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SOLUTION PROPERTIES OF POLYMER BY ULTRASOUND

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ABSTRACT

The object of this investigation is to obtain information on intermolecular interaction of segment of polymer chain. For that purpose, compressibility of polymer was measured in dilute solution by measurements of velocity of ultrasonic longitudinal wave at 1 MHz and density. Two kinds of compressibilities of solute were adopted as compressibilities of polymer.

One is the "partial specific compressibility"($\bar{\kappa}_2^0$) of solute and another one is the "compressibility of mixing unit (κ_2)" of solute. $\bar{\kappa}_2^0$ is obtained by applying the additive of compression volumes ($\kappa = \phi_1\kappa_2 + \phi_2\kappa_2$, ϕ_2 :volume fraction of solute) and κ_2 is obtained by applying the additive of intermolecular forces ($\kappa^{-1/7} = \phi_1\kappa_1^{-1/7} + \phi_2\kappa_2^{-1/7}$) to polymer solution. $\bar{\kappa}_2^0$ was found to be independent of molecular weight of polymer. However, values of $\bar{\kappa}_2^0$ were found to depend on solvent and further the excluded - volume ( ) of segment. On the other hand, κ_2 is independent of not only molecular weight of polymer but also solvent. Therefore, it is found that "compressibility of mixing unit (κ_2)" corresponds to compressibility of segment. Data of compressibility of polystyrene measured in various solvents are given as

Table 1 Partial specific compressibility ($\bar{\kappa}_2^0$) and compressibility of mixing unit (κ_2) of Polystyrene (M=5x10^4) in various solvents at 30 . c_1: Ultrasonic velocity of solvent

PST	c_1	$\bar{v}_{20}$	κ_1	$\bar{\kappa}_{20}$	κ_2	$\beta \times 10^{24}$
Solvent	(m/s)	(cm^3/g)	(cm^2/dyne)			(cm^3)
Cyclohexane	1228.6	0.943	86.2	35.2	40.5	1.66
Ethylacetate	1120.5	0.914	89.6	24.2	44.7	2.39
Butanone	1176.0	0.920	91.0	22.8	44.6	2.78
sec-BB	1297.0	0.943	70.0	35.8	43.7	5.79
m-Cbrobenzene	1254.2	0.924	58.0	39.9	42.7	8.03
Toluene	1288.2	0.926	70.3	35.2	43.4	9.93
Benzene	1279.2	0.917	70.4	36.3	44.1	10.69
Average value		*0.927*			*43.0*	