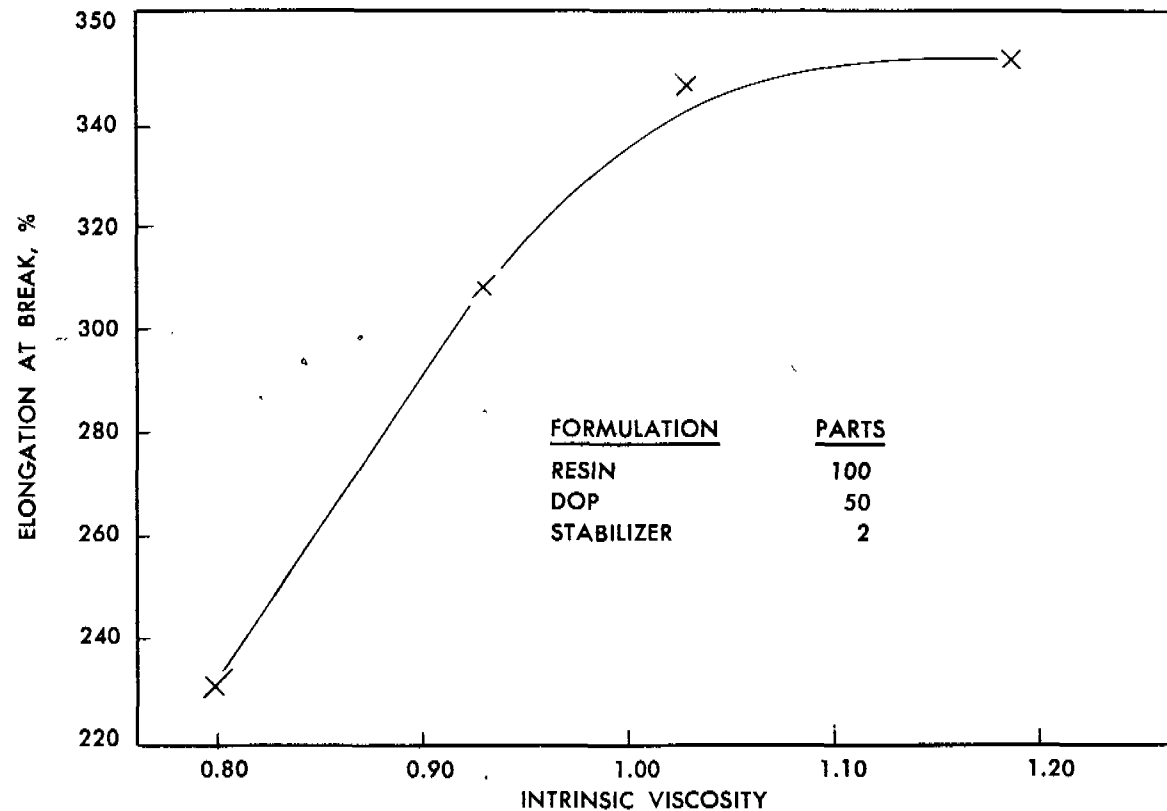
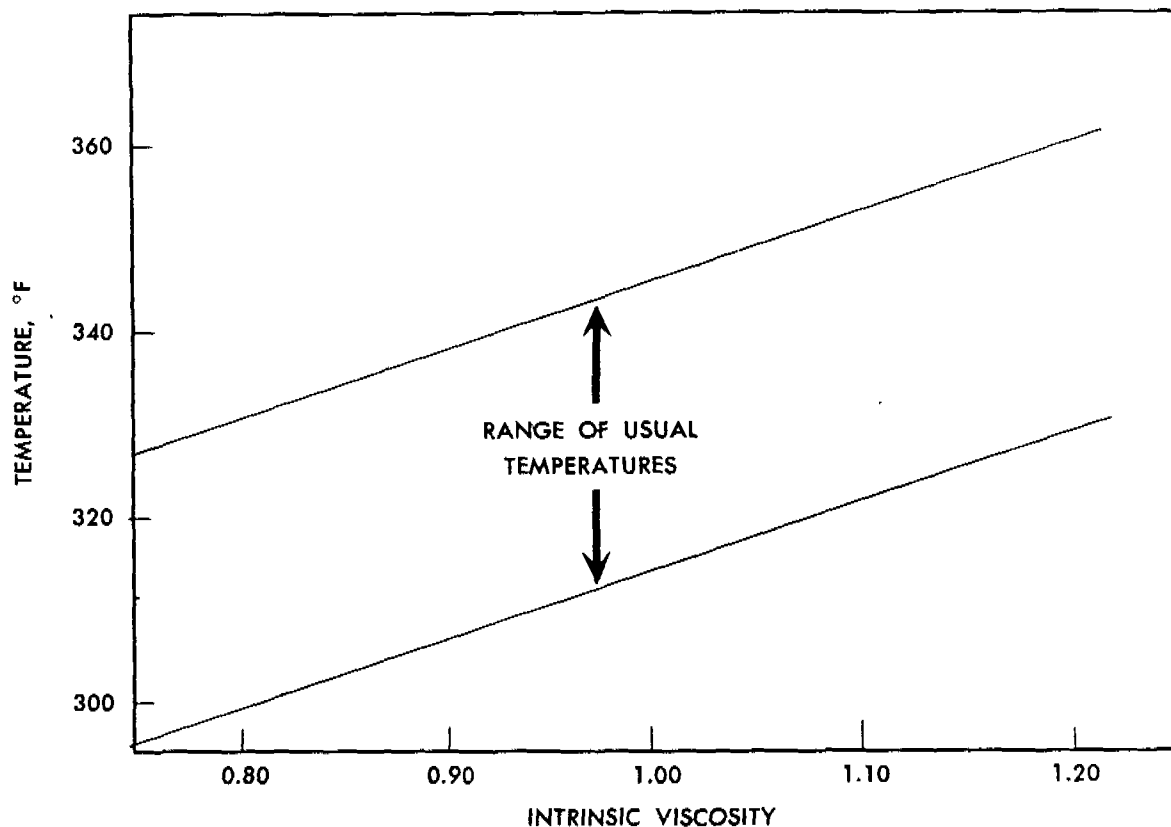


FIGURE 2. EFFECT OF MOLECULAR WEIGHT ON ELONGATION



Calendering temperatures increase from a 300° to 330°F level with a 0.80 viscosity resin to a 330° to 360°F level for the 1.18 viscosity resin, as shown in Figure 3.

FIGURE 3. EFFECT OF MOLECULAR WEIGHT ON CALENDERING TEMPERATURE



Higher processing temperatures tend to create resin instability problems if the processing cycle is of long duration. A compromise must often be made between the molecular weight resin selected and the processing technique.

The higher molecular weight resins are used in extrusions of flexible tubing, wetting, electrical components, garden hose, and calendered film which require short dwell times at the elevated processing temperatures. Intermediate molecular weight resins are used in film and sheet, coated fabrics and rigid applications. Low molecular weight resins are used in fluidized bed coatings, phonograph records and injection molded parts.