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Tables of Dielectric Dispersion Data for Pure Liquids and Dilute Solutions

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Tables of Dielectric Dispersion Data for Pure Liquids and Dilute Solutions

Floyd Buckley and Arthur A. Maryott



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Tables of Dielectric Dispersion Data for Pure Liquids and Dilute Solutions

Floyd Buckley and Arthur A. Maryott

Primary dielectric dispersion data and characteristic dispersion parameters are tabulated for almost 200 substances in the liquid state and for dilute aqueous and nonaqueous solutions with more than 150 solutes. There are 6 tables and 1 section of graphs. There are 4 tables for pure liquids, 2 containing summaries of the derived dispersion parameters and 2 containing the primary data. The section on graphs supplements the tables for pure liquids and contains reproductions of pertinent data that are available only in the form of graphs.

1. Introduction

This tabulation of the data on dielectric dispersion for pure liquids and dilute solutions is part of a general program at the National Bureau of Standards for the critical evaluation and compilation of data from selected fields of physics and chemistry. The first table of the series on dielectric properties, titled Table of Dielectric Constants of Pure Liquids, appeared as NBS Circular 514, and the second table, titled Table of Dielectric Constants and Electric Dipole Moments of Substances in the Gaseous State, appeared as NBS Circular 537. The preparation of additional tables of dielectric properties is in progress.

This tabulation contains primary dispersion data and derived dispersion parameters for pure

liquids and dilute solutions. Tables 1 to 4 pertain to pure liquids and consist of three parts: (1) Characteristic dispersion parameters (Cole-Cole¹ representation) are given in tables 1 and 2 for inorganic and organic substances, respectively; (2) original data from the literature are listed in the corresponding tables 3 and 4; and (3) pertinent data available in the literature in graphical form only are reproduced in a separate section. Only those graphs are reproduced that add significantly to the general picture of dispersion represented by tables 1 to 4. Tables 5 and 6 contain the numerical data and the derived dispersion parameters for dilute aqueous and nonaqueous solutions.

2. Representation of Dispersion Data for Pure Liquids²

At ordinary temperatures the dependence of the dielectric constant, ϵ' , and the dielectric loss factor, ϵ'' , on frequency is, for a large class of compounds, adequately represented by the dispersion equations of Debye. For the compounds listed in tables 1 to 4, deviations from this behavior fall into one of the following types:

1. The plot of the complex dielectric constant $\epsilon = \epsilon' - i\cdot\epsilon''$ in the complex plane is a segment of a semicircle. The loss curve $\epsilon'' = f(\ln \lambda)$ has the characteristic Debye symmetry, but the maximum loss is reduced and the half-width of the absorption curve is increased.

2. The plot of ϵ in the complex plane is asymmetrical over the entire range of dispersion.

3. The absorption near the high-frequency limit of the dispersion range is considerably larger, and the limiting value $\epsilon'_{\lambda=0}$ is significantly smaller, than that predicted from the Debye equations.

Although it is to be expected that more extensive and accurate data will reveal a rather complex dependence of ϵ' and ϵ'' on frequency and molecular structure, data at present available for compounds exhibiting the behavior of types 1 and 2 are adequately represented by the two empirical modifications of the Debye functions introduced by Cole (see footnote 1). For substances showing the behavior of type 3 the data can best be represented by superimposing two or more independent but overlapping dispersion curves.

2.1. Cole-Cole Representation

The general dispersion equation for the complex dielectric constant is

$$\epsilon = \epsilon' - i\cdot\epsilon'' = \epsilon_0 + \frac{\epsilon_\infty - \epsilon_0}{1 + (i\omega\tau)^{1-\alpha}},$$

where

$$\epsilon_0 = \epsilon \text{ for } \lambda = 0$$

$$\epsilon_\infty = \epsilon \text{ for } \lambda = \infty$$

λ = wavelength in vacuum (or air)

$$\omega = 2\pi\frac{c}{\lambda} \quad (c = \text{velocity of light in vacuum})$$

τ = characteristic relaxation time

$$\lambda_c = 2\pi c \tau = \text{critical wavelength}$$

α = distribution (relaxation time) parameter.

¹ K. S. Cole and R. H. Cole, J. Chem. Phys. **9**, 341 (1941); D. W. Davidson and R. H. Cole, J. Chem. Phys. **19**, 1484 (1951).

² General discussions of dielectric phenomena are found in the following books and monographs:

P. Debye, *Polar molecules*, Chemical Catalog Co., New York, 1929 (new unrevised edition, Dover Publications, New York, N. Y., 1945).

C. P. Smyth, *Dielectric behaviour and structure* (McGraw-Hill Book Co., New York, N. Y., 1955).

C. J. F. Böttcher, *Theory of electric polarization* (Elsevier Publishing Co., New York, N. Y., 1952).

H. Fröhlich, *Theory of dielectrics* (Oxford Univ. Press, London, 1949).

W. F. Brown, Jr., *Dielectrics*, *Handbuch der Physik*, vol. 17 (Springer-Verlag, Berlin, 1956).

The locus of ϵ in the complex plane is a segment of a semicircle with the parametric representation:

$$\epsilon' - \epsilon_0 = \frac{\epsilon_\infty - \epsilon_0}{2} \cdot \left\{ 1 - \frac{\sinh [(1-\alpha)\ln \omega\tau]}{\cosh [(1-\alpha)\ln \omega\tau] + \sin \alpha \frac{\pi}{2}} \right\}$$

$$\epsilon'' = \frac{\epsilon_\infty - \epsilon_0}{2} \cdot \left\{ \frac{\cos \alpha \frac{\pi}{2}}{\cosh [(1-\alpha)\ln \omega\tau] + \sin \alpha \frac{\pi}{2}} \right\}$$

The locus can be easily drawn from the following:

(a) Coordinates of the center,

$$\epsilon' = \frac{\epsilon_\infty + \epsilon_0}{2}$$

$$\epsilon'' = -\frac{\epsilon_\infty - \epsilon_0}{2} \cdot \tan \alpha \frac{\pi}{2}.$$

(b) Radius of the circle,

$$R = \frac{\epsilon_\infty - \epsilon_0}{2} \cdot \sec \alpha \frac{\pi}{2}.$$

Useful characteristics of the dispersion curve are:

(a) Maximum loss factor,

$$\epsilon''_{\max} = \frac{\epsilon_\infty - \epsilon_0}{2} \cdot \tan (1-\alpha) \frac{\pi}{4}.$$

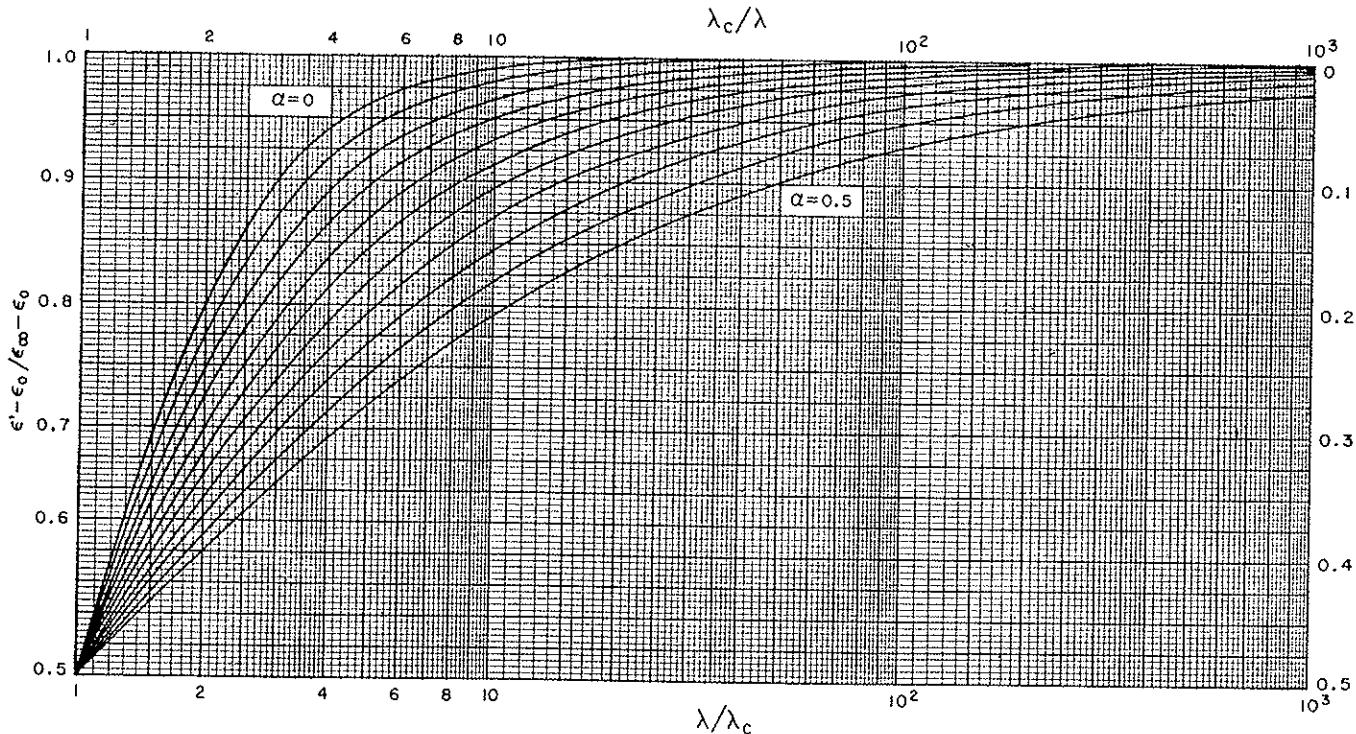


FIGURE 2. A family of dispersion curves.

The value of the Cole-Cole distribution parameter, α , is given for intervals of 0.05. The scale of ordinates on the right is to be used in conjunction with the upper scale of abscissas.

(b) Critical wavelength for which ϵ'' is a maximum,

$$\frac{\lambda_c}{\lambda} = \left(\frac{v}{u} \right)^{\frac{1}{1-\alpha}}.$$

The geometrical significance of these dispersion parameters is shown in figure 1.

The graphs given in figures 2, 3, and 4, in conjunction with the parameters given in tables 1 and 2, permit a rapid estimation of ϵ' and ϵ'' for any wavelength.

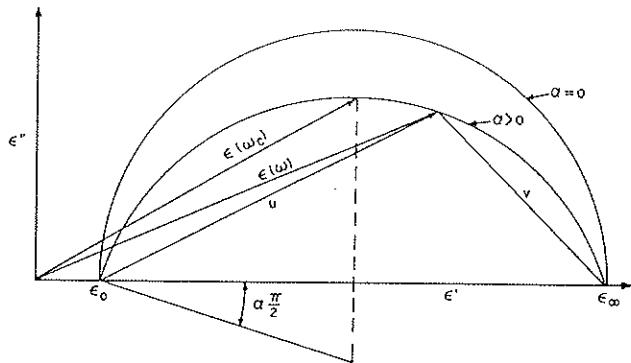


FIGURE 1. Representation in the complex plane of $\epsilon = \epsilon_0 + (\epsilon_\infty - \epsilon_0) / [1 + (i \cdot \omega\tau)^{1-\alpha}]$.

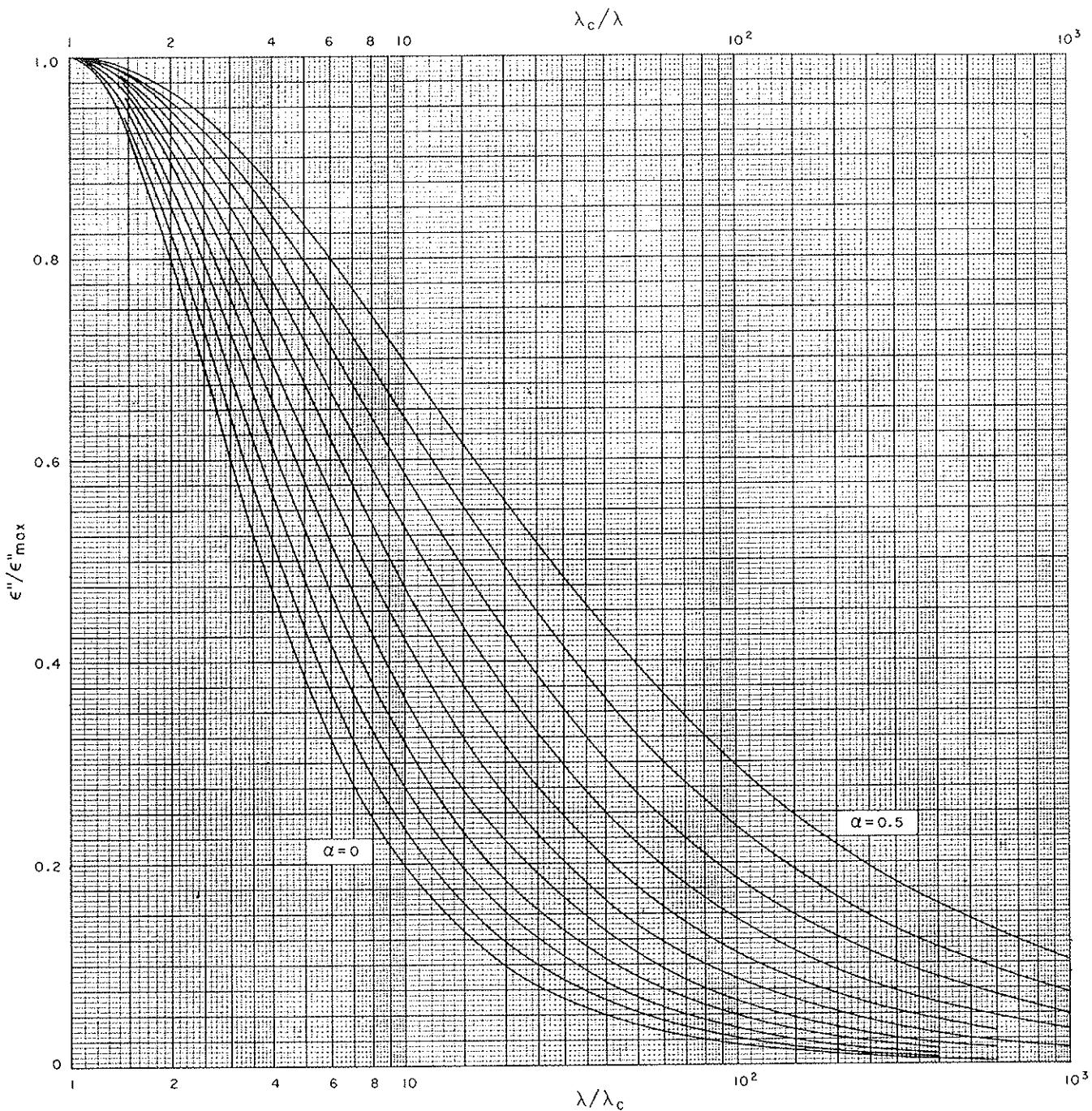


FIGURE 3. *A family of absorption curves.*

The value of the Cole-Cole distribution parameter, α , is given for intervals of 0.05. The scale of ordinates on the right is to be used in conjunction with the upper scale of abscissas.

2.2. Cole-Davidson Representation

The parameters characterizing the Cole-Davidson representation (see footnote 1) are defined by

$$\epsilon = \epsilon' - i\cdot\epsilon'' = \epsilon_0 + \frac{\epsilon_\infty - \epsilon_0}{(1+i\cdot\omega\tau)^\beta}.$$

The parametric equations for the locus of ϵ in the complex plane are:

$$\epsilon' - \epsilon_0 = (\epsilon_\infty - \epsilon_0) \cdot (\cos \varphi)^\beta \cdot \cos \beta\varphi$$

$$\epsilon'' = (\epsilon_\infty - \epsilon_0) \cdot (\cos \varphi)^\beta \cdot \sin \beta\varphi$$

$$\tan \varphi = \omega\tau,$$

and in polar form,

$$R = (\epsilon_\infty - \epsilon_0) \cdot \left(\cos \frac{\theta}{\beta} \right)^\beta$$

$$\theta = \tan^{-1} \frac{\epsilon''}{\epsilon' - \epsilon_\infty} = \beta\varphi.$$

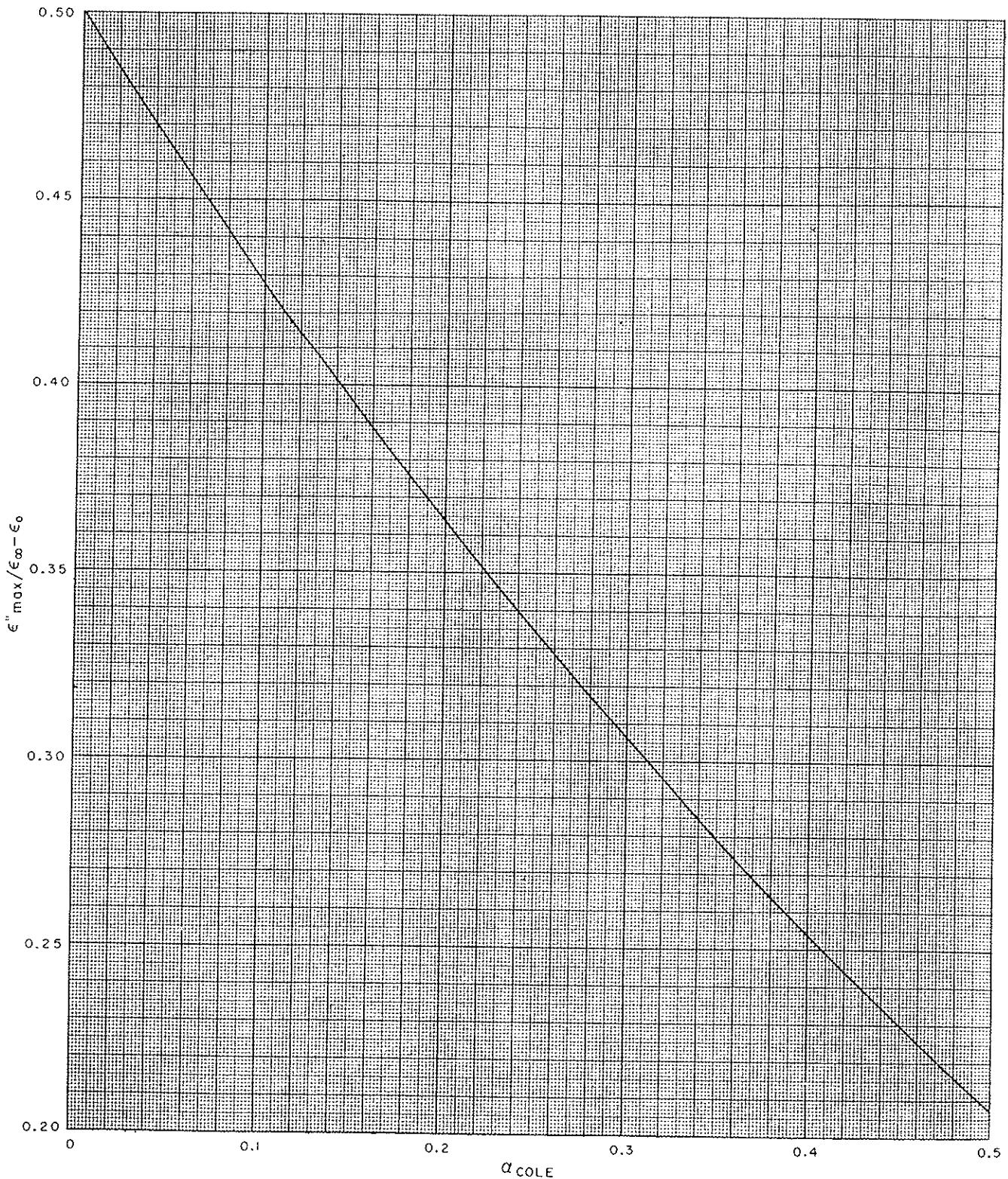


FIGURE 4. Relative maximum absorption as a function of the Cole-Cole distribution parameter, α .

In this representation, if $\beta < 1$, the locus degenerates into a segment of a Debye semicircle for $\omega \rightarrow 0$, and into a segment of a straight line $\theta = \beta(\pi/2)$ for $\omega \rightarrow \infty$. A family of loci,

$$R' = \frac{\epsilon - \epsilon_0}{\epsilon_\infty - \epsilon_0} = \left(\cos \frac{\theta}{\beta} \right)^{\beta},$$

is shown in figure 5.

The significance of the parameter ω_c (or λ_c , τ) differs from that of the corresponding quantity in the Cole-Cole representation. In the latter case the condition that determines ω_c is that ϵ'' shall be a maximum, whereas in this representation the condition is $\theta = (\pi/4)$. The relation $\omega_c \tau = 1$ is sat-

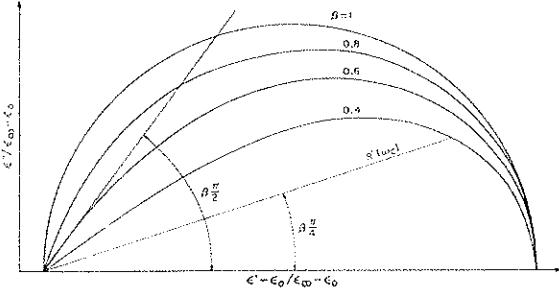


FIGURE 5. A family of curves representing $(\epsilon - \epsilon_0)/(\epsilon_\infty - \epsilon_0) = 1/(1 + i \cdot \omega \tau)^\beta$.

isified in both cases. The parameter λ_c for both representations appears in tables 1 and 2.

2.3. Debye Representation

The Debye representation is the special case, $\alpha=0$, of the Cole-Cole representation, or $\beta=1$ of the Cole-Davidson representation.

2.4. Two or More Relaxation Times

Tentative assignments of the dispersion characteristics of a second dispersion region are given for a few compounds. These parameters satisfy the following relations, in which subscripts 1 and 2 denote the dispersion regions at low and high frequency, respectively. In the complex plane,

$$\epsilon = \epsilon' - i \cdot \epsilon'' = \epsilon_2 + \delta \epsilon$$

$$\delta \epsilon = \epsilon_1 - \epsilon_{10} = (\epsilon_1' - \epsilon_{10}) - i \cdot \epsilon_1'' = \frac{\epsilon_{1\infty} - \epsilon_{10}}{1 + i \cdot \omega \tau_1}$$

$$\epsilon_2 = \epsilon_2' - i \cdot \epsilon_2'' = \epsilon_{20} + \frac{\epsilon_{2\infty} - \epsilon_{20}}{1 + i \cdot \omega \tau_2}$$

so that

$$\delta \epsilon' = \epsilon_{1\infty} - \epsilon_{10} = \frac{\epsilon_{1\infty} - \epsilon_{10}}{1 + (\omega \tau_1)^2}$$

$$\delta \epsilon'' = \epsilon_1'' = \frac{\epsilon_{1\infty} - \epsilon_{10}}{1 + (\omega \tau_1)^2} \cdot \omega \tau_1$$

3. Representation of Dispersion Data for Dilute Solutions

3.1. Nonaqueous Solutions

3.11. Cole-Cole Representation: If the solvent has no loss then the dispersion equations in this representation are identical with those for the pure liquids, provided ϵ' and ϵ'' are replaced by the corresponding incremental dielectric constant and loss, $(\Delta \epsilon'/c)$ and $(\Delta \epsilon''/c)$. These quantities are defined by the relations

$$\epsilon_{12}' = \epsilon_1 + \left(\frac{\Delta \epsilon'}{c} \right) \cdot c$$

$$\epsilon_{12}'' = \left(\frac{\Delta \epsilon''}{c} \right) \cdot c$$

$$\tan \delta_{12} = \left(\frac{\Delta \tan \delta}{c} \right) \cdot c.$$

The subscripts 12 and 1 refer to the solution and

$$\epsilon_2' = \epsilon' - \frac{\epsilon_{1\infty} - \epsilon_{10}}{1 + (\omega \tau_1)^2} = \epsilon_{20} + \frac{\epsilon_{2\infty} - \epsilon_{20}}{1 + (\omega \tau_2)^2}$$

$$\epsilon_2'' = \epsilon'' - \frac{\epsilon_{1\infty} - \epsilon_{10}}{1 + (\omega \tau_1)^2} \cdot \omega \tau_1 = \frac{\epsilon_{2\infty} - \epsilon_{20}}{1 + (\omega \tau_2)^2} \cdot \omega \tau_2.$$

The geometrical significance of these relations is shown in figure 6 for the special case in which the dispersion in both regions is of the Debye type.

The method of representation can be extended to allow for more than two regions of dispersion and generalized to allow for $\alpha_i \neq 0$. The dispersion parameters for successive regions of dispersion are distinguished in tables 1 and 2 by numbers in parentheses in the column for $\epsilon_{\lambda=\infty}$.

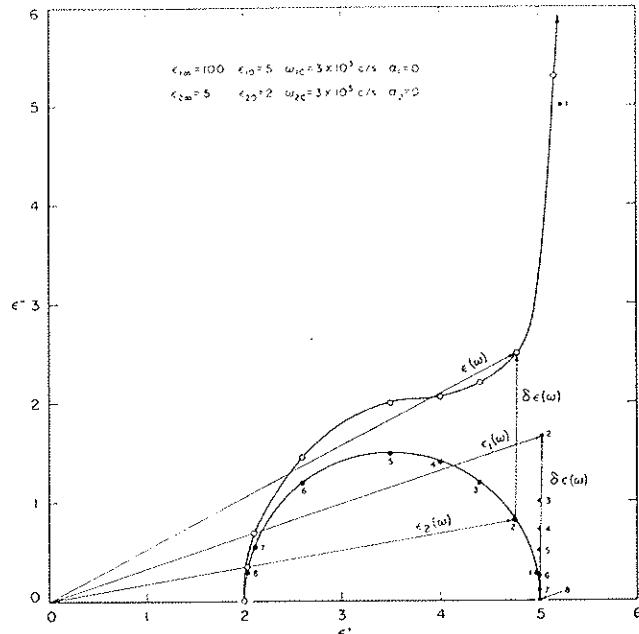


FIGURE 6. A Cole-Cole plot for the case of two times of relaxation.

The section of the plot that corresponds to low frequencies and the greater relaxation time is not drawn.

solvent, respectively, c denotes the concentration, and δ the loss angle.

3.12. Debye Representation: This is the Cole-Cole representation for $\alpha=0$.

In those cases where only loss data were reported the critical wavelength was evaluated from one of the following equations:

$$\frac{\Delta \tan \delta}{c} = \frac{(\epsilon_1 + 2)^2}{\epsilon_1} \frac{4\pi N \mu^2}{27 kT} \frac{\omega \tau}{1 + (\omega \tau)^2}$$

$$\frac{\Delta \epsilon''}{c} = \left\{ \left(\frac{\Delta \epsilon}{c} \right)_\infty - \left(\frac{\Delta \epsilon}{c} \right)_0 \right\} \cdot \frac{\omega \tau}{1 + (\omega \tau)^2}.$$

3.2. Aqueous Solutions

The characteristic parameters listed in tables 5 and 6 are those of the Debye representation and have been determined for each solution.

4. Pure Liquids

Table 1. Dielectric dispersion parameters for pure inorganic liquids

Table 2. Dielectric dispersion parameters for pure organic liquids

Chemical Formulas and the Order of Listing Compounds

Formulas for the inorganic substances are written in the usual manner and are arranged in alphabetical sequence. Those for the organic substances are written with carbon first and hydrogen, if present, second. Symbols for the remaining elements then follow in alphabetical order. The order of listing the compounds is determined firstly by the number of carbon atoms, secondly by the number of hydrogen atoms, and finally by the symbols of the remaining elements taken in alphabetical order.

All compounds are listed in tables 1 and 2, and an ordinal number is assigned to each compound to facilitate finding it in other sections of the tables.

Dispersion Parameters

Treatment of data: The data for most substances are sufficiently limited in extent and lacking in confirmation to prevent an exact evaluation of the dispersion parameters. The supporting data referred to in tables 1 and 2 are very meager in many instances and consequently no attempt has been made to assign limits of accuracy to the derived quantities. The data of other authors are often inconsistent with the values given.

The parameters listed have been determined, when feasible, from Cole-Cole plots. If $\epsilon_{\lambda=0}$ is not given the corresponding quantity is n_D^2 . In some instances $\epsilon_{\lambda=0}$ is the sum of n_D^2 and a small contribution from atomic polarization. The parameters of the Cole-Davidson representation are given for a small number of compounds.

Tabulated quantities:

$\epsilon_{\lambda=\infty}$ (or ϵ_∞) = the value of the complex dielectric constant $\epsilon = \epsilon' - i\cdot\epsilon''$ for $\lambda = \infty$.

$\epsilon_{\lambda=0}$ (or ϵ_0) = the value of ϵ for $\lambda = 0$.

n_D^2 = the square of the refractive index for the sodium-*D* line.

α = the distribution parameter in the representation $\epsilon = \epsilon_0 + (\epsilon_\infty - \epsilon_0)/[1 + (i\cdot\lambda_c/\lambda)^{1-\alpha}]$.

β = the distribution parameter in the representation $\epsilon = \epsilon_0 + (\epsilon_\infty - \epsilon_0)/(1 + i\cdot\lambda_c/\lambda)^\beta$.

λ_c = the critical wavelength characteristic of the dispersion.

Notations:

ϵ_∞ : Boldface type denotes values taken from the "Table of Dielectric Constants of Pure Liquids" by A. A. Maryott and E. R. Smith, NBS Circular 514. Other values are those given by the authors cited.

(): Parentheses denote that the value given is considerably more uncertain than the estimated error characteristic of this quantity.

[]: Brackets denote that the value is assumed.

(): Numbers in parentheses preceding the values listed for ϵ_0 denote the successive dispersion regions.

References and Bibliography: The references in tables 1 and 2 refer only to the work upon which the selected parameters depend. All references in tables 1 to 4, and the section on graphical data, are assembled in a bibliography at the end of table 4.

TABLE 1. Dielectric dispersion parameters for pure inorganic liquids

No.	Substance	<i>t</i> (°C)	$\epsilon_{\lambda=\infty}$	$\epsilon_{\lambda=0}$	n_D^2	α_{Cole}	λ_c (cm)	References
1.....	D_2O Deuterium oxide 99.5%	5	85.8	5.5	1.76	0	3.84	48.2 Collie.
		10	83.8	5.5		0	3.12	
		20	80.1	5.5		0	2.31	
		30	76.5	5.5		0	1.76	
		40	73.1	5.5		0	1.36	
		50	69.8	5.5		0	1.11	
2.....	H_2O Water	60	66.7	5.5	1.78	0	0.92 ₃	53 Hasted.
		0	88.2	5.0		0	3.34	
		10	84.0	5.0		0	2.43	
		20	80.4	5.2		0	1.78	
		30	76.5	5.2		0	1.36	
		40	73.1	5.6		0	1.10	
		50	70.7	5.8		0	0.91	
		60	66.2	5.9		0	.76	
3.....	H_2SO_4 Sulfuric acid	20	80.37		1.78	0	1.76	55 Poley. 53 53 Little. 52 Saxton. 48, 46 Collie. 48 Abadie. 39 Slevogt. 53 Brand.

*Adjusted values.

TABLE 2.—*Dielectric dispersion parameters for pure organic liquids*

No.	Substance	t (°C)	ϵ_{∞}	$\epsilon_{\infty - \theta}$	n_D^2	$\alpha_{\infty 0}$	λ (cm)	References
1.	CBrCl ₃	Bromotrifluoromethane.....	0 20 40 60	2.447 2.405 2.364 2.343	2.39 2.35 2.31 2.27	0.24 .19 .15 .03	0.8 .6 .5 .4	56, 3 Smyth et al.
2.	CBr ₂ Cl ₂	Dibromodichloromethane.....	20 40 60	2.55 2.508 2.461	2.45 2.43 2.38	0 0 0	.65 .5 .35	56, 3 Smyth et al.
3.	CBr ₂ F ₂	Dibromodifluoromethane.....	0 20 60	2.824 2.713	2.12 2.07	0.13 .10	.49 .43	56, 3 Smyth et al.
4.	CBr ₃ Cl	Tribromochloromethane.....	0 20 60	2.601 2.092 2.902	2.36 2.55 2.46	0 0 0	.6 .15 .096	56, 3 Smyth et al.
5.	CBr ₃ F	Tribromofluoromethane.....	0 20 60	2.561 3.092 2.906	2.36 2.55 2.50	0 0 0	.6 .15 .096	56, 3 Smyth et al.
6.	CCl ₃ F	Trichlorofluoromethane.....	0 20	2.374 2.303	2.03 1.99	0 0	.45 .38	56, 3 Smyth et al.
7.	CCl ₄	Carbon tetrachloride.....	20	2.238	2.13	0	<.85	50 Whiffen, Bleaney.
8.	CS ₂	Carbon disulfide.....	20	2.641	2.65	0	<.85	50 Whiffen, Bleaney.
9.	CHCl ₃	Chloroform.....	25 ~45.2	4.718 6.26	2.08 2.22	[9] [0]	(1.4) (4)	43 Connor. 53 Slear.
10.	CH ₂ O ₂	Formic acid.....	20	4.2 (110)	2.10	0	4.5	49 Burdin.
11.	CH ₃ NO	Formamide.....	~109, 9 ^a ~103, 2 ^a	82.17 77.70	9.8 9.6	0 0	1.33×10 ³ 9.3×10 ²	55 Denney.
12.	CH ₃ O	Methanol.....	~96.7 ~76.7	73.76 67.91	9.3 8.8	0 0	6.2×10 ² 3.6×10 ²	2.3×10 ²
13.	C ₂ Cl ₆	Tetrachloroethylene.....	~10 20 30 40 50	40.37 37.98 35.75 33.64 31.65	6.3 6.1 5.9 5.7 5.5	0 0 0 0 0	20.2 16.0 12.6 10.0 8.0	52 Lane, (as Policy).
14.	C ₂ H ₅ Cl ₃	1,1,1-Trichloroethane.....	4 20 40 20 40	7.71 7.20 6.57	2.10 2.05 2.05	0.06 .03 .01	1.25 1.04 0.84	56, 2 Smyth et al.
15.	C ₂ H ₄ Br ₂ Cl	1-Bromo-1-chloroethane.....	25 55	4.76 4.58	2.63 2.55	0.07 ^b .03	2.18 1.43	52 Smyth et al.
16.	C ₂ H ₄ Br ₂	1,2-Dibromoethane.....	25 55	11.66 10.16	2.41 2.35	.03 ^b 2.08	1.83 1.31	52 Smyth et al.
17.	C ₂ H ₄ Cl ₂	1,2-Dichloroethane.....	1 25 55	10.16 8.66	2.12 2.08	.04 ^b 2.03	0.85	52 Smyth et al.
18.	C ₂ H ₄ O ₂	Acetic acid.....	~97.7 (50 Timmermans).					Table 4.

^a Supercooled; mp, -97.7 (50 Timmermans).
^b Table 4.

TABLE 2.—Dielectric dispersion parameters for pure organic liquids—Continued

No.		Substance	t (°C)	ϵ_{∞}	$\epsilon_{t=0}$	n_D^2	α_{ce}	λ_e (cm)	References
C₂—Continued									
19	C ₂ H ₅ Br	Bromoethane	1	10.23 9.20	2.26 2.20	2.05 2.01	0.064 .053	0.99 .38	52 Smyth et al.
20	C ₂ H ₅ I	Iodoethane	25	7.69	2.28	[0]	(1.4)	43 Conner.	
21	C ₂ H ₆ O	Ethanol	-142.6 -133.9 -124.8 -117.6 -113.8	79.0 74.2 67.3 63.9 62.6	8.0 7.6 6.5 (6.0)	0 0 0 0	5×10 ⁵ 1.65×10 ⁵ 3.9×10 ⁴ 2.06×10 ⁴ 1.63×10 ⁴	35 Hassler; Graphs.	
22	C ₂ H ₆ O ₂	Ethylene glycol	-10 0 10 20 30 40 50	30.21 28.39 26.68 23.66 22.14 4.20 4.14	4.47 4.45 4.38 1.85	0 0 0 0	(62.0) (48.6) (35.0) (27.0) (21.2) (16.7) (13.3)	52 Lane.	
23	C ₃ H ₆ Cl	3-Chloro-1-propene	10	40.7	2.23	0.05	(0.14)	(30)	53 Yamamura.
24	C ₃ H ₆ Cl ₂	1,3-Dichloropropane	25	41.3	5.43	2.01	.75	21	53 M.R.P. Table 4.
25		2,2-Dichloropropane	25 (10.2)	12.58	2.09	[0]	(0.6)	43 Conner.	
26	C ₃ H ₆ Cl ₂ O	2,3-Dichloro-1-propanol	20 40	11.42 10.24	2.03 2.00	0	1.47 1.23	56.2 Smyth et al.	
27		1,3-Dichloro-2-propanol	35.0	35.0	2.00	0	0.99	Graphs.	
28	C ₃ H ₆ N ₂ O ₄	2,2-Dinitropropane	60	23.20	1.93	0.03	0.75	56.1 Smyth et al.	
29	C ₃ H ₆ O	Acetone	40	21.20	1.90	0	.63	Graphs.	
30		2-Propen-1-ol (allyl alcohol)	20	19.29	0.87	0	.52	56.1 Smyth et al.	
31	C ₃ H ₆ O ₂	Propionic acid	20	21.20	1.85	[0]	.65	46 Abadie; Graphs. Table 4.	
32	C ₃ H ₆ O ₃	1,3,5-Trioxane	65 80	15.55 14.20	1.92 1.83	0	1.4 1.3	56.4 Smyth et al.	
33	C ₃ H ₇ Br	1-Bromopropane	1 25 55	8.90 8.69 7.09	2.27 2.22 2.15	0.08 ^a .087 .033	1.53 1.09 0.89	52 Smyth et al.	
34		2-Bromopropane	1 25 55	10.52 9.46 8.14	2.24 2.19 2.12	0.06 ^a 0.02 ^a 1.97	1.26 0.99 .72	52 Smyth et al.	
35	C ₃ H ₈ O	1-Propanol	b—156 b—150	(2) (1) (3)	3.35 3.55 2.80 5.80 (3.40) (3.40)	0 (0.3) 0 (0.27) (0.3)	1.5×10 ³ 8.6×10 ³ 2×10 ³ 7.1×10 ⁴ 1.2×10 ⁵	52 Cole.	

5.70	3.56	3.6×10^6
b-145	0	1.7×10^6
(1) 67.4	3.56	3×10^6
(2) 5.70	2.94	0
(3) 64.0	5.58	9.4×10^6
(2) 5.58	3.62	4.8×10^6
(1) 60.6	5.30	1.2×10^6
(2) 5.30	3.53	4×10^6
-120	5.20	1.22×10^6
(2) 5.20	3.55	6.7×10^6
-89.0	43.7	0
-78.2	40.5	0
-64.4	36.8	0
-46.3	32.6	0
-60	(37.2)	(0.27)
-40	(31.0)	(0.27)
-20	(27.7)	(0.27)
0	(25.0)	(0.27)
18 to 20	20.8	2.65
	25	20.1
	c-95.7	47.1
	-90.0	44.5
	-82.8	42.7
	-73.2	39.5
	-60	(37.8)
	-40	(31.8)
	-20	(28.2)
	0	(24.4)
	20	19.0
	-89.1	65.3
	-84.1	63.7
	-80.0	60.1
	-75.0	57.7
	-65.5	53.8
	-55.4	49.5
	-45.7	45.7
	-74.6	76.2
	-70	74.2
	-65.5	70.5
	-60	67.4
	-50	63.9
	-40	60.4
	25	2.55
	C ₄	Hexachloro-1,3-butadiene
	C ₄ Cl ₆	Furan
	C ₄ H ₈ O	Thiophene
	C ₄ H ₈ S	Pyrrole
	C ₄ H ₈ N	
	C ₄ H ₈ Cl ₂	1,4-Dichlorobutane
	44.....	1,2-Dichlorobutane
36.....	2-Propanol	
37.....	C ₃ H ₆ O ₂	1,2-Propanediol
38.....		1,3-Propanediol
39.....	C ₃ H ₆ O ₃	Glycerol
40.....	C ₄ Cl ₆	
41.....	C ₄ H ₈ O	
42.....	C ₄ H ₈ S	
43.....	C ₄ H ₈ N	
44.....	C ₄ H ₈ Cl ₂	
45.....		
		Suppercooled; mp, -126.1° C (50 Timmermans).
		Suppercooled; mp, -89.5° C (50 Timmermans).
		d = $\epsilon + (\epsilon_{\infty} - \epsilon_0)/(1 + \omega\tau)^{\beta}$.

Table 4.

b Suppercooled; mp, -126.1° C (50 Timmermans).
 c Suppercooled; mp, -89.5° C (50 Timmermans).
 d = $\epsilon + (\epsilon_{\infty} - \epsilon_0)/(1 + \omega\tau)^{\beta}$.

TABLE 2.—Dielectric dispersion parameters for pure organic liquids—Continued

No.	Substance	t (°C)	$\epsilon_{\infty-\infty}$	$\epsilon_{\infty-0}$	n_D^2	$\alpha_{CoI\alpha}$	λ_e (cm)	References
46.....	C ₄ H ₈ O	Tetrahydrofuran. ^a	1 20 40	8.90 8.20 7.60	2.00 1.98 1.95	0.03 .07 .09	0.73 .54 .42	55.1 Smyth et al.
47.....		2-Butanone.						Table 4.
48.....	C ₄ H ₈ O ₂	Butyric acid.	3 20 40 60	6.40 6.04 5.63 5.22	2.48 2.48 2.48 2.48	1.88 1.88 1.88 1.88	.09 .06 .04 0	52.8 Smyth et al.
49.....		Ethyl acetate.						Table 4.
50.....	C ₄ H ₈ Br	1-Bromobutane.	1 25 55	7.57 6.93 6.24	2.26 2.22 2.16	2.11 2.07 2.02	.11 _a .09 _b .07 _c	52 Smyth et al.
51.....		1-Bromo-2-methyl-propane.	1 25 55	7.82 7.18 6.32	2.26 2.21 2.14	2.11 2.06 2.00	.03 _d .03 _e 0	52 Smyth et al.
52.....		2-Bromobutane.	1 25 55	9.43 8.64 7.65	2.25 2.20 2.14	2.10 2.06 2.01	0 0 0	52 Smyth et al.
53.....		2-Bromo-2-methyl-propane.	1 25 55	11.56 10.30 8.75	2.19 2.17 2.11	2.07 2.03 1.98	0.01 _f .03 _g 0	52 Smyth et al.
54.....	C ₄ H ₈ Cl	1-Chlorobutane.	1 25	7.24	1.96	[0]	{(1.5)}	43 Conner.
55.....		1-Chloro-2-methyl-propane.						Table 4.
56.....		2-Chloro-2-methyl-propane.	4 20 40 20	10.72 9.87 8.90 9.90	1.94 1.92 1.89 1.92	0	1.05 0.90 .82	52.2 Smyth et al.
57.....	C ₄ H ₆ I	1-Iodobutane.	25	6.12	1.92	0	.80	55 Polley.
58.....	C ₄ H ₈ N	Pyrrolidine.	1 20 40 60	9.29 8.30 7.36 6.60	(2.10 _i) 2.07 2.05 2.03	0.18 .15 .11 .07	{(3.5)} 4.0 2.45 1.50 1.10	43 Conner. 55.1 Smyth et al.
59.....	C ₄ H ₁₀ O	1-Butanol..	1-138.4 t-131.9 t-127.2 t-117.4 t-99.9 -82.3 -64.3 -45.8 -26.6 -3.7 -25 -25 0.7 (19)	{(1)} 59 (2) 4.8 (1) 54.7 (2) 4.6 (1) 52.6 (2) 4.4 (1) 49.1 (2) 4.4 41.7 36.3 32.4 28.5 25.1 21.0 3.2 23.8 20.6 3.1 17.9 17.1	4.8 3.3 4.6 3.2 4.4 3.2 4.4 3.1 4.1 3.8 3.7 3.6 3.5 0 0 0 0 0 0 0	0 (0.22) 0 (0.22) 0 (0.22) 0 (0.22) 0 (0.22) 0 0 0 0 0 0 0	1.19×10 ⁰ 4.3×10 ⁰ 1.8×10 ⁰ 6.2×10 ⁰ 3.05×10 ⁰ 1.45×10 ⁰ 3.88×10 ⁰ 1.51×10 ⁰ 3.22×10 ⁰ 4.28×10 ⁰ 1.01×10 ¹ 2.63×10 ¹ 1.11×10 ² 3.40×10 ² 1.22×10 ³ 2.58×10 ² 100	55 Dannhauser. Reinisch. Sievert. MIT.

2-Butanol.	$\epsilon = 121$	2	54.6	4.4	0	3.8×10^3	55	Damhauer; Graphs.
	-107.3		48.6	4.2	0	1.45×10^7		
	-92.8		43.3	4.1	0	1.27×10^6		
	-73.2		37.2	4.0	0	1.07×10^6		
	-55.4		32.3	-----	0	1.75×10^4		
	-28.4		26.0	-----	0	5.7×10^3		
	-3.5		21.4	-----	0	4.9×10^2		
2-Methyl-1-propanol.		20	15.8	3.5	1.95	(0)	44	Benoit.
	b-137.0		(1) 56	5.5	0	8.3×10^3	55	Damhauer.
	b-127.5		(2) 5.5	2.5	(0.22)	2.13×10^3		
	b-120.1		(2) 4.8	4.8	(0.22)	4.30×10^3		
	b-110.1		(1) 48.8	3.4	0	7.22×10^3		
			(2) 4.5	3.4	(0.22)	6.45×10^7		
			(1) 44.9	4.3	0	8.7×10^3		
			(2) 4.3	3.2	(0.22)	7.08×10^8		
			40.4	4.4	0	9.6×10^1		
			36.6	4.0	0	6.73×10^4		
			32.2	3.4	0	1.20×10^3		
			27.6	3.1	0	3.63×10^1		
			25.2	2.9	0	4.0×10^3		
			20.8	2.7	0	1.73×10^3		
			-0.7	-----	0	4.50×10^2		
			.7	21.3	3.1	0	340	Reinisch.
			20	18.5	3.1	1.95	0	
						0	150	
						0	150	Hofelin.
						0	33	Szymanski.
						0	32	Girard; Graphs.
						0	32	Table 4.
2-Methyl-2-propanol.						0	32	Table 4.
Ethyl ether.	C_2					0	32	Table 4.
Pyridine.						0	32	Table 4.
3-Pentanone.						0	32	Table 4.
1-Bromopentane.						0	32	Table 4.
C_3H_8N						0	32	Table 4.
$C_3H_{10}O$						0	32	Table 4.
C_3H_7Br						0	32	Table 4.
1-Bromo-3-methyl-butane.						0	32	Table 4.
1-Chloro-3-methyl-butane.						0	32	Table 4.
2-Chloro-2-methyl-butane.						0	32	Table 4.
1-Pentanol.						0	32	Table 4.
3-Methyl-1-butanol.						0	32	Table 4.
2-Methyl-2-butanol.						0	32	Table 4.
$C_6H_4Cl_2$	C_6					0	32	Table 4.
C_6H_5Br	Bromobenzene.					0	32	Table 4.
						0	32	Poly.

^a May contain 1 percent of water.^b Supercooled; mp, -89° C (50 Timmermans).^c Supercooled; mp, -115° C).^d Supercooled; mp, (-108° C).^e Supercooled; mp, (-115° C).^f Supercooled; mp, (-115° C).^g Supercooled; mp, (-115° C).^h Supercooled; mp, (-108° C).ⁱ Supercooled; mp, (-115° C).^j Supercooled; mp, (-115° C).^k Supercooled; mp, (-115° C).^l Supercooled; mp, (-115° C).^m Supercooled; mp, (-115° C).ⁿ Supercooled; mp, (-115° C).^o Supercooled; mp, (-115° C).^p Supercooled; mp, (-115° C).^q Supercooled; mp, (-115° C).^r Supercooled; mp, (-115° C).^s Supercooled; mp, (-115° C).^t Supercooled; mp, (-115° C).^u Supercooled; mp, (-115° C).^v Supercooled; mp, (-115° C).^w Supercooled; mp, (-115° C).^x Supercooled; mp, (-115° C).^y Supercooled; mp, (-115° C).^z Supercooled; mp, (-115° C).^{aa} Supercooled; mp, (-115° C).^{bb} Supercooled; mp, (-115° C).^{cc} Supercooled; mp, (-115° C).^{dd} Supercooled; mp, (-115° C).^{ee} Supercooled; mp, (-115° C).^{ff} Supercooled; mp, (-115° C).^{gg} Supercooled; 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TABLE 2.—*Dielectric dispersion parameters for pure organic liquids—Continued*

No.	Substance	<i>t</i> (°C)	ϵ_{∞}	α_{∞}	n_D^2	α_{Cal}	$\lambda_*(\text{cm})$	References
C ₆ H ₅ Cl—Continued								
75	C ₆ H ₅ Cl	Chlorobenzene	1 25 55	6.15 5.63 5.09	2.40 2.35 2.29	0.10 ₀ 0.0 ₄ .01 ₅	2.77 1.94 1.37	52 Smyth et al.
76	C ₆ H ₅ ClO	<i>p</i> -Chlorophenol	22	5.69	2.56	0	2.22	55 Poley, Table 4,
77	C ₆ H ₅ F	Fluorobenzene	21	5.44	2.38	2.15	0	55 Poley.
78	C ₆ H ₅ I	Iodobenzene	21	4.64	2.76	2.62	0	55 Poley.
79	C ₆ H ₅ NO ₂	Nitrobenzene	20	35.74	4.07	0	8.6	55 Poley.
80	C ₆ H ₆	Benzene	20	35.74	2.40	[0]	[0]	43 Girard; Graphs, Table 4; Graphs.
81	C ₆ H ₆ O	Phenol						
82	C ₆ H ₅ N	Aniline	20	6.89	2.52	[0]	(3.7)	49 Fisher. 55.1 Smyth et al.
83		γ -Picoline	1 20 40 60	(13.1) (12.2) (11.3) (10.5)	2.30 2.27 2.24 2.21	0.08 .05 .03	3.2 2.51 1.98	
84	C ₆ H ₁₀ O	Cyclohexanone	1 20 40 60	17.01 16.90 14.99 13.99	2.21 2.18 2.15 2.13	0.11 .11 .11 .10	2.71 1.95 1.55 1.23	56.1 Smyth et al., Table 4.
85	C ₆ H ₁₁ Br	Bromocyclohexane	21	8.54	2.43	2.27	0	2.6 Dieringer.
			25 55	7.92 7.18	2.38 2.33	2.23 2.18	.17 ₇ .10 ₈ .07 ₃	5.90 3.67 2.45
86	C ₆ H ₁₁ Cl	Chlorocyclohexane	21	8.02	2.23	0	4.5	56 Dieringer.
87	C ₆ H ₁₁ NO ₂	Nitrocyclohexane	21			0	2.7	56 Dieringer.
88	C ₆ H ₁₂	Cyclohexane				0	4.4	56 Dieringer.
89	C ₆ H ₁₂ O	Cyclohexanol	25 45	(1) 10.8 (2) 4.3 (1) 16.3 (2) 4.1	4.3 3.5 4.1 3.4	2.15 0	458 0 30 143 12.5	Table 4; Graphs, 56 Arnout.
90	C ₆ H ₁₃ O ₃	Paraldehyde	25 20 40 60	16.8 14.70 12.25 10.30	3.2 2.27 2.25 2.23	0	460	53 Rehnisch.
91	C ₆ H ₁₃ Br	1-Bromohexane	1 25 55	6.30 5.82 5.30	2.25 2.21 2.17	1.97 2.08 2.04	.05 .07 .10	56.4 Smyth et al.
92	C ₆ H ₁₄	1-Hexane	20	1.89	1.89	1.89	<1.4	47 Bleaney.
93	C ₆ H ₁₄ O	1-Hexanol	-40 -25 0.7 20	19.7 17.7 15.0 (1) 12.9	3.6 3.3 3.0 (2) 3.2	0 0 0 2.00	5.12×10 ³ 2.5×10 ³ 5.35×10 ² 0	54 Rehnisch.
							197 ₄	52 Bruma,

94.....	$C_6H_{10}O_2$	2-Methyl-2,4-pentanediol.....
95.....	$C_6H_{10}O_6$	Sorbitol.....
96.....	$C_6H_{10}OS_2$	Hexamethylidisiloxane.....
.....
97.....	$C_7H_{15}N$	Benzonitrile.....
98.....	C_7H_7Cl	Benzyl chloride.....
99.....	C_7H_9	Toluene.....
100.....	C_7H_9O	Benzyl alcohol.....
101.....	.....	Methoxybenzene (Anisole).....
102.....	.....	o-Cresol.....
103.....	.....	m-Cresol.....
104.....	.....	p-Cresol.....
105.....	$C_7H_9O_2$	o-Methoxyphenol.....
106.....	C_7H_9N	<i>m</i> -Toluidine.....
107.....	.....	Benzylamine.....
108.....	$C_7H_{14}O$	2-Hexanone.....
.....
109.....	.....	4-Hexanone.....
110.....	.....	5-Methyl-3-hexanone.....
111.....	$C_7H_{14}O_2$	Isoamyl acetate.....
112.....	$C_7H_{15}Br$	1-Bromoheptane.....
113.....	C_7H_{19}	t-Hexane.....
114.....	$C_7H_{16}O$	1-Hexanol.....
.....
115.....	$C_8H_{16}O$	Acetophenone.....
.....
116.....	.....	<i>o</i> -Xylene.....
117.....	C_8H_{16}	<i>m</i> -Xylene.....

TABLE 2.—Dielectric dispersion parameters for pure organic liquids—Continued

No.	Substance	t (°C)	ϵ_{∞}	$\epsilon_{\infty - \alpha}$	n_D^2	α_{calc}	λ_e (cm)	References
C_8 —Continued								
118.	Ethyl benzene.							Table 4.
119.	$C_8H_{11}N$	2,4,6-Trimethyl-pyridine (γ -Collidine).	20 40 60	8.00 7.46 6.94	2.50 2.40 2.34	0.08 .06 .10	7.6 6.2 4.4	56, 4 Smyth et al.
120.	$C_8H_{10}O_2$	Octanoic acid (Caprylic acid).						Table 4.
121.	$C_8H_{17}Br$	1-Bromo-octane.	1	5.32 5.00 4.80	2.25 2.21 2.17	.24 _b .22 _b .22 _b	6.78 4.09 2.58	52 Smyth et al.
122.	$C_8H_{17}Cl$	1-Chlorooctane.	1 25 55	5.47 5.05 4.55	2.20 2.15 2.10	.22 _b .20 _b .18 _b	5.12 3.92 1.94	52 Smyth et al.
123.	$C_8H_{17}I$	1-Iodo-octane.	1	4.90 4.62 4.27	2.37 2.33 2.28	.24 _b .22 _b .216 _b	12.10 7.24 4.22	52 Smyth et al.
124.	$C_8H_{17}DO$	1-Octanol-D ₁ .	-15.5 0 49			0	2.50×10^3 1.07×10^3 (100)	Corval; Graphs.
125.	$C_8H_{18}O$	1-Octanol.	-15.5 0.7 25 49	13.40 12.00 9.80 7.80	3.10 2.10 3.10 3.10	0.05 0.04 0.04 0.04	2.07×10^3 9.5×10^2 2.56×10^2 78.9	Dalbert; Graphs.
126.			20	(1) 10.35 (2) 3.05	3.05 3.05	0.03	0	Lebrun
127.			-36 -20 25 49	16.50 13.70 10.50 7.85	2.80 2.80 2.80 2.80	0.07 _b 0.07 _b 0.05 _b 0.04	3.85×10^1 7.73×10^1 1.20×10^2 222	Dalbert; Graphs.
128.	$C_9H_{11}N$	Quinoline.	1 20 40 60	9.70 9.63 8.40 7.81	2.65 2.63 2.61 2.58	0.11 0.09 0.07 0.07	14.5 8.4 6.63 3.72	55, 1 Smyth et al.
129.		Isophquinoline.	25 40 60	10.43 9.88 9.22	2.62 2.62 .03	0.05 0.11 0.63	12.4 8.52 6.63	55, 1 Smyth et al.
130.	$C_9H_{11}Br$	1-Bromononane.	1 25 55	5.01 4.74 4.40	2.24 2.21 2.17	.24 _b .24 _b .22 _b	9.10 5.36 2.97	52 Smyth et al.
131.	$C_9H_{20}O$	1-Nonanol.	20	(1) 9.05 (2) 3.05	3.05	2.05	0	Lebrun; Graphs.
132.	$C_{10}H_{17}Br$	1-Bromonaphthalene.	20-5 25 55	4.9 4.83 4.57	2.75	0	375 8.6	55
133.	$C_{10}H_{17}Cl$	1-Chloronaphthalene.	1 25 55	5.39 5.04 4.72	2.76 2.71 2.65	.18 _b .08 _b .06 _b	20.50 9.24 3.23	52 Smyth et al.
134.		Eugenol.	20	9.31	2.37	[0]	(57)	52 Fischer.
135.		1-Methyl-4-isopropylbenzene (<i>p</i> -cymene).	20	2.243	2.22	[0]	(1.8)	46 Whiffen.

136.	$C_{10}H_{16}O$	Citral.....	Table 4; Graphs.
137.	$C_{10}H_{16}O_2$	Geranic acid.....	Table 4; Graphs.
138.	$C_{10}H_{18}$	<i>trans</i> -Decahydronaphthalene.....	Table 4; Graphs.
139.	$C_{10}H_{18}O$	Geraniol.....	Table 4; Graphs.
140.	$C_{10}H_{18}Br$	1-Bromodecane.....	52 Smyth et al.
141.	$C_{10}H_{20}Cl$	1-Chlorodecane.....	Table 4.
142.	$C_{10}H_{20}O$	1-Decanol.....	55 Lebrun.
143.	$C_{10}H_{20}O$	C_{11}	55.1 Lebrun.
144.	$C_{10}F_{20}O$	C_{12}	Table 4.
145.	$C_{10}Pr_2N$	Perfluorodihexyl ether.....	Table 4.
146.	$C_{10}H_9Cl$	Heptacosulfonotributyl amine.....	Table 4.
147.	$C_{12}H_{10}O$	3-Chlorobiphenyl.....	56.1 Smyth et al.
148.		2-Acetonaphthone.....	Table 4.
149.	$C_{12}H_{20}O_2$	Phenyl ether.....	Table 4.
150.	$C_{12}H_{20}O_2$	Geranyl acetate.....	Table 4; Graphs.
151.	$C_{12}H_{20}Br$	Dodecanoic acid (Lauric).....	52 Smyth et al.
152.	$C_{12}H_{20}Cl$	1-Bromododecane.....	52 Smyth et al.
153.	$C_{12}H_{20}O$	1-Chlorododecane.....	52 Smyth et al.
154.	$C_{13}H_{20}O$	1-Dodecanol.....	Table 4.
155.	$C_{13}H_{20}O_2$	C_{13}	Table 4.
156.	$C_{14}H_{20}Br$	Benzophenone.....	56.6 Smyth et al.
157.	$C_{14}H_{20}O$	1-Bromotetradecane.....	52 Smyth et al.
		Methyl laurate.....	Table 4.
		C_{14}	Table 4.

TABLE 2.—Dielectric dispersion parameters for pure organic liquids—Continued

No.		Substance	<i>t</i> (°C)	ϵ_{∞}	$\epsilon_{\infty - \infty}$	n_D^2	α_{obs}	$\lambda \cdot (\text{cm})$	References
158.....	C ₁₅ H ₃₀ O	8-Pentadecanone.....	50 65 80	6.4 6.2 5.64	2.3 2.3 2.3	2.05	0.11 .11 .10	6.2 4.7 4.7	56, 6 Smyth et al.
159.....	C ₁₅ H ₃₀ O ₂	Methyl myristate.....	C ₁₅						Table 4.
160.....	C ₁₅ H ₃₀ O ₂	Hexadecanoic acid (Palmitic).....							Table 4.
161.....	C ₁₅ H ₃₀ Br	1-Bromoheptadecane.....							52 Smyth et al.
162.....	C ₁₆ H ₃₀ Cl	1-Chlorohexadecane.....							Table 4.
163.....	C ₁₆ H ₃₀ O	1-Hexadecanol.....							Table 4; Graphs.
164.....	C ₁₇ H ₃₀ O	9-Heptadecanone.....							Table 4; Graphs.
165.....	C ₁₇ H ₃₀ O ₂	Methyl palmitate.....	C ₁₅						Table 4; Graphs.
166.....	C ₁₈ H ₃₂ O ₂	Linoleic acid.....							Table 4.
167.....	C ₁₈ H ₃₀ O ₂	Oleic acid.....							Table 4.
168.....	C ₁₈ H ₃₀ O ₄	Diethyl sebacate.....							Table 4.
169.....	C ₁₈ H ₃₀ O ₂	Ethyl palmitate.....							Table 4; Graphs.
170.....	C ₁₈ H ₃₀ O ₂	Cetyl acetate.....							52, 8 Smyth et al.
171.....	C ₁₈ H ₃₀ O	1-Octadecanol.....	C ₂₀						Table 4.
172.....	C ₂₀ H ₄₀ O	Phytol.....							Table 4; Graphs.
173.....	C ₂₀ H ₄₀ O ₂	Octadecyl acetate.....							52, 8 Smyth et al.
174.....	C ₂₀ H ₄₂ O	Di-dihydrocitronellyl ether.....							Table 4; Graphs.
175.....	C ₂₀ H ₄₀ O ₂	Decyl ether.....							56, 6 Smyth et al.
176.....	C ₂₁ H ₄₂ O ₄	Monostearin.....	C ₂₁						52, 8 Smyth et al.
177.....	C ₂₁ H ₄₀ O ₂	Ethyl abietate.....	C ₂₂						Table 4.
178.....	C ₂₁ H ₄₂ O ₂	Phytol acetate.....	C ₂₄						Table 4; Graphs.
179.....	C ₂₄ H ₅₀ O ₄	Diocetyl sebacate.....							Table 4.

180	$C_{31}H_{58}O_2$	Decyl stearate.....	C_{28}	40	2.91	2.16	.34	5.8
			C_{30}	60	2.73	2.15	.26	4.5
		Ethylene dimyristate.....		80	2.65	2.15	.14	3.5
181	$C_{30}H_{60}O_4$	Tetradecyl palmitate.....		70	2.98	2.19	.2t	52.8
182	$C_{30}H_{60}O_2$	Tetradecyl palmitate.....	C_{32}	50	2.66	2.17	.24	52.8
183	$C_{32}H_{64}O_2$	Tetradecyl stearate.....		50	2.67	2.15	.14	52.8
			C_{31}	82	2.57	2.16	.36	(2.3)
184	$C_{33}H_{66}O_4$	Ethylene dipalmitate.....		75	2.89	2.23	.22	3.0
185	$C_{33}H_{68}O_2$	Cetyl stearate.....	C_{33}	60	2.61	2.13	.28	3.8
186	$C_{33}H_{70}O_4$	Ethylene distearate.....		80	2.84	2.13	.13	2.7
			C_{33}	80	2.73	2.26	.22	3.4
187	$C_{33}H_{72}O_3$	Distearin.....		80	3.25	2.30	.31	6.6
188	$C_{33}H_{74}O_4$	Tripalmitin.....	C_{31}	90	3.22	2.36	.30	4.7
			C_{32}					Table 4.
189	$C_{37}H_{90}O_6$	Trifolin.....						Table 4.
190	$C_{37}H_{92}O_6$	Tristearin.....						52.8

Table 3. Dielectric dispersion data for pure inorganic liquids

Table 4. Dielectric dispersion data for pure organic liquids

Tabulated Quantities: In general, the real and imaginary parts of the complex dielectric constant $\epsilon = \epsilon' - i\cdot\epsilon''$ are listed. For a few compounds the data are given, in part, as the real and imaginary parts of the complex refractive index $n^* = n - i\cdot\kappa$. The relation between ϵ and n^* is $\epsilon = n^{*2}$.

TABLE 3. Dielectric dispersion data for pure inorganic liquids

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References
1.....	D ₂ O Deuterium oxide (99.5%)	5	∞ 10.0 3.213 1.27	85.87 38.44 15.48	1.52(κ) ^a 38.7 25.3	48 Collie,
		10	∞ 10.0 3.213 1.27	83.89 45.34 18.39	1.27(κ) 38.5 28.2	
		20	∞ 10.0 3.213 1.27	80.08 55.42 23.85	0.94(κ) 35.2 32.1	
		30	∞ 10.0 3.213 1.27	76.47 60.26 31.77	0.71(κ) 29.5 33.8	
		40	∞ 10.0 3.213 1.27	73.04 61.52 38.44	0.54(κ) 23.5 34.0	
		50	∞ 10.0 3.213	69.78 62.17	0.43(κ) 19.6	
		60	∞ 10.0 3.213	66.68 62.93	0.34(κ) 16.6	
		25 to 40	467			49 Fischer.
		(20)	23.6 to 451			40 Divikovsky.
		0	∞ 9.22 3.282 1.267	88.15 80.0 46.0 14.5	26.5 41.0 27.5	53 Halsted.
2.....	H ₂ O Water	10	∞ 9.22 3.282 1.267	84.15 79.3 56.0 22.0	19.4 37.0 33.0	
		20	∞ 9.22 3.282 1.267	80.36 77.8 63.0 31.0	13.9 31.5 35.0	
		30	∞ 9.22 3.282 1.267	76.77 75.8 65.8 38.7	10.2 26.0 35.5	
		40	∞ 9.22 3.282 1.267	73.35 73.0 66.3 43.5	8.4 20.5 34.0	
		50	∞ 9.22 3.282 1.267	70.10 69.7 65.5 48.0	6.5 16.5 31.0	
		60	∞ 9.22 3.282 1.267	67.00 66.0 63.5 50.5	5.0 13.5 26.5	
		1.5	∞ 3×10^3 300 100 10 3	87.54 87.0 87.0 86.5 80.5 38.0	0.17 .61 2.77 25.0 39.1	53 MIT.

^a κ =absorption coefficient.

TABLE 3. Dielectric dispersion data for pure inorganic liquids—Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References
		5	∞ 100 10 3	86.13 85.2 80.2 41.	2.3 22.1 39.0	
		15	∞ 100 10 3	82.23 81.0 78.8 49.	1.7 16.2 34.3	
		25	∞ 3×10^3 300 100 10 3	78.54 78.2 78. 77.5 76.7 55.	0.36 .39 1.24 12.0 29.7	
		35	∞ 100 10 3	75.04 74.0 74.0 58.	0.93 9.4 25.5	
		45	∞ 100 10 3	71.70 71.0 70.7 59.	0.75 7.5 23.6	
		55	∞ 100 10 3	68.53 68. 67.5 60.	0.63 6.0 21.6	
		65	∞ 100 10 3	65.51 64.5 64.0 59.0	0.54 4.9 18.9	
		75	∞ 100 10 3	62.62 61. 60.5 57.	0.47 4.0 16.0	
		85	∞ 300 100 10 3	59.85 58. 57. 56.5 54.	0.17 .42 3.1 14.0	
		95	∞ 100 10	57.19 52. 52.	0.36 2.4	
		0	10.0 3.21 1.27	79.66 44.82 16.22	24.7 41.6 28.3	48 Collie.
		10	10.0 3.21 1.27	78.07 53.85 22.33	17.5 37.6 32.3	
		20	10.0 3.21 1.27	77.42 61.41 30.88	13.1 31.8 35.8	
		30	10.0 3.21 1.27	76.78 63.31 38.43	9.8 25.5 36.0	
		40	10.0 3.21 1.27	72.56 65.58 43.24	7.54 21.2 33.6	
		50	10.0 3.21 1.27	68.44 63.13 48.26	5.80 17.1 30.6	
		60	10.0 3.21 1.27	65.37 63.09 49.79	4.55 13.8 27.3	
		75	10.0 3.21 1.27	60.49 60.70 51.71	3.30 10.5 22.3	
		0	1.58 1.24	19.1 14.5	30.4 25.6	
		5	1.58 1.24	25.3 19.1	34.7 30.3	
		10	1.58 1.24	31.9 24.4	37.0 33.5	
		15	1.58 1.24	38.2 29.8	37.6 35.5	
		20	1.58 1.24	44.1 35.0	37.2 36.2	

TABLE 3. Dielectric dispersion data for pure inorganic liquids—Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References
		25	1.58 1.24	48.8 39.9	35.8 36.0	
		30	1.58 1.24	52.7 44.2	33.5 35.2	
		35	1.58 1.24	55.6 48.0	31.0 33.6	
		40	1.58 1.24	57.8 51.3	28.1 31.5	
		(20)	501 436 308 216 101 89.8 64.5 41.0 23.6 8.4 5.1 3.2 1.6	80.8 80.2 80.4 80.4 80.3 80.0 79.5 79.0 78.7 74.0 67.0 56.7 40.0	0.28 .45 .63 1.27 1.44 1.95 2.8 5.3 14.3 22.0 34.0 39.0	49 Burdun.
		18.6 18.9 18.1 19.5	246 58.3 16.2 10.44	80.8 80.8 80.7 78.6	0.6 2.8 10.2 12.1	39 Slevogt.
		21	11.12 10.57 10.00 9.75 9.16	78.5 78.1 78.0 77.6 77.0	12.2 13.0 13.5 14.0 14.8	53 Little.
		19	9.35 6.10 3.58 2.8	78.0 73.2 61.8 55.3	12.1 18.1 26.5 33.9	39 Bäz.
		-8	1.24 0.62	(n) b	2.55 1.77	52 Lanc.
		0	3.21 1.24 0.62	4.75	2.89 2.77 2.04	
		10	3.21 1.24 0.62	5.45	2.44 2.90 2.37	
		20	3.21 1.24 0.62	6.15	2.00 2.86 2.59	
		30	3.21 1.24 0.62	6.70	1.60 2.67 2.70	
		40	3.21 1.24 0.62	7.10	1.29 2.41 2.70	
		50	3.21 1.24 0.62	7.30	1.08 2.13 2.63	
		17	10.4 4.6 2.5 1.5 0.66 .24 .10 .05 .014	(n) b 9.0 8.77 8.41 7.84 6.02 3.63 2.62 2.22 2.15		47 Lindeman.
		18	56.7 53.0 50.0 46.0 33.4 31.0 29.0 13.45	(n) b 8.92 8.97 8.96 8.96 8.92 8.92 8.95 8.80		36 Ardenne.
		20	3.99 3.55 3.20 1.25 0.802	70.1 67.7 61.8 31.5 21.34	24.6 27.1 32.0 35.5 20.6	55 Poley.
		(20?)	83.6	80.2	2.5	55.1 Yamamura.

* κ =absorption coefficient. b n =refractive index.

TABLE 3. Dielectric dispersion data for pure inorganic liquids—Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References
		0 5 10 15 20 25 30 35 40 50 60 70 80 90 100	10.00	79.7 80.0 78.1 77.6 77.4 77.2 76.8 75.5 72.6 68.4 64.7 61.9 59.4 57.0 54.4	24.7 20.7 17.4 15.0 13.1 11.1 9.8 8.5 7.5 5.7 4.5 3.6 3.1 2.6 2.2	46 Collie.
		0 14 25 50 75 80 90 100	9.72	80.0 79.0 77.1 69.5 63.5 62.3 57.7 55.3	24.8 17.4 13.9 8.39 5.30 4.92 3.95 3.40	43 Conner.
		0 10 20 30 40 50 30	1.24	14.89 21.29 29.64 37.76 44.60 48.75 1.24	26.3 31.6 35.2 35.8 34.2 31.1	52 Lane.
		24, 30 (20) 5 to 45 1 to 50 11, 1 (20) 20 20.5; 25.5 24 (20) 18 21 to 28 (15); 30; 50 17 17 14 to 20 (18) 22	0.86 3.16 7.4 16.7 0.87 3 to 10 16.7 320 to 1002 23, 6; 450 1.65; 3.7 4 8.5 to 23.8 12.6 to 19 23 to 73 220 to 300 268 36 to 321 4.8 to 20.5	(110)	32 35 40 45.6 42 19	55.1 Srivastava. 53 Hertel. 53 LeMontagner. 52 Yamamura. 51.1 51.2 Yasumi. 50 Kiely. 46 Abadie. 44 Benoit. 41 Khodakov. 40.1 Divilkovsky. 39 Kebbel. 37 Elle. 37 Goldsmith. 33 Seeberger. 29 Frankenberger. 29 Novosilzew. 27 Deubner. 27 Helm. 27 Knerr.
3.....	H ₂ SO ₄ Sulfuric acid.....	20	∞ 303.0 198.0 156.7 101.4 26.74 10.20	98 95 77 62.5 28 10	32 35 40 45.6 42 19	53 Brand.

TABLE 4. Dielectric dispersion data for pure organic liquids

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References
1.....	C ₁ CBrCl ₃ Bromotrichloromethane.....	0 20 40 60	∞ 3.22 1.24 ∞ 3.22 1.24 ∞ 3.22 1.24 ∞ 3.22 1.24	2.447 2.441 2.426 2.405 2.403 2.389 2.364 2.361 2.351 2.343 2.319 2.313 2.542 2.541 2.540 2.524	0.014 .021 .012 .020 .0082 .0018 .0059 .0016 <.003 .0136 .036	56.3 Smyth et al.
2.....	CBr ₂ Cl ₂ Dibromodichloromethane.....	25 40 60	∞ 10.0 3.22 1.24 ∞ 10.0 3.22 1.24 ∞ 3.22 1.24	2.508 2.511 2.511 2.494 2.461 2.470 2.455	<.003 .011 .030 .006 .020	56.3 Smyth et al.

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References
C₁—Continued						
3.....	CBr_2F_2 Dibromodifluoromethane	0	∞	2.824		56.3 Smyth et al.
			3.22	2.769	.016	
4.....	CBr_3Cl Tribromochloromethane	20	∞	2.713		56.3 Smyth et al.
			3.22	2.676	.225	
5.....	CBr_3F Tribromofluoromethane	0	∞	2.601		56.3 Smyth et al.
			3.22	2.600	.009	
6.....	CCl_3F Trichlorofluoromethane	0	∞	2.593	.018	56.3 Smyth et al.
			3.22			
7.....	CCl_4 Carbon tetrachloride	0	∞	3.092		52.2 Smyth et al.
			10.0	3.080	.038	
8.....	CS_2 Carbon disulfide	0	∞	3.001	.213	50.2 Smyth et al.
			1.24	2.776	.262	
9.....	CHCl_3 Chloroform	25	∞	2.996		43 Conner, 53 Fischer, 53 Sirkar, 53.2 Ghosh.
			3.22	2.996	.030	
10.....	CH_2O_2 Formic acid	25	∞	2.994	.168	43 Conner, 53 Fischer, 53 Sirkar, 53.2 Ghosh.
			1.24	2.778	.241	
.....		40	∞	2.902		47 Bleaney.
			10.0	2.913	.022	
.....		60	∞	2.884	.135	50 Whiffen, 53 MIT, 55 Takahashi, 55.2 Srivastava.
			3.22	2.735	.215	
.....		60	∞	2.804	.106	47 Bleaney.
			1.24	2.698	.194	
.....		20	∞	2.774	.048	50.2 Smyth et al.
			3.22	2.737	.113	
.....		20	∞	2.739		47 Bleaney.
			1.24			
.....		40	∞	2.703	.035	50 Whiffen, 53 MIT, 55 Takahashi, 55.2 Srivastava.
			3.22	2.670	.081	
.....		60	∞	2.700		47 Bleaney.
			1.24			
.....		20	∞	2.677	.0169	50 Whiffen, 53 MIT, 55 Takahashi, 55.2 Srivastava.
			3.22	2.639	.00175	
.....		20	∞	2.676		47 Bleaney.
			1.24			
.....		40	∞	2.647 _b		50 Whiffen, 53 MIT, 55 Takahashi, 55.2 Srivastava.
			3.22	2.647 _b	.00064	
.....		20	∞	2.647 _b	.00191	47 Bleaney.
			3.22			
.....		20	∞	(*)	(*)	50 Whiffen, 55.2 Srivastava.
			3.22			
.....		20	∞	(*)	(*)	47 Bleaney.
			3.22			
.....		20	∞	(*)	(*)	50 Whiffen, 55.2 Srivastava.
			3.22			
.....		20	∞	(*)	(*)	47 Bleaney.
			3.22			
.....		20	∞	(*)	(*)	50 Whiffen, 55.2 Srivastava.
			3.22			
.....		20	∞	(*)	(*)	47 Bleaney.
			3.22			
.....		20	∞	(*)	(*)	50 Whiffen, 55.2 Srivastava.
			3.22			
.....		20	∞	(*)	(*)	47 Bleaney.
			3.22			
.....		20	∞	(*)	(*)	50 Whiffen, 55.2 Srivastava.
			3.22			
.....		20	∞	(*)	(*)	47 Bleaney.
			3.22			
.....		20	∞	(*)	(*)	50 Whiffen, 55.2 Srivastava.
			3.22			
.....		20	∞	(*)	(*)	47 Bleaney.
			3.22			
.....		20	∞	(*)	(*)	50 Whiffen, 55.2 Srivastava.
			3.22			
.....		20	∞	(*)	(*)	47 Bleaney.
			3.22			
.....		20	∞	(*)	(*)	50 Whiffen, 55.2 Srivastava.
			3.22			
.....		20	∞	(*)	(*)	47 Bleaney.
			3.22			
.....		20	∞	(*)	(*)	50 Whiffen, 55.2 Srivastava.
			3.22			
.....		20	∞	(*)	(*)	47 Bleaney.
			3.22			
.....		20	∞	(*)	(*)	50 Whiffen, 55.2 Srivastava.
			3.22			
.....		20	∞	(*)	(*)	47 Bleaney.
			3.22			
.....		20	∞	(*)	(*)	50 Whiffen, 55.2 Srivastava.
			3.22			
.....		20	∞	(*)	(*)	47 Bleaney.
			3.22			
.....		20	∞	(*)	(*)	50 Whiffen, 55.2 Srivastava.
			3.22			
.....		20	∞	(*)	(*)	47 Bleaney.
			3.22			
.....		20	∞	(*)	(*)	50 Whiffen, 55.2 Srivastava.
			3.22			
.....		20	∞	(*)	(*)	47 Bleaney.
			3.22			
.....		20	∞	(*)	(*)	50 Whiffen, 55.2 Srivastava.
			3.22			
.....		20	∞	(*)	(*)	47 Bleaney.
			3.22			
.....		20	∞	(*)	(*)	50 Whiffen, 55.2 Srivastava.
			3.22			
.....		20	∞	(*)	(*)	47 Bleaney.
			3.22			
.....		20	∞	(*)	(*)	50 Whiffen, 55.2 Srivastava.
			3.22			
.....		20	∞	(*)	(*)	47 Bleaney.
			3.22			
.....		20	∞	(*)	(*)	50 Whiffen, 55.2 Srivastava.
			3.22			
.....		20	∞	(*)	(*)	47 Bleaney.
			3.22			
.....		20	∞	(*)	(*)	50 Whiffen, 55.2 Srivastava.
			3.22			
.....		20	∞	(*)	(*)	47 Bleaney.
			3.22			
.....		20	∞	(*)	(*)	50 Whiffen, 55.2 Srivastava.
			3.22			
.....		20	∞	(*)	(*)	47 Bleaney.
			3.22			
.....		20	∞	(*)	(*)	50 Whiffen, 55.2 Srivastava.
			3.22			
.....		20	∞	(*)	(*)	47 Bleaney.
			3.22			
.....		20	∞	(*)	(*)	50 Whiffen, 55.2 Srivastava.
			3.22			
.....		20	∞	(*)	(*)	47 Bleaney.
			3.22			
.....		20	∞	(*)	(*)	50 Whiffen, 55.2 Srivastava.
			3.22			
.....		20	∞	(*)	(*)	47 Bleaney.
			3.22			
.....		20	∞	(*)	(*)	50 Whiffen, 55.2 Srivastava.
			3.22			
.....		20	∞	(*)	(*)	47 Bleaney.
			3.22			
.....		20	∞	(*)	(*)	50 Whiffen, 55.2 Srivastava.
			3.22			
.....		20	∞	(*)	(*)	47 Bleaney.
			3.22			
.....		20	∞	(*)	(*)	50 Whiffen, 55.2 Srivastava.
			3.22			
.....		20	∞	(*)	(*)	47 Bleaney.

TABLE 4.—*Dielectric dispersion data for pure organic liquids—Continued*

No.	Substance		<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References
11.....	C ₁ --Continued		(20)	501	110.5	2.4	49 Burdun.
	CH ₃ NO	Formamide.....		436	107.6	---	
				308	108.0	4.9	
				216	109.0	5.8	
				101	110.0	8.0	
				89.8	108.5	10.8	
				64.5	108.0	15.8	
				41.0	107.0	21.0	
				23.6	93.6	40.8	
				8.4	77.7	44.4	
12.....	C ₂ H ₆ O Methanol.....		-10	∞	40.37		52 Lane.
				3.21	7.20	5.66	
				1.24	6.75	3.76	
				0.62	6.05	2.88	
			0	∞	37.98		
				3.21	7.41	6.52	
				1.24	6.78	4.06	
				0.62	6.03	2.88	
			10	∞	35.75		55 Polley.
				3.21	7.78	7.36	
				1.24	6.81	4.36	
				0.62	6.05	2.98	
			20	∞	33.64		
				3.21	8.33	8.16	
				1.24	6.88	4.74	
				0.62	6.02	3.14	
			30	∞	31.65		
				3.21	9.07	8.92	
				1.24	6.93	5.14	
				0.62	6.03	3.30	
			40	∞	29.29		
				3.21	9.94	9.66	
				1.24	6.97	5.58	
				0.62	6.04	3.47	
			50	∞	28.03		
				3.21	11.08	10.28	
				1.24	7.08	6.00	
				0.62	6.10	3.64	
			20	3.99	9.72	10.20	55 Mizushima.
				3.51	8.68	9.14	
				3.20	7.78	7.69	
				1.25	5.98	4.48	
			25	0.802	5.68	3.23	
				3.20	8.18	8.00	
				1.25	6.04	4.13	
				5×10 ³	48	-----	
			-60	950	51	7	
				55	13	10	
				5×10 ³	43		
				950	45	2	
			-40	308	43	10	
				58	20	11	
				5×10 ³	39		
				950	40	1	
			-20	308	40	4	
				58	26	10	
				5×10 ³	35		
				950	37	1	
			0	308	37	2	
				58	29	7	
				5×10 ³	35		55 Denney.
				950	37	1	
				308	37	2	
				58	29	7	
			-143 to 118	10 ⁴ to ∞	(**) (*)	(**) (*)	
				25	∞	32.63	
				300	31.0	1.2	
				400	30.9	2.5	
			18.4	10	23.9	15.3	
				3	8.9	7.2	
				243		34.6	1.55	39 Slovogt.
				58.3		34.3	5.15
			19.5	16.3	22.6	15.4	
				10.44	17.0	17.4	
				9.0	15.8	11.0	
			19.0	6.20	7.57	7.90	39 Bätz.
				3.80	4.44	5.52	
				2.80	3.50	4.24	

* Graphs. ** Table 2. ^a Data also at 20° and 40° C.

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References
	C ₁ —Continued			b (<i>n</i> ²)		
	CH ₃ O Methanol (continued).....	18	56.0 53.2 51.5 51.1 49.3 49.0 34.9 34.2 34.0 13.45	31.4 32.4 32.3 32.4 31.8 31.6 29.9 30.0 29.5 22.7		36 v. Ardenne.
		20	436		0.790	49 Fischer.
		25			.648	
		30			.545	
		40			.345	
		(20)	83.6	32.2	3.5	55 Yamamura.
		5	3.08	7.25	5.71	53 Koizumi.
		20		8.35	7.20	
		35		9.69	9.37	
		50		10.87	9.48	
		9	1.38	6.79	4.24	55 Okabayashi.
		(15 to 35)	1.24 7.4 3.24			55.1 Srivastava.
		25				52 Yamamura.
		40	1.08×10^3			52 Yasumi.
		(16 to 18)	18 to 24			50 Klages.
		(20)	440			39 Divilkovsky.
		(20)	1.65			39 Fillipov.
		20	147 to 520			39 Kobbelt.
		24	2.8×10^3			39 Maibaum.
		(20)	340 to 1190			37 Schmelzer.
		(20)	$(2.8 \text{ to } 7.6) \times 10^3$			37 Zuckermann.
						32 Malsch.
	C ₂					
13.....	C ₂ Cl ₄ Tetrachloroethylene.....	20	0.8 to 3.3	(*)	(*)	50 Whiffen.
14.....	C ₂ H ₃ Cl ₃ 1,1,1-Trichloroethane.....	4	∞ 3.22 1.24	7.71 6.981 4.891	1.95 2.70	56.2 Smyth et al.
		20	∞ 10.00 3.22 1.24	7.20 7.242 6.720 5.007	0.49 1.52 2.49	
		40	∞ 10.0 3.22 1.24	6.57 6.605 6.309 5.165	0.37 1.16 2.15	
		20	3.20 1.25 0.802	6.64 5.20 4.02	1.59 2.42 2.44	55 Polley.
		25	9.72	7.02	0.64	43 Conner.
15.....	C ₂ H ₄ Br ₂ Dibromoethane.....	25	∞ 10.0 3.22 1.27	4.76 4.62 4.02 3.28	.46 .95 .80	52.5 Smyth et al.
		40	∞ 10.0 3.22 1.27	4.67 4.61 4.17 3.37	.37 .89 .86	52.1 52.7 52.4
		55	∞ 10.0 3.22 1.27	4.58 4.58 4.23 3.47	.31 .77 .89	
		25 to 70	3.18			53.2 Ghosh.
16.....	C ₂ H ₄ BrCl 1-Bromo-2-chloroethane.....	-20 to -40	3.18			55 Ghosh.
17.....	C ₂ H ₄ Cl ₂ 1,2-Dichloroethane.....	1	∞ 10.0 3.22 1.27	11.66 11.12 8.91 5.64	1.60 3.97 3.93	52.5 Smyth et al.
		25	∞ 10.0 3.22 1.27	10.16 9.98 9.01 6.14	1.00 2.79 3.70	52.1 52.7 52.4
		40	∞ 10.0 3.22 1.27	9.37 9.27 8.62 6.49	0.75 2.18 3.35	
		55	∞ 10.0 3.22 1.27	8.66 8.63 8.24 6.67	0.57 1.77 2.96	
		-25 to 60	3.3 3.18			53 Sircar. 53.2 Ghosh.

*Graphs.

b *n*-refractive index.

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References	
C₂—Continued							
18	C ₂ H ₄ O ₂	Acetic acid	20	∞ 9	6.15 4.72	0.95	52.2 Bruma.
19	C ₂ H ₅ Br	Bromoethane	1	∞ 10.0 3.22 1.27	10.23 10.20 9.50 7.09	.80 2.14 3.46	52.5 Smyth et al. 52.1 52.7 52.4
			25	∞ 10.0 3.22 1.27	9.20 9.24 8.87 7.29	0.60 1.54 2.70	
			25	3			48 Crouch.
20	C ₂ H ₅ I	Iodoethane	25	∞ 9.72	7.69 7.76	0.76	43 Conner.
21	C ₂ H ₆ O	Ethanol	-10	∞ 3.21 1.24 0.62	30.2 4.55 4.11 3.43	1.51 1.23 0.97	52 Lane.
			0	∞ 3.21 1.24 0.62	28.39 4.56 4.14 3.43	1.69 1.32 1.01	
			10	∞ 3.21 1.24 0.62	26.68 4.56 4.21 3.45	1.92 1.41 1.05	
			20	∞ 3.21 1.24 0.62	25.07 4.54 4.23 3.45	2.23 1.55 1.04	
			30	∞ 3.21 1.24 0.62	23.56 4.61 4.24 3.47	2.68 1.72 1.17	
			40	∞ 3.21 1.24 0.62	22.14 4.80 4.27 3.46	3.22 1.99 1.25	
			50	∞ 3.21 1.24 0.62	20.80 5.10 4.39 3.48	3.88 2.28 1.37	
			-60	∞ 5×10^3 950 308 59	41 39 24 9 3.1	4 21 9 2	• 28, 27 Mizushima.
			-40	∞ 5×10^3 950 308 59	35.7 32 33 17.5 4.0	3 9 15 4	
			-20	∞ 950 308 59	31.2 31 26 6.0	3 13 6	
			-143 to -113	6×10^3 to ∞	(**) (*)	(**) (*)	55 Hassion.
			21	3.99 3.55 3.20 1.25 0.802	4.84 4.75 4.59 4.13 3.89	2.91 2.77 2.50 1.42 1.30	55] Poley.
			25	∞ 300 100 10 3	24.30 23.7 22.3 6.5 1.7	1.47 6.0 1.63 0.12	53 MIT.
			18.4 19.1 20 19.8	243 58.3 16.3 10.59	26.0 20.4 9.35 5.9	3.20 9.95 11.5 7.3	39 Slevogt.
			20	10.0 6.0 3.8 2.8	4.67 2.98 2.54 1.78	5.64 3.48 2.64 1.70	39 Bätz.

*Graphs. **Table 2.
• Data also at 0°, 20°, 40°, and 60° C.

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References
21	C ₂ —Continued					
	C ₂ H ₅ O Ethanol—Continued	18	55.5 52.6 51.7 48.6 32.1 13.4	[<i>n</i>] ^b 22.4 22.2 21.2 20.8 17.0 8.4		36 v. Ardenne.
		20	518		1.237 0.995 .826 .587 .411	49 Fischer.
		25				
		30				
		40				
		50				
		0	182	27.7 26.5 25.2 23.9 22.6 21.3	0.1 6.9 4.5 2.6 1.7 1.2	33 Szymanowski.
		10				
		20				
		30				
		40				
		50				
		20	159	24.8	5.0	39 Sosinski.
		(20?)	83.6	23.0	8.3	55 Yamamura.
		18.5	16.66	7.56	7.2	44 Benoit.
		(20?)	12.60	5.5	7.8	48 Bolton.
		20	9.95		0.966 (<i>n</i> _A) b	50 Honerjäger.
		25	3.24	4.06	2.58	52 Yasumi.
		5	3.08	4.37	1.93	53 Koizumi.
		20		4.38	2.19	
		35		4.46	2.70	
		50		4.71	3.79	
		8	1.38	4.25	1.42	55 Okabayashi.
		24	0.86	3.6	1.65	53 Hertel.
		30	1.24			55.1 Srivastava.
		5 to 35	7.4			52 Yamamura.
		40	1.08×10 ³			50 Klages.
		?	30 to 105			44 Khmel'kova.
		16 to 18	18 to 24			39 Divilkovsky.
		(19 to 20)	440			39 Filipov.
		20	3×10 ³			39 Panchenkov.
		18.7	4			37 Elle.
		20 to 40	5×10 ³			37 Hackel.
		21	2.1×10 ³			37 Schmelzer.
		(20)	(2 to 12)×10 ²			37 Zouckermann.
		(20)	(2.8 to 7.6)×10 ³			32 Malsch.
22	C ₂ H ₆ O ₂ Ethylene glycol	25	∞ 300 100 10 3	41.3 41 39 12 7	1.85 6.2 12.0 5.5	53 MIT.
		30	∞ 14.16 7.86	40.7 12.65 7.06	12.48 9.79	53 Yamamura.
		20	∞ 14.16 7.86	38.7 15.85 10.33	11.25 11.14	
		30	∞ 14.16 7.86	36.7 20.56 12.59	10.85 10.7	
		40	∞ 14.16 7.86	34.9 23.52 15.35	12.62 13.9	
		-20	5×10 ³ 718 308	46.5 36.7 29.4	2 16 17	28 Mizushima.
		0	5×10 ³ 718 308	44.3 44.3 42.0	1 4 6	
		20	5×10 ³ 718 308	44.3 41.3 41.3	1 2 2	
		40	5×10 ³ 718 308	37.7 37.7 37.7	1 2 1	
		25	(1 to 2)×10 ³			39 Schmale.
23	C ₃ H ₅ Cl 3-Chloropropene	-100 to 40	3.18			54.2 Ghosh.
24	C ₃ H ₅ Cl ₂ 1,3-Dichloropropane (trimethylene chloride).	25	9.72	10.2	1.34	43 Conner.

^b*n*=refractive index. *k*=absorption coefficient.

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References	
25....	C ₃ --Continued 2,2-Dichloropropane.....	2	∞ 3.22 1.24	12.58 10.77 6.427	4.05 5.3	56.2 Smyth et al.	
		20	∞ 3.22 1.24	11.42 10.12 6.766	3.10 4.7		
		40	∞ 3.22 1.24	10.24 9.54 6.993	2.27 4.1		
26....	C ₃ H ₆ Cl ₂ O	2,3-Dichloro-1-propanol.....	(20)	(45 to 600)	(*)	(*)	32 Girard.
27....		1,3-Dichloro-2-propanol.....	(20)	(45 to 600)	(*)	(*)	32 Girard.
28....	C ₃ H ₆ N ₂ O ₄	2,2-Dinitropropane.....	60	∞ 10.0 3.22	35.0 33.6 22.4	8.0 15.7 ± 2	56.2 Smyth et al.
		60	3.22	23.3	16.3	53 Powles.	
29....	C ₃ H ₆ O	Acetone.....	25	∞ 490	20.7	0.0334	53 Fischer.
		20	∞ 16.66	21.2 21.0	.88	44 Benoit.	
		(20°)	3.16	18.5	3.1	53 LeMontagner.	
		20	(3 to 12)	(*)	(*)	46 Abadie.	
		5 to 65	(60 to 120)			51 Sen.	
		(20)	18			50 Imanov.	
		5 to 63	57 to 100			49 Sirkar.	
		25	(1 to 2) × 10 ³			39 Schmale.	
		(20)	(2.8 to 7.6) × 10 ³			32 Malsch.	
		1	∞ 10.4 3.22 1.24	23.29 22.95 21.69 18.18	1.73 4.39 8.92	56.1 Smyth et al.	
		20	∞ 10.4 3.22 1.24	21.20 21.07 20.51 17.75	1.32 3.55 7.78		
		40	∞ 10.4 3.22 1.24	19.29 19.29 18.58 16.72	1.02 2.63 6.15		
30....	2-Propen-1-ol-(Allyl alcohol).....	-50	5×10^3 781 308	28.5 20.3 10.6	1 13 5	28 Mizushima.	
		-30	5×10^3 781 308	27.3 26.3 20.3	<1 8 7		
		-10	5×10^3 781 308	25.2 25.2 25.2	<1 3 3		
		10	5×10^3 781 308	22.5 22.5 22.5	<1 <2 <1		
		30	5×10^3 781 308	19.4 19.4 19.4	<1 <2 <1		
31....	C ₃ H ₆ O ₂	Propionic acid.....	65 to 110	(60 to 120)		51 Sen.	
32....	C ₃ H ₆ O ₃	1,3,5-Trioxane.....	65	∞ 10.4 3.22 1.24	15.55 15.75 13.11 8.51	56.5 Smyth et al.	
		80	∞ 10.4 3.22 1.24	14.20 15.04 12.29 8.00	2.16 5.27 6.80		
		25	∞ 10.4 3.22 1.27	14.20 15.04 12.29 8.00	1.62 4.36 5.97		
33....	C ₃ H ₇ Br	1-Bromopropane.....	1	∞ 10.0 3.22 1.27	8.90 8.57 7.39 5.07	52.5 Smyth et al.	
		25	∞ 10.0 3.22 1.27	8.09 7.97 7.18 5.46	0.66 1.94 2.53	52.1	
		40	∞ 10.0 3.22 1.27	7.59 7.48 7.00 5.52	0.53 1.63 2.36	52.7	
		55	∞ 10.0 3.22 1.27	7.09 7.06 6.79 5.52	0.44 1.33 2.18	52.4	

*Graphs.

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References
34.....	C ₃ —Continued 2-Bromopropane.....	1	∞ 10.0 3.22 1.27	10.52 9.88 9.26 6.45	1.02 2.82 4.08	52, 5 Smyth et al. 52, 1 52, 7 52, 4
		25	∞ 10.0 3.22 1.27	9.46 9.33 8.80 6.77	0.69 2.05 3.53	
		40	∞ 10.0 3.22 1.27	8.89 8.86 8.42 6.81	0.55 1.66 3.08	
		55	∞ 10.0 3.22 1.27	8.14 8.30 8.02 6.78	0.46 1.41 2.70	
35.....	C ₃ H ₈ O 1-Propanol.....	156 to -120 -144 to -45	6×10^3 to 1.5×10^2 6×10^3 to 1.5×10^2	(**) (*) (**) (*)	(**) (*) (**) (*)	52 Cole, 51 Davidson,
		25	∞ 300 100 10 3	20.1 19.0 16.0 3.7 2.3	3.8 6.7 2.5 0.21	53 MIT.
		20	∞ 324 199 85 62 28.0 17.1 11.1 6.42 3.45 2.94	20.8 19.3 17.4 11.2 9.2 5.35 4.5 4.06 3.93 3.62 3.46		47 Girard.
		18 to 20	598 330 200 188 113 97 86 75 61.7 53 45 42.7 28.1 28.1 17.7 17.5	19.0 18.7 17.1 16.8 14.8 13.5 12.15 11.2 10.05 9.01 7.2 7.4 7.2 4.7 4.1 3.4	1.7 3.7 5.1 5.5 7.7 7.7 7.5 8.1 8.1 7.3 7.4 5.5 5.2 3.8 3.3	37 Abadie.
		-60	5×10^3 950 380 57.8	24.4 7 5 3	14 7 2 1	28, 27 Mizushima.
		-40	5×10^3 950 380 57.8	30 15 6.5 3.1	4 13 4 1	
		-20	5×10^3 950 380 57.8	27.5 24 11 3.1	3 8 9 2	
		0	5×10^3 950 308 57.8	24 25 17.5 3.9	3 3 9 3	
		19 18.3 18.8 18.5 20	1130 243 58.3 16.3 10.44	21.1 20.3 9.3 5.7 4.5	4.83 9.4 4.65 3.81	39 Slevogt.
		20	77.67 70.91 60.19	14.8 13.7 12.2	8.3 8.9 9.1	56 Fischer.
		20 (20) 15 to 35	3 to 500 40 to 600 360 to 660	(*) (*)	(*)	42 Abadie. 32 Girard. 36 Keutner.
		0 10 20 30 40 50	182	12.6 15.4 17.4 17.4 16.8 16.2	10.6 10.1 7.5 4.5 3.0 1.8	33 Szymanowski.

*Graphs. **Table 2.

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References
	C ₃ H ₈ O	C ₃ —Continued				
35	1-Propanol—Continued	22.7	70.82	14.9	8.1	39 Slatis.
		18	16.66	4.70	3.5	44 Benoit.
		5	3.08	3.42	1.06	53 Koizumi.
		20		3.45	1.30	
		35		3.50	1.72	
		50		3.61	2.36	
		(20?)	30 to 105			44 Khmel'kova.
		16 to 18	18 to 24			39 Divilkovsky.
		23.3	440			39 Phillipov.
		20	159			39 Sosinski.
		—60 to 60	500			37.2 Cavallaro.
		20 to 40	5×10 ³			37 Hackel.
		19 to 21	2.1×10 ³			37 Schmelzer.
		25	170 to 10 ⁵			37 Schreck.
		(20)	(2.8 to 7.6)×10 ³			32 Malsch.
36	2-Propanol	—100 to —73	6×10 ³ to ∞	(**) (*)	(**) (*)	55 Hassion.
		—60	5×10 ³	15.5	14	427 Mizushima.
			950	6	6	
			308	4	1	
		—40	5×10 ³	28	8	
			950	13	13	
			308	4.5	2	
		—20	5×10 ³	28	<3	
			950	24	9	
			308	7.5	6	
		0	5×10 ³	24	<3	
			950	24	3	
			308	16	9	
		20	5×10 ³	20.5	<3	
			950	21	1	
			308	19	4	
		(20)	45 to 600	(*)	(*)	32 Girard.
		25	3.24	3.06	1.18	52 Yasumi.
37	C ₃ H ₈ O ₂	1,2-Propanediol	10	∞ 22.78 15.46 7.61	(35) 5.4 4.2 4.85	55.2 Yamamura.
			20	∞ 49.16 22.82 15.18 7.63	(33) 27.72 6.9 5.2 5.32	8.4 7.4 4.3 4.23
			30	∞ 50.02 22.80 15.00 7.62	(31) 27.11 9.3 7.2 4.84	6.4 10.7 6.0 4.72
			40	∞ 49.14 22.83 15.00 7.64	(29) 25.95 11.9 8.7 6.50	8.4 10.2 4.8 5.0
			—80 to —45	6×10 ³ to ∞	(**) (*)	(**) (*)
38	1,3-Propanediol	—90 to —30	3×10 ³ to 3×10 ⁷	(*)	(*)	51 Davidson.
39	C ₃ H ₈ O ₃	—95 to —40	3×10 ³ to 3×10 ⁷	(*)	(*)	32 White.
	Glycerol	—80 to —40	10 ³ to 3×10 ⁷			32 White.
		—75 to —40	6×10 ³ to ∞	(**) (*)	(**) (*)	54 Schulze.
		0	6×10 ⁴ 3×10 ⁴ 2×10 ⁴	48.20 48.10 47.86	0.99 2.14 3.5	51 Davidson.
			—10	5×10 ³ 950 308 57.8	23 12 7 3	53 Harris.
			10	5×10 ³ 950 308 57.8	44 34 14 4	428 Mizushima.
			30	5×10 ³ 950 308 57.8	40.5 42 38 9	<3
			50	950 308 57.8	37 40 18.7	<3
					7 7 11	

*Graphs.

**Table 2.

* Data also at 40° and 60° C.

* Data also at —50° C.

TABLE 4. Dielectric dispersion data for pure organic liquids--Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References
	C ₃ --Continued			(<i>n</i> ²)		
39.....	C ₃ H ₈ O ₃ Glycerol--Continued	18	62.0 55.6 49.5 48.9 34.0 13.45	28.6 27.1 23.1 23.4 16.4 10.3		36 v. Ardenne.
		-30 to 20	(8 to 37.5) $\times 10^3$			
		31	57 to 84			53 Litovitz.
		25	(3 to 9) $\times 10^3$			49 Sirkar.
		25	(1 to 2) $\times 10^3$			36 Hiegemann.
		-75 to 19	170 to 10 ³			36 Schmaks.
		24 to 40	410			36 Schreck.
		15 to 70	12 to 14			35 Divilkovsky.
		-61 to 64	610			33 Sebberger.
						26 Mizushima.
	C ₄					
40.....	C ₄ Cl ₆ Hexachloro-1,3-butadiene	25	∞ 100 10 3	2.55 2.55 2.51 2.47	0.014 .060 .062	53 MIT.
41.....	C ₄ H ₄ O Furan	1	∞ 3.22 1.24	3.095 3.088 3.009	.129 .318	55.1 Smyth et al.
		20	∞ 3.22 1.24	2.954 2.958 2.920	.092 .245	
42.....	C ₄ H ₆ S Thiophene	1	∞ 10.7 3.22 1.24	2.837 2.823 2.816 2.870	.011 .082 .176	55.1 Smyth et al.
		20	∞ 10.7 3.22 1.24	2.769 2.764 2.752 2.697	.013 .064 .154	
		40	∞ 10.7 3.22 1.24	2.701 2.700 2.697 2.650	.006 .051 .124	
		60	∞ 10.7 3.22 1.24	2.635 2.634 2.603 2.582	.007 .038 .090	
43.....	C ₄ H ₅ N Pyrrole	1	∞ 10.7 3.22 1.24	8.42 8.370 6.975 4.482	1.11 2.33 2.22	55.1 Smyth et al.
		25	∞ 10.7 3.22 1.24	8.10 8.046 7.003 4.829	0.87 2.00 2.40	
		40	∞ 10.7 3.22 1.24	7.76 7.670 7.055 5.251	0.64 1.59 2.53	
		60	∞ 10.7 3.22 1.24	7.45 7.362 6.978 5.569	0.47 1.24 2.35	
44.....	C ₄ H ₈ Cl ₂ 1,4-Dichlorobutane	1	∞ 10.0 3.22 1.27	9.64 9.40 6.56 4.42	1.84 3.42 2.45 2.48	52.5 Smyth et al. 52.1 52.7 52.4
		25	∞ 10.0 3.22 1.27	8.90 9.06 7.09 4.79	1.21 2.86 2.73	
		40	∞ 10.0 3.22 1.27	8.44 8.70 7.30 5.08	0.90 2.45 2.80	
		55	∞ 10.0 1.27	7.98 7.28 5.36	2.00 2.80	

[†] 95% Glycerol, 5% water.

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References
49	C ₆ —Continued Ethyl acetate—Continued	30	∞ 75.0 60.0 50.0 42.9 37.5 33.3	5.94 6.00 5.98 5.96 5.93 5.91 5.90	0.04 .06 .10 .11 .11 .11	56 Krishna.
			-60 -50 -40 -30 -20 -10 0 10 20 30	37.5 4.24 4.54 5.10 6.78 7.09 6.88 6.60 6.36 6.12 5.91	.22 .40 .82 .59 .38 .25 .19 .16 .13 .11	
50	C ₄ H ₉ Br	1-Bromobutane	1	∞ 10.0 3.22 1.27	7.57 7.18 5.53 4.02	52.5 Smyth et al. 52.1 52.7 52.4
			25	∞ 10.0 3.22 1.27	6.93 6.74 5.70 4.10	0.79 1.87 1.97
			40	∞ 10.0 3.22 1.27	6.57 6.44 5.61 4.20	0.63 1.60 1.84
			55	∞ 10.0 3.22 1.27	6.24 6.20 5.47 4.29	0.51 1.38 1.77
			25	3		48 Crouch.
51	1-Bromo-2-methyl propane	1	∞ 10.0 3.22 1.27	7.82 7.38 6.04 4.00	52.5 Smyth et al. 52.1 52.7 52.4	
			25	∞ 10.0 3.22 1.27	7.18 6.90 6.01 4.31	0.74 1.92 2.32
			40	∞ 10.0 3.22 1.27	6.74 6.60 5.91 4.33	0.59 1.61 2.18
			55	∞ 10.0 3.22 1.27	6.32 6.24 5.78 4.40	0.46 1.35 2.08
			25	9.72		43 Conner.
52	2-Bromobutane	1	∞ 10.0 3.22 1.27	9.43 9.52 7.59 4.83	52.5 Smyth et al. 52.1 52.7 52.4	
			25	∞ 10.0 3.22 1.27	8.64 8.75 7.63 5.27	0.98 2.53 3.28
			40	∞ 10.0 3.22 1.27	8.15 8.30 7.45 5.39	0.78 2.07 3.03
			55	∞ 10.0 3.22 1.27	7.65 7.90 7.21 5.49	0.62 1.76 2.75
			25	9.72		43 Conner.
53	2-Bromo-2-methyl propane	1	∞ 3.22 1.27	11.56 9.66 5.92	52.5 Smyth et al. 52.7 52.4	
			25	∞ 3.22 1.27	10.30 9.04 6.52	2.55 3.95
			40	∞ 3.22 1.27	9.52 8.75 6.76	2.09 3.52
			55	∞ 3.22 1.27	8.75 8.21 6.60	1.64 3.14

TABLE 4.—Dielectric dispersion data for pure organic liquids—Continued

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References
C ₄ —Continued						
59.....	C ₄ H ₁₀ O 1-Butanol	—139 to —3	1.5×10 ⁴ to ∞	(**) (*)	(**) (*)	55 Dannhauser, 54 Dannhauser,
		25	∞ 3×10^4 3×10^3 300 100 10	17.1 17.4 17.4 14.8 11.5 3.5	0.17 42 4.0 6.3 1.7	53 MIT.
		19 18.3 18.8 18.8 19.5	243 58.3 16.3 10.44	17.9 16.0 6.1 3.9 3.34	6.0: 5.5: 2.5: 1.82	39 Slevogt.
		20	77.63 60.12	8.0 6.3	6.7 5.4	56 Fischer.
		(20)	45 to 600	(*)	(*)	32 Girard.
		20	9	3.74	1.10	52.2 Bruma.
		25	3.24	3.08	1.08	52 Yasumi.
		5 20 35 50	3.08	3.05 3.10 3.19 3.29	0.67 .81 1.17 1.35	53 Koizumi.
		25	3.00	3.04	0.64	48 Crouch.
		18	1.38	2.93	.57	55 Okabayashi.
		15 to 35 23.9 20 20 18 20 to 40 21 (20) 17.9	360 to 600 446 147 to 520 159 (2.6 to 22)×10 ² 10 ¹ 5.6×10^3 (1.85 to 1.22)× 10 ² (1.7 to 10)×10 ⁴			36 Keutner. 39 Filipov. 39 Maibaum. 39 Sosinski. 37 Cavallaro. 37 Hackel. 37 Schmelzer. 37 Zouckermann.
60.....	2-Butanol	—121 to —4	1.5×10 ⁴ to ∞	(**) (*)	(**) (*)	55 Dannhauser.
		20	16.66	3.94	2.1	44 Benoit.
		(19 ²)	1.7×10 ⁴ to 2.7× 10 ⁵			36 Schreck.
61.....	2-Methyl-1-propanol	—137 to 0	1.5×10 ⁴ to ∞	(**) (*)	(**) (*)	55 Dannhauser.
		—50	5×10 ³ 950 308 57.8	10 4 3 2.8	12 2 1 0.4	28, 27 Mizushima.
		—30	5×10 ³ 950 308 57.8	23.5 7 4 2.8	8 10 1 0.6	
		—10	5×10 ³ 950 308 57.8	23.5 17 7 3	3 19 7 2	
		10	5×10 ³ 950 308 57.8	21 20 13 3.5	3 3 7 3	
		30	950 308 57.8	17 16.5 6.7	1 3 4	
		50	950 308 57.8	15 15 10.5	1 1 4	
		20	10 to 10 ³	(*)	(*)	46 Häfelin.
		(20)	70 to 600	(*)	(*)	32 Girard.
		0 10 20 30 40 50	182	5.4 8.6 11.9 13.6 13.7 13.25	8.45 8.40 5.56 3.54 2.14	33 Szymanowski.
		25	3.24	2.94	1.01	52 Yasumi.

*Graphs.

**Table 2.

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	<i>t</i> (°C)	<i>λ</i> (cm)	<i>ε'</i>	<i>ε''</i>	References
C₄—Continued						
61	2-Methyl-1-propanol—Continued	5 20 35 50 23 (20) 25	3.08 (1.7 to 2.7) × 10 ⁴ 180	2.89 2.97 3.08 3.24 2.86 10.9 3.55 2.966 2.77 8.49 4.77 3.327 2.96 6.89 5.67 3.923 3.20 3.09 3.29 3.04 2.80 2.87 3.00 3.24 2.82 4.70 4.68 4.609 4.30 4.24 4.239 4.184 4.01 4.335 14.65 11.49 6.740 13.55 13.25 11.62 7.386 12.45 12.32 11.32 7.969 11.44 11.36 10.63 8.333 6.88 6.15 4.30 3.30 6.31 5.95 4.53 3.47 6.00 5.77 4.57 3.47 0.51 .73 1.00 1.25 0.54 1.56 0.670 .38 1.12 1.79 1.54 0.93 .66 1.48 1.93 0.85 .70 .86 1.24 0.45 0.151 .429 1.03 0.110 .280 .705 (0) (0) 0.00168 .00451 .0835 53 Koizumi. 55 Okabayashi. 36 Schreck. 34 Maisch. 56.5 Smyth et al. 52 Yamamura. 53 Koizumi. 55 Okabayashi. 56.6 Smyth et al. 32 Maisch. 37 Schmelzer. 50 Imanov. 49 Sen. 55.1 Smyth et al.		
62	2-Methyl-2-propanol	30 50 70 825 35 45 25 26 35 50 26	∞ 10.0 3.22 1.25 ∞ 10.0 3.22 1.25 ∞ 10.0 3.22 1.25 7.43 7.45 7.44 3.24 3.08 3.00 3.24 1.38 10.0 3.22 1.25 7.45 7.44 4.70 4.68 4.609 4.30 4.24 4.239 4.184 4.01 4.335 14.65 11.49 6.740 13.55 13.25 11.62 7.386 12.45 12.32 11.32 7.969 11.44 11.36 10.63 8.333 6.88 6.15 4.30 3.30 6.31 5.95 4.53 3.47 6.00 5.77 4.57 3.47 0.51 .73 1.00 1.25 0.54 1.56 0.670 .38 1.12 1.79 1.54 0.93 .66 1.48 1.93 0.85 .70 .86 1.24 0.45 0.151 .429 1.03 0.110 .280 .705 (0) (0) 0.00168 .00451 .0835 53 Koizumi. 55 Okabayashi. 56.6 Smyth et al. 32 Maisch. 37 Schmelzer. 50 Imanov. 49 Sen. 55.1 Smyth et al.			
63	C ₄ H ₁₀ O	Ethyl ether	4 25 20 19.7 17.2 —10 to 28	∞ 10.0 3.22 1.25 ∞ 10.0 3.22 1.25 ∞ 7.6 × 10 ³ 4.8 × 10 ³ 2.8 × 10 ³ 1.06 × 10 ³ (10) (60 to 81)	4.70 4.68 4.609 4.30 4.24 4.239 4.184 4.01 4.335 14.65 11.49 6.740 13.55 13.25 11.62 7.386 12.45 12.32 11.32 7.969 11.44 11.36 10.63 8.333 6.88 6.15 4.30 3.30 6.31 5.95 4.53 3.47 6.00 5.77 4.57 3.47 0.51 .73 1.00 1.25 0.54 1.56 0.670 .38 1.12 1.79 1.54 0.93 .66 1.48 1.93 0.85 .70 .86 1.24 0.45 0.151 .429 1.03 0.110 .280 .705 (0) (0) 0.00168 .00451 .0835 53 Koizumi. 55 Okabayashi. 56.6 Smyth et al. 32 Maisch. 37 Schmelzer. 50 Imanov. 49 Sen. 55.1 Smyth et al.	
64	C ₅ H ₅ N	Pyridine	1 20 40 60	∞ 10.7 3.22 1.24 ∞ 10.7 3.22 1.24 ∞ 10.7 3.22 1.24 ∞ 10.7 3.22 1.24	14.65 11.49 6.740 13.55 13.25 11.62 7.386 12.45 12.32 11.32 7.969 11.44 11.36 10.63 8.333 6.88 6.15 4.30 3.30 6.31 5.95 4.53 3.47 6.00 5.77 4.57 3.47 0.51 .73 1.00 1.25 0.54 1.56 0.670 .38 1.12 1.79 1.54 0.93 .66 1.48 1.93 0.85 .70 .86 1.24 0.45 0.151 .429 1.03 0.110 .280 .705 (0) (0) 0.00168 .00451 .0835 53 Koizumi. 55 Okabayashi. 56.6 Smyth et al. 32 Maisch. 37 Schmelzer. 50 Imanov. 49 Sen. 55.1 Smyth et al.	
65	C ₅ H ₁₀ O	3-Pentanone	0 to 82	(60 to 120)		51.1 Sen.
66	C ₅ H ₁₁ Br	1-Bromopentane	1 25 40	∞ 10.0 3.22 1.27 ∞ 10.0 3.22 1.27 ∞ 10.0 3.22 1.27	6.88 6.15 4.30 6.31 5.95 4.53 3.47 6.00 5.77 4.57 3.47 0.51 .73 1.00 1.25 0.54 1.56 0.670 .38 1.12 1.79 1.54 0.93 .66 1.48 1.93 0.85 .70 .86 1.24 0.45 0.151 .429 1.03 0.110 .280 .705 (0) (0) 0.00168 .00451 .0835 52.5 Smyth et al. 52.1 52.7 52.4	

ε mp, 25.5° C Timmermans (50).

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References	
C₅—Continued							
66.....	C ₅ H ₁₁ Br	1-Bromopentane—Continued.....	55	∞ 10.0 3.22 1.27	5.70 5.58 4.55 3.59	0.51 1.34 1.43	
			75	10.0	5.27	0.38	
67.....		1-Bromo-3-methyl butane.....	25	∞ 9.72	5.93 5.84	1.05	43 Conner.
			-150 to 20	3.33×10^3	(*)	(*)	46.1 Schallamach.
68.....	C ₅ H ₁₁ Cl	1-Chloro-3-methyl butane.....	25	∞ 9.72	5.94 6.07	0.73	43 Conner.
69.....		2-Chloro-2-methyl butane.....	25	∞ 9.72	(9.1) 6.95	.66	43 Conner.
70.....	C ₅ H ₁₂ O	1-Pentanol.....	-60	5×10^3 950 308 57.8	5.5 4 3 2.6	5 1 0.4 .2	28, 27 Mizushima.
			-40	5×10^3 950 308 57.8	13 5 3 2.6	11 2 1 0.3	
			-20	5×10^3 950 308 57.8	19 10 4 2.6	3 6 2 1	
			0	5×10^3 950 308 57.8	17.5 17 7.5 2.7	3 5 6 1	
			20	950 308 57.8	16 13 2.8	1 5 2	
			40	950 308 57.8	13 13.5 5.7	1 2 3	
			60	950 308 57.8	11 12 9.3	1 1 3	
			0	182	3.9	4.58	33 Szymanowski.
			10		6.1	6.11	
			20		8.4	6.84	
			30		10.7	5.46	
			40		11.55	3.60	
			50		11.6	2.13	
			20	16.66	4.03	1.68	44 Benoit.
			(20)	45 to 600	(*)	(*)	32 Girard.
			5	3.08	2.75	0.49	53 Koizumi.
			20		2.83	.64	
			35		2.94	.91	
			50		3.05	1.13	
			15 to 35	360 to 660			36 Keutner.
			16 to 22	320 to 1002			41 Khodakov.
			20	147 to 520			39 Maibaum.
			20	159			39 Sosinski.
71.....		3-Methyl-1-butanol.....	-100 to 0.7	750 to ∞	(**)	(**)	54 Reinisch.
72.....		2-Methyl-2-butanol.....	(20?)	30 to 105			44 Khmel'kova.
C₆							
73.....	C ₆ H ₄ Cl ₂	o-Dichlorobenzene.....	25.5	18 to 152			49 Fischer.
74.....	C ₆ H ₅ Br	Bromobenzene.....	1	∞ 10.0 3.22 1.27	5.74 5.17 3.62 2.95	1.12 1.36 0.82	52.5 Smyth et al. 52.1 52.7 52.4
			25	∞ 10.0 3.22 1.27	5.39 5.08 3.92 3.08	.76 1.34 0.94	
			40	∞ 10.0 3.22 1.27	5.18 5.02 4.06 3.08	.61 1.26 0.94	

*Graphs. **Table 2.

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References
	C ₆ —Continued					
74.....	C ₆ H ₅ Br Bromobenzene—Continued.....	55	∞ 10.0 3.22 1.27	4.96 4.86 4.16 3.18	0.48 1.12 1.05	
		75	10.0 20	4.71 4.32 4.16 4.06 3.00	0.38 1.36 1.42 1.40 0.98	55 Poley.
			1.25 0.802	2.82	.71	
		0	32 to 100			
		25	3			53 Ghosh.
		20	16.7			48 Crouch.
						44 Benoit.
75.....	C ₆ H ₅ Cl Chlorobenzene.....	1	∞ 10.0 3.22 1.27	6.15 5.73 3.29	.88 1.27	52.5 Smyth et al.
		25	∞ 10.0 3.22 1.27	5.63 5.50 4.64 3.44	0.64 1.41 1.35	52.1 52.7 52.4
		40	∞ 10.0 3.22 1.27	5.31 5.26 4.66 3.55	0.50 1.21 1.39	
		55	∞ 10.0 3.22 1.27	5.09 5.06 4.63 3.63	0.39 1.01 1.33	
		22	∞ 3.99 3.55 3.20 1.25 0.802	5.67 4.93 4.79 4.59 3.37 2.96	1.32 1.42 1.49 1.39 1.06	55 Poley.
		20	78.01 70.64 60.45	5.66 5.69 5.72	0.108 .152 .158	56 Fischer.
		25	450	5.61	0.0149 ₃	53 Fischer.
		25	3	4.83	1.64	48 Crouch.
		25	32 to 100 57 to 120 536			53 Ghosh. 50 Sen.
		—30 to 0 20 to 50				49 Fischer. 39 Schnale. 32 Malsch.
		25 (20)	(1 to 2) $\times 10^3$ (2.8 to 7.6) $\times 10^3$			
76.....	C ₆ H ₅ ClO <i>p</i> -Chlorophenol.....		3.18			56 Ghosh.
77.....	C ₆ H ₅ F Fluorobenzene.....	21	∞ 3.99 3.20 1.25 0.802	5.44 ^b 5.22 5.09 4.15 3.43	0.71 .95 1.54 1.48	55 Poley.
78.....	C ₆ H ₅ I Iodobenzene.....	21	∞ 3.99 3.20 1.25 0.802	4.64 3.44 3.31 2.88 2.80	0.92 .875 .47 .36	55 Poley.
79.....	C ₆ H ₅ NO ₂ Nitrobenzene.....	25	∞ 46.2 37.5 30.0 27.3 14.3 10.0	34.82 32.5 32.1 31.8 30.7 25.7 20.6	4.5 5.6 7.44 9.0 11.1 12.65	56 Clark.
		15 20 25 30 40 50	10.0	19.8 21.4 20.6 22.6 21.4 23.9	14.1 12.9 12.7 12.0 11.6 11.2	
		20	∞ 3.99 3.55 3.20 1.25 0.802	35.73 10.15 8.53 7.45 4.73 4.05	12.36 10.91 9.51 4.58 3.26	55 Poley.
		25	∞ 3 $\times 10^3$ 10	34.82 34.4 31.1	0.31 5.2	53 MIT.

^b Laboratory of Physical Chemistry University Leiden, unpublished
449583—58—6

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References
C₆—Continued						
79.....	C ₆ H ₅ NO ₂ Nitrobenzene—Continued.....	20	78.09 70.58 60.86	35.9 36.2 35.1	5.3 5.3 5.9	56 Fischer.
		17	3 to 200	(*)	(*)	46, 43 Girard.
		18	∞ 72 54.0 32.3 13.45	(n ²) ^b 36.4 34.0 33.5 31.5 26.5		36 v. Ardenne.
		20	441		0.553	49 Fischer.
		25			.491	
		30			.437	
		40			.339	
		50			.262	
		20	182	34.2	1.96	33 Szymanowski.
		30		32.3	1.40	
		40		30.8	1.07	
		50		29.6	0.82	
		60		26.58	.71	
		(17)	3.16	8.1	6.4	53 LeMontagner.
		25 to 42	532			53 Fischer.
		14	58 to 76			50 Choudhury.
		10 to 60	10			50 Heston.
		26.7	57 to 120			50 Sen.
		20.5	320 to 1002			41 Khodakov.
		16	3×10^3			39 Panchenkov.
		25	(1 to 2) $\times 10^3$			39 Schimale.
80.....	C ₆ H ₆ Benzene.....	20	∞ 3.33	2.2836 2.2841	[tan δ] 0.0005 0.0004 0.0009 .0009	55 Hartshorn.
			1.2			
		20	3.2	i 2.2850 2.2835 2.2780 1.35	i .00057 .00050 .00035 i 0.0017 2.2828 2.2778	47 Bleaney.
		1 to 60	1.27 1 to 10	2.284	.0011	50 Heston.
		20	0.85 to 3.33	(*)	(*)	50 Whiffen.
		(20)	3 to 17			46 Abadie.
		20	3.39			55 Takahashi.
		(20?)	3.27			55.2 Srivastava.
81.....	C ₆ H ₅ O Phenol.....	40 to 120	3.18			55 Ghosh.
82.....	C ₆ H ₅ N Aniline.....	20	∞	6.89		49 Fisher.
		20	603		0.02766	
		25			.02433	
		30			.02132	
		40			.01662	
		50			.01276	
		25	460		.0500	53 Fischer.
		42			.0343	
		14	58 to 77			50 Choudhury.
83.....	γ-Picoline.....	1	∞ 33.3	(13.1) 12.86	1.00	55.1 Smyth et al.
		20	∞ 33.3 10.7 3.22 1.24	(12.2) 12.06 11.59 8.165 4.355	0.71 2.16 4.14 3.72	
		40	∞ 33.3 10.7 3.22 1.24	(11.3) 11.30 10.93 8.726 4.715	0.55 1.67 3.68 4.05	
		60	∞ 33.3 10.7 3.22 1.24	(10.5) 10.57 10.29 8.893 5.432	0.40 1.21 3.04 4.36	

^aGraphs.^b *n*=refractive index.ⁱ Different samples.

TABLE 4.—*Dielectric dispersion data for pure organic liquids—Continued*

No.	Substance		<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References
C₆—Continued							
84.....	C ₆ H ₁₀ O	Cyclohexanone	1	∞ 3.22 1.24	17.01 10.76 5.55	6.39 5.06	56.1 Smyth et al.
			20	∞ 3.22 1.24	16.00 11.67 6.84	5.72 5.28	
			40	∞ 10.4 3.22 1.24	14.99 14.1 11.92 7.33	2.1 4.65 5.26	
			60	∞ 10.4 3.22 1.24	13.99 13.4 11.81 7.94	2.0 3.65 5.16	
			21	14 to 67			56 Dieringer.
85.....	C ₆ H ₁₁ Br	Bromocyclohexane	1	∞ 10.0	8.54 7.57	2.24	52.5 Smyth et al. 52.1
			25	∞ 10.0	7.92 7.42	1.70	
			40	∞ 10.0	7.55 7.24	1.42	
			55	∞ 10.0	7.18 7.02	1.16	
			75	10.0	6.68	0.91	
			21	14 to 67			56 Dieringer.
86.....	C ₆ H ₁₁ Cl	Chlorocyclohexane	21	14 to 67			56 Dieringer.
87.....	C ₆ H ₁₁ NO ₂	Nitrocyclohexane	21	14 to 67			56 Dieringer.
88.....	C ₆ H ₁₂	Cyclohexane	20	∞ 3.33 1.20	2.0250 0.0002 .0002	[tan δ]	55 Hartshorn.
			20	3.2 1.35	2.0244 2.0248	.00005 .00019	47 Bleaney.
			20	0.85 to 3.33	(*)	(*)	50 Whiften.
89.....	C ₆ H ₁₂ O	Cyclohexanol	25	6×10^4 3×10^4 1.5×10^3 8.5×10^2 5.0×10^2 3.0×10^2 1.88×10^2 909 625 417 313 185 113 60.4 42.9 21.6 9.09 3.20	16.8 16.8 16.8 16.8 16.7 16.1 15.94 14.50 12.2 10.0 8.0 5.73 4.65 4.42 4.10 3.77 3.31 3.04	0.15 .18 .45 .70 .08 .75 2.61 4.8 6.2 6.4 6.1 4.12 2.55 2.20 1.67 0.96 .63 .38	56 Arnoult.
			45	3×10^4 5.0×10^3 3.0×10^3 1.88×10^3 909 625 417 313 185 113 60.4 42.9 21.6 9.09 3.20	15.3 15.3 15.3 15.3 15.3 15.3 15.3 15.0 14.8 13.0 10.55 8.7 5.97 5.0 4.16 3.57 3.26	.09 .40 .86 .97 1.94 2.2 2.85 4.8 5.5 5.2 4.35 2.92 1.75 1.01 0.54	
			-25 to 49	3×10^2 to 3×10^4	(**) (*)	(**) (*)	53 Reinisch.
			60 to 140	3.18			55 Ghosh.
90.....	C ₆ H ₁₂ O ₃	Paraldehyde	20	∞ 10.4 3.22 1.24	14.70 5.14 2.87 2.43	4.78 2.08 1.00	56.5 Smyth et al.

*Graphs. **Table 2.

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TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References
90....	C ₆ H ₁₂ O ₃ Paraldehyde—Continued.....	40	∞ 10.4 3.22 1.24	12.25 6.54 3.21 2.42	4.24 2.26 1.09	
		60	∞ 10.4 3.22 1.24	10.30 7.26 3.74 2.53	3.36 2.56 1.15	
91....	C ₆ H ₁₃ Br 1-Bromohexane.....	1	∞ 10.0 3.22 1.27	6.30 3.75 2.96	1.37 1.07	52.5 Smyth et al. 52.1 52.7 52.4
		25	∞ 10.0 3.22 1.27	5.82 5.20 4.03 3.11	0.91 1.38 1.15	
		40	∞ 10.0 3.22 1.27	15.56 5.17 4.14 3.18	0.75 1.34 1.17	
		55	∞ 10.0 3.22 1.27	5.30 5.14 4.15 3.26	0.61 1.21 1.17	
92....	C ₆ H ₁₄ 1-Hexane.....	20	∞ 3.2 1.35	1.890 1.902 1.902	[tan δ] 0.00034 .00076	47 Bleaney.
93....	C ₆ H ₁₄ O 1-Hexanol.....	-40 to 0.7	750 to ∞	(**) (*)	(**) (*)	54 Reinisch.
		-50 to 60	9	(*)	(*)	54 Brot.
		20	9.0	3.17 (**)	0.70 (**)	52.2 Bruma.
		-50 to 25	3.22	(*)	(*)	53 Brot.
		-50 to 50	1.25	(*)	(*)	55 Brot.
94....	C ₆ H ₁₄ O ₂ 2-Methyl-2,4-pentanediol.....	15 to 35	360 to 660			36 Keutner.
95....	C ₆ H ₁₄ O ₆ Sorbitol.....	-70 to -20	3×10 ³ to 3×10 ⁷	(*)	(*)	32 White.
96....	C ₆ H ₁₈ OSi ₂ Hexamethyl disiloxane.....	-60	∞ 3.22 1.24	2.422 2.404 2.368	0.0200 .0430	55.2 Smyth et al.
		-40	∞ 3.22 1.24	2.353 2.343 2.321	(.0152) (.0274)	
		-20	∞ 3.22 1.24	2.290 2.285 2.279	.0111 .0205	
		2	∞ 10.22 3.22 1.24	2.227 2.221 2.224 2.220	.0006 .0075 .0154	
		20	∞ 10.22 6.17 3.22 1.24	2.179 2.178 2.180 2.179 2.178	.0004 .0014 .0050 .0123	
		40	∞ 10.22 3.22 1.24	2.130 2.130 2.130 2.132	.0003 .0031 .0091	
97....	C ₇ H ₈ N Benzonitrile.....	21	∞ 3.99 3.20 1.25 0.802	25.57 9.39 7.17 4.64 3.99	9.65 7.98 4.29 3.07	55 Poley.
		20	∞ 514	25.63	0.2348 .2060 .1855 .1465 .1201	49 Fischer.
98....	C ₇ H ₇ Cl Benzyl chloride.....	-20 to 120	3 to 100			54 Ghosh.

*Graphs. **Table 2.

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References
C₇—Continued						
99	C ₇ H ₈ Toluene	—80 —60 —40 —20 0 20 40 60 80 (19?) 18.1 —95 to 27 18 (20?)	1.27 10 (10) 57 to 120 16.66 3.27	 2.41 2.41	[tan δ] 0.0147 .0196 .0236 .0265 .0265 .0251 .0230 .0200 .0178 .0205 .053	46 Whiffen. 46 Dunsmuir. 50 Imanov. 50 Sen. 44 Benoit. 55.2 Srivastava. 28 Mizushima.
100	C ₇ H ₈ O Benzyl alcohol	—20 0 20 40 20 19 5 to 30 5 to 80	5×10 ³ 718 308 5×10 ³ 718 308 5×10 ³ 718 308 77.78 70.68 59.98 3 to 200 35 to 120 9.4×10 ³ ∞ 457 42	15.1 11.1 8.4 19.9 14.8 13.8 13.0 13.0 13.0 11.1 11.0 11.0 10.9 10.4 9.9 (*) 4.33 4.36 4.20	2 6 3 1 2 2 0.6 .9 .5 .6 .9 .4 4.8 4.9 4.9 (*) 0.00793 .00580	56 Fischer. 43 Girard. 54 Ghosh. 53 Fischer. 52 Kastha. 54.2 Ghosh. 52 Kastha. 54.2 Ghosh. 52 Kastha. 56 Ghosh. 56 Ghosh. 49 Fischer.
101	Methoxybenzene (anisole)	25 42	∞ 457 42	4.33 4.36 4.20	0.00793 .00580	53 Fischer.
102	<i>o</i> -Cresol	18 to 84 30 to 100	34 to 44 3.18			52 Kastha. 54.2 Ghosh.
103	<i>m</i> -Cresol	18 to 84 20 to 120	34 to 44 3.18			52 Kastha. 54.2 Ghosh.
104	<i>p</i> -Cresol	16 to 87 40 to 120	34 to 44 3.18			52 Kastha. 56 Ghosh.
105	C ₇ H ₈ O ₂ <i>o</i> -Methoxyphenol	40 to 140	3.18			56 Ghosh.
106	C ₇ H ₉ N <i>m</i> -Toluidine	18 20 25 30 40 50	∞ 584 10.0 3.22 1.25	5.95 12.86 12.26 11.08 11.55 8.939 4.86	.04130 .03500 .02996 .02200 .01711 2.80	49 Fischer.
107	Benzylamine	—40 to 100	3 to 125			54.1 Ghosh.
108	C ₇ H ₁₄ O 2-Heptanone	4 25 50 70 75 1	∞ 10.0 3.22 1.25 ∞ 10.0 3.22 1.25 ∞ 10.0 3.22 1.25 ∞ 10.4 3.22 1.24	12.86 12.26 11.08 11.55 8.939 4.86 10.41 10.40 9.069 5.78 9.49 9.28 9.37 8.686 2.15 13.01 12.00 7.76 4.58	2.80 1.84 4.00 4.00 1.20 3.00 3.99 3.50 0.77 2.15 2.7 4.42 3.86	56.6 Smyth et al. 56.1 Smyth et al.

*Graphs.

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	t (°C)	λ (cm)	ϵ'	ϵ''	References
108	C ₇ H ₁₄ O 2-Heptanone—Continued	20	∞ 10.4 3.22 1.24	11.98 11.22 8.74 5.03	2.2 4.15 4.12	
		40	∞ 10.4 3.22 1.24	11.02 10.44 8.93 5.67	(0.90) 3.40 4.07	
		60	∞ 10.4 3.22 1.24	10.18 9.84 9.00 6.3	0.91 2.56 3.82	
109	4-Heptanone	1	∞ 10.4 3.22 1.24	13.82 (11.43) 7.91 4.31	(3.62) 5.10 3.9	56.1 Smyth et al.
		20	∞ 10.4 3.22 1.24	12.67 12.00 8.58 4.83	2.2 4.61 4.3	
		40	∞ 10.4 3.22 1.24	11.61 11.06 9.25 5.54	1.6 3.67 4.07	
		60	∞ 10.4 3.22 1.24	10.71 (9.82) 9.00 6.05	(0.92) 2.91 3.75	
110	5-Methyl-3-hexanone	30 to 85	(60 to 120)			51.1 Sen.
111	C ₇ H ₁₄ O ₂ Isoamyl acetate	30 to 95	(60 to 120)			51.1 Sen.
		20	∞ 10.0 3.22 1.25	4.72 4.61 4.10 3.35	0.42 .87 1.04	52.8 Smyth et al.
		50	∞ 10.0 3.22 1.25	4.34 4.33 4.82 3.41	0.27 .64 .88	
112	C ₇ H ₁₅ Br 1-Bromoheptane	1	∞ 10.0 3.22 1.27	5.74 4.57 3.37 2.78	1.06 1.17 0.77	52.5 Smyth et al. 52.1 52.7 52.4
		25	∞ 10.0 3.22 1.27	5.33 4.53 3.56 2.89	.86 1.11 0.87	
		40	∞ 10.0 3.22 1.27	5.11 4.50 3.68 2.99	.75 1.08 0.91	
		55	∞ 10.0 3.22 1.27	4.90 4.47 3.71 3.03	.67 1.01 0.95	
		75	∞ 10.0	(7.26) 4.42	.51	
113	C ₇ H ₁₆ 1-Heptane	20	∞ 3.2 1.35	1.024 1.9220 1.9223	[tan δ] 0.00037 .00076	47 Bleaney.
114	C ₇ H ₁₆ O 1-Heptanol	20	1.27	1.920	.00060 -	50 Heston, 55.1 Lebrun.
		0	3.8×10^4 2.7×10^4 7.5×10^3 3.8×10^3 2.1×10^3 1.43×10^3 1.07×10^3 860 749 374.5 249.7 187.3 122.0 59.1 44.08 21.66 9.51 3.19	14.0 14.0 13.90 13.55 12.65 11.54 10.5 9.43 8.77 5.17 5.26 4.00 4.50 3.07 3.78 2.43 3.52 1.80 3.36 1.13 3.26 1.04 2.94 0.55 2.85 .40 2.46		

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References	
114....	C ₇ H ₁₆ O 1-Heptanol—Continued.....	20	3×10 ⁴ 2.38×10 ³ 1.5×10 ³ 810 650 553 431 313 231.7 188 153 104 78.7 60.15 43.8 21.6 17.23 9.46 3.17	11.70 11.6 11.45 10.9 10.43 10.0 9.2 7.86 7.05 6.09 5.25 4.19 3.85 3.49 3.44 3.12 3.00 2.99 2.62	0.94 1.64 2.70 3.10 3.48 4. 4.86 4.22 4.13 3.71 2.94 2.53 1.94 1.70 1.09 0.88 .66 .36	55 Lebrun.	
			-34 to 50	7.5×10 ² to 3.8×10 ³	(*)	(*)	51 Oppenheim.
			20	9.	2.98	0.55	52.2 Bruma.
			-35 to 60	9.0	(*)	(*)	54 Brot.
			-35 to 25	3.22	(*)	(*)	53 Brot.
			-50 to 50	1.25	(*)	(*)	55 Brot.
115....	C ₈ H ₈ O Acetophenone.....	20	∞ 10.4 3.22 1.24	18.66 (12.8) 5.62 3.63	(6.1) 3.5 2.2	56.1 Smyth et al.	
			40	∞ 10.4 3.22 1.24	17.77 13.0 6.67 4.11	5.0 4.2 2.8	
			60	∞ 10.4 3.22 1.24	16.88 13.0 7.66 4.35	5.9 4.4 3.3	
			25 to 42	490		[tan δ] 0.052	53.2 Fischer.
116....	C ₈ H ₁₀ o-Xylene.....	-25 -20 0 20 40 60 80 100 120 140		1.27		.054 .057 .058 .057 .059 .049 .044 .040 .035	46 Whiffen.
			-20 to 0	30 to 120			
117....	m-Xylene.....	-30		30 to 120			53.1 Ghosh.
118....	Ethyl benzene.....	-95 to 27		60 to 120			53.1 Ghosh.
119....	C ₈ H ₁₁ N 2,4,6-Trimethyl pyridine (γ -Collidine).	20	∞ 10.4 3.22 1.24	8.00 6.15 3.37 2.71	2.07 1.67 0.77	50 Sen.	56.5 Smyth et al.
			40	∞ 10.4 3.22 1.24	7.46 6.06 3.75 2.75	1.71 1.80 0.95	
			60	∞ 10.4 3.22 1.24	6.94 5.95 4.09 2.85	1.40 1.90 1.03	
120....	C ₈ H ₁₆ O ₂ Octanoic acid (Caprylic acid).....	20	∞ 9.	2.45 2.44	0.05	52.2 Bruma.	
121....	C ₈ H ₁₇ Br 1-Bromo-octane.....	1	∞	5.32		52.5 Smyth et al.	52.1
				4.10 3.10 2.74	.97 .93 .57	52.7	52.4
			25	∞ 10.0 3.22 1.27	5.00 4.14 3.28 2.79	.84 .90 .69	
			40	∞ 10.0 3.22 1.27	4.80 4.17 3.41 2.810	.75 .90 .73	

*Graphs.

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	<i>t</i> (°C)	<i>λ</i> (cm)	<i>ε'</i>	<i>ε''</i>	References	
121...	C ₈ H ₁₇ Br	1-Bromoocane—Continued	55	∞ 10.0 3.22 1.27	4.60 4.18 3.48 2.92	0.67 .87 .75	
122...	C ₈ H ₁₇ Cl	1-Chlorooctane	1	∞ 10.0 3.22 1.27	5.47 4.35 3.22 2.76	.90 1.09 0.74	52.5 Smyth et al. 52.1 52.7 52.4
			25	∞ 10.0 3.22 1.27	5.05 4.43 3.50 2.89	.68 1.04 0.86	
			40	∞ 10.0 3.22 1.27	4.80 4.40 3.61 2.95	.59 .96 .87	
			55	∞ 10.0 3.22 1.27	4.55 4.32 3.63 3.01	.52 .86 .88	
			75	10.0	4.22	.41	
123...	C ₈ H ₁₇ I	1-Iodooctane	24.5	8 to 150			42 Klages.
			1	∞ 3.22 1.27	4.90 2.78 2.54	.64 .35	52.5 Smyth et al. 52.7 52.4
			25	∞ 3.22 1.27	4.62 2.97 2.59	.72 .44	
			40	∞ 3.22 1.27	4.44 3.03 2.62	.72 .49	
			55	∞ 3.22 1.27	4.27 3.07 2.65	.70 .52	
124...	C ₈ H ₁₇ DO	1-Octanol-D-1	-15 to 50	750 1.8×10 ⁸	(*)	(*)	52 Corval.
125...	C ₈ H ₁₈ O	1-Octanol	0	3.8×10 ⁴ 2.7×10 ⁴ 7.5×10 ³ 3.8×10 ³ 2.1×10 ³ 1.43×10 ³ 1.07×10 ³	12.2 12.1 12.10 11.6 10.70 9.34 8.33	.27 .38 .89 2.10 3.25 4.01	55.1 Lebrun.
			20	860 749 374.5 249.7 187.3 122.0 59.1 44.08 21.66 9.51 3.19	7.31 6.12 4.41 3.09 3.54 3.27 3.07 2.99 2.78 2.64 2.40	4.30 4.24 2.96 2.14 1.90 1.26 0.83 .72 .434 .34 .167	55.2 Lebrun.
			2.5	3×10 ⁴ 2.38×10 ³ 1.50×10 ³	10.35 10.25 10.05	.94	
			6	810 650 553 431 313 231.7 188 153 104 78.7 60.15 43.8 21.6 17.23 9.46 3.17	9.41 8.90 8.26 7.6 6.45 5.61 5.13 4.49 3.77 3.54 3.30 3.14 2.99 2.85 2.87 2.52	2.64 2.97 3.24 3.6 3.70 3.64 3.28 2.80 2.24 1.89 1.40 1.27 0.76 .68 .52 .28	
			25	12.5 9.04	2.683 2.644	.382 .324	56.5 Smyth et al.
				1.25	2.38	.135	
				12.5 9.04 8.22 1.25	2.841 2.736 2.584 2.56	.603 .513 .323 .22	

*Graphs.

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References
	C ₈ —Continued					
125.	C ₈ H ₁₈ O 1-Octanol—Continued.....	50	12.5 9.04 3.22 1.25	3.172 2.976 2.662 2.65	1.02 0.855 .496 .56	
		87	1.25	2.76	.56	
		20	9.	2.84	.43	52, 2 Bruma.
		—15 to 49	750 to 3.7×10^3	(*)	(*)	53 Dalbert.
		20	3 to 2×10^3	(*)	(*)	42 Girard.
		—20 to 60	9.0	(*)	(*)	54 Brot.
		—50 to 50	1.25	(*)	(*)	55 Brot.
		—6 to 20	3×10^1 to ∞			52 Hamou.
		40	1.08×10^3			50 Klages.
		(?)	30 to 105			44 Kluamel'kova.
		25	9.72			43 Conner.
		—14 to 24	6×10^3 to 6×10^7			36 Smyth.
126.	2-Octanol.....	—36 to 49				53 Dalbert.
		—60 to 60	2.6×10^3	(*)	(*)	37 Cavallaro.
		25	9.72			43 Conner.
127.	Butyl ether.....	—130 to 20	1.5×10^3	(*)	(*)	46 Schallamach.
	C ₉					
128.	C ₉ H ₇ N Quinoline.....	1	∞ 33.3 3.22 1.24	9.70 9.325 3.532 3.227	2.19 1.42 0.75	55, 1 Smyth et al.
		20	∞ 33.3 3.22 1.24	9.03 8.896 3.904 3.226	1.27 1.93 1.04	
		40	∞ 33.3 3.22 1.24	8.40 8.473 4.398 3.276	0.86 2.27 1.29	
		60	∞ 33.3 3.22 1.24	7.81 8.082 4.898 3.441	0.64 2.32 1.63	
129.	Isoquinoline.....	25	∞ 33.3 3.22 1.24	10.43 9.834 3.821 3.242	2.16 1.85 1.00	55, 1 Smyth et al.
		40	∞ 33.3 3.22 1.24	9.88 9.714 4.038 3.267	1.65 2.20 1.20	
		60	∞ 33.3 3.22 1.24	9.22 9.307 4.563 3.339	1.10 2.53 1.55	
130.	C ₉ H ₁₀ Br 1-Bromononane.....	1	∞ 10.0 3.22 1.27	5.01 3.77 2.84 2.57	0.92 .76 .46	52, 5 Smyth et al. 52, 1 52, 7 52, 4
		25	∞ 10.0 3.22 1.27	4.74 3.86 3.05 2.66	.81 .82 .57	
		40	∞ 10.0 3.22 1.27	4.57 3.91 3.17 2.73	.73 .83 .63	
		55	∞ 10.0 3.22 1.27	4.49 3.93 3.16 2.77	.65 .76 .66	
131.	C ₉ H ₁₈ O 1-Nonanol.....	0	3.8×10^4 2.7×10^4 7.5×10^3 3.8×10^3 2.1×10^3 1.43×10^2 1.07×10^2 860 749 374.5 249.7 187.3 122.0 59.1 44.08 21.66 9.51 3.19	11. 11. 10.85 10.10 8.75 7.40 6.60 5.70 5.55 3.84 3.57 3.23 3.14 3.04 2.92 2.70 2.60 2.36	.30 .42 .96 2.25 3.25 3.63 3.70 3.37 3.36 2.21 1.65 1.27 0.98 .75 .61 .37 .23 .14	55, 1 Lebrun.

*Graphs.

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References
C₉—Continued						
131...	C ₉ H ₁₈ O 1-Nonanol—Continued	20	3×10 ⁴ 2.38×10 ³ 1.50×10 ³ 810 650 553 431 313 231.7 188 153 104 78.7 60.15 43.8 21.6 17.23 9.46 3.17	9.05 8.85 8.68 8.04 7.53 7.04 6.22 5.55 4.89 4.37 3.96 3.55 3.38 3.17 3.12 2.90 2.81 2.72 2.47	0.94 1.47 2.30 2.67 2.86 2.95 3.02 2.90 2.54 2.15 1.86 1.48 1.13 0.99 .60 .56 .46 .25	55 Lebrun.
			—5 to 60 —5 to 20 —50 to 50	9.0 3.22 1.25	(*) (*) (*)	54 Brot. 53 Brot. 55 Brot.
C₁₀						
132...	C ₁₀ H ₇ Br 1-Bromonaphthalene	1	3.22	2.99	0.36	52.7 Smyth et al.
		25	∞ 10.0 3.22 1.27	4.83 3.76 3.02 2.89	.81 .51 .21	52.5 52.1 52.7 52.4
		40	∞ 10.0 3.22 1.27	4.70 3.90 3.07 2.87	.77 .59 .25	
		55	∞ 10.0 3.22 1.27	4.57 4.00 3.12 2.87	.71 .66 .31	
		75	10.0	4.04	.56	
		20	78.05 70.48 60.18	4.78 4.76 4.70	4.27 4.46 4.76	56 Fischer.
		20.5	54.88 52.92 5.90 5.74	2.177 2.178 1.825 1.827	[n] ^b	51 Meckbach.
		20.5	1.3 to 80	(*)	(*)	
		20	529		0.0835	49 Fischer.
		25			.0738	
		30			.0661	
		40			.0521	
		50			.0423	
133...	C ₁₀ H ₇ Cl 1-Chloronaphthalene	1	∞ 10.0 3.22 1.27	5.30 3.97 3.16 2.83	1.06 0.49 .19	52.5 Smyth et al. 52.1 52.7 52.4
		25	∞ 10.0 3.22 1.27	5.04 4.16 3.08 2.80	.86 .63 .28	
		40	∞ 10.0 3.22 1.27	4.88 4.22 3.13 2.80	.75 .70 .33	
		55	∞ 10.0 3.22 1.27	4.72 4.29 3.24 2.83	.64 .76 .37	
		75	10.0	4.35	.52	
		20	77.63 70.52 60.22	4.87 4.86 4.85	2.92 2.93 3.62	56 Fischer.
134...	C ₁₀ H ₁₂ O ₂ Eugenol	20	78.23 70.61 60.90	6.7 6.3 6.0	3.2 3.1 3.5	56 Fischer.
135...	C ₁₀ H ₁₄ 1-Methyl-4-isopropyl benzene (<i>p</i> -cymene)	—70 —50 —30 —10 10 30 50 70 100 150	1.27		{(tan δ)/c} ⁱ 0.0049 .0067 .0080 .0087 .0090 .0089 .0085 .0081 .0073 .0061	46 Whiffen.

^aGraphs.^b *n*=refractive index. ⁱ{(tan δ)/c}=specific loss tangent; *c*=moles/100 ml.

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References	
C₁₀—Continued							
136...	C ₁₀ H ₁₆ O	Citral.....	-150 to 20	3.33×10 ³	(*)	(*)	
137...	C ₁₀ H ₁₆ O ₂	Geranic acid.....	-140 to 20	9.23×10 ³	(*)	(*)	
138...	C ₁₀ H ₁₈	<i>trans</i> -Decahydronaphthalene.....	20	0.85 to 3.33	(*)	(*)	
139...	C ₁₀ H ₁₈ O	Geraniol.....	-150 to 50	3.33×10 ³	(*)	(*)	
140...	C ₁₀ H ₂₁ Br	1-Bromodecane.....	1	∞ 10.0 3.22 1.27	4.75 3.42 2.71 2.50	0.72 .63 .32	
			25	∞ 10.0 3.22 1.27	4.44 3.52 2.88 2.59	.57 .71 .42	
			40	∞ 10.0 3.22 1.27	4.28 3.54 2.97 2.59	.50 .71 .47	
			55	∞ 10.0 3.22 1.27	4.12 3.54 3.05 2.63	.45 .69 .51	
			75	10.0	3.53	.38	
141...	C ₁₀ H ₂₁ Cl	1-Chlorodecane.....	24.5	8 to 150		42 Klages.	
142...	C ₁₀ H ₂₂ O	1-Decanol.....	20	3×10^4 2.38×10^3 1.50×10^3 810 650 553 431 313 231, 7 188 153 104 78, 7 60, 15 43, 8 21, 6 17, 23 9, 46 3, 17	7.75 7.6 7.56 7.15 6.76 6.5 6.06 5.41 4.89 4.42 4.05 3.68 3.50 3.32 3.24 2.97 2.86 2.72 2.49	.72 .97 1.74 1.86 2.08 2.16 2.32 2.22 2.09 1.84 1.55 1.36 1.14 0.95 .67 .57 .45 .26	55.2 Lebrun.
			25	3×10^4 3×10^4 5×10^3 3.0×10^3 1.43×10^3 910 630 313 185 104, 2 60 9, 1 3, 20	7.80 7.80 7.78 7.72 7.60 7.33 7.00 5.08 4.27 3.49 3.25 2.76 2.48	.25 .44 .94 1.35 1.86 2.32 2.05 1.43 1.18 0.44 .20	55.1 Lebrun.
			2.5	10.0	2.54	.231	56.4 Smyth et al.
			8.4	1.25	2.353	.105	
			20	10.0 3.22 1.25	2.68 2.48 2.365	.34 .29 .134	
			40	10.0 3.22 1.25	2.92 2.574 2.41	.527 .356 .20	
			60	10.0 3.22 1.25	3.21 2.672 2.47	.747 .481 .29	
			82	1.25	2.58	.41	
			20	9.0	2.78	.40	52.2 Bruma.
			20 0 to 60 -50 to 50	$3 \text{ to } 2.2 \times 10^3$ 9.0 1.25	(*) (*) (*)	(*) (*) (*)	47 Girard. 54 Brot. 55 Brot.
C₁₁							
143...	C ₁₁ H ₂₄ O	1-Undecanol.....	25	3×10^3 3×10^4 5×10^3 3.0×10^3 1.43×10^3	6.45 6.45 6.41 6.40 6.33	----- 0.19 .31 .65	55.1 Lebrun.

*Graphs.

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References
	C ₁₁ —Continued					
143....	C ₁₁ H ₂₂ O i-Undecanol—Continued		910 630 313 185 104, 2 60 9.1 3.20	6.16 6.04 4.81 4.01 3.46 3.32 2.79 2.46	0.98 1.20 1.62 1.51 1.16 1.02 0.42 .20	
	C ₁₂					
144....	C ₁₂ F ₂₆ O Perfluorodihexyl ether	25	∞ 100 10 3	1.87 1.86 1.86 1.85	.0055 .0122 .092	53 MIT.
145....	C ₁₂ F ₂₇ N Heptacosanofluorotributyl amine	25	∞ 300 100 10 3	1.85 ₃ 1.85 1.85 1.85 1.85	.0011 .0025 .0028 .0020	53 MIT.
146....	C ₁₂ H ₉ Cl 3-Chlorobiphenyl	24.5	8 to 150			42 Klages.
147....	C ₁₂ H ₁₀ O 2-Acetonaphthone	60	∞ 10.4 3.22 1.24	13.03 4.73 3.65 3.43	2.49 1.16 0.60	56.1 Smyth et al.
		70	∞ 10.4 3.22 1.24	12.49 5.24 3.65 3.42	2.83 1.36 0.68	
		80	∞ 10.4 3.22 1.24	12.15 5.63 3.83 3.47	3.29 1.57 0.78	
		90	∞ 3.22 1.24	12.01 3.88 3.47	1.71 0.87	
148....	Phenyl ether	40	∞ 10.4 3.22 1.24	3.61 3.56 3.43 3.17	.123 .295 .397	56.1 Smyth et al.
		60	∞ 10.4 3.22 1.24	3.47 3.46 3.39 3.18	.085 .222 .360	
		80	∞ 10.4 3.22 1.24	3.35 3.35 3.31 3.19	.061 .162 .312	
		10 to 50	∞ 3			
149....	C ₁₂ H ₂₀ O ₂ Geranyl acetate	-70 to 20	112			50 Dodd.
150....	C ₁₂ H ₂₄ O ₂ Dodecanoic acid (Lauric)	(?)	1 to 50	(*)	(*)	46.2 Schallamach.
151....	C ₁₂ H ₂₅ Br 1-Bromododecane	1	∞ 10.60 8.75 3.22 1.27	4.31 3.60 3.00 2.52 2.40	0.65 .64 .42 .23	54 Buchanan. 52.5 Smyth et al. 52.1
		25	∞ 12.74 10.60 8.75 3.22 1.27	4.07 3.08 3.27 3.20 2.64 2.43	.53 .57 .58 .51 .31	
		40	∞ 12.74 10.60 8.75 3.22 1.27	3.93 3.10 3.32 3.26 2.69 2.45	.45 .52 .55 .54 .36	
		55	∞ 12.74 10.60 8.75 3.22 1.27	3.80 3.11 3.32 3.29 2.75 2.49	.40 .45 .50 .54 .40	
		75	12.74 10.60 8.75	3.26 3.27 3.28	.25 .39 .40	

*Graphs.

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References
	C ₁₂ —Continued					
152....	C ₁₂ H ₂₅ Cl 1-Chlorododecane.....	1	∞ 1.27	4.45 2.45	0.32	52.5 Smyth et al. 52.4
		25	∞ 1.27	4.47 2.50	.41	
		40	∞ 1.27	3.99 2.55	.45	
		55	∞ 1.27	3.85 2.58	.49	
		—10 to 20	1.08×10 ³			50 Klages.
153....	C ₁₂ H ₂₅ O 1-Dodecanol.....	25	3×10 ⁵ 3×10 ⁴ 5×10 ³ 3.0×10 ³ 1.43×10 ³ 910 630 313 185 104.2 60. 9.1 3.20	6.37 6.35 6.30 6.35 6.16 5.95 5.72 4.19 3.46 3.16 3.00 2.68 2.44	.23 .35 .79 1.12 1.32 1.59 1.35 0.99 .71 .34 .167	55.1 Lebrun.
		25	∞ 10.0 3.22 1.25	6.5 2.575 2.446 2.347	.300 .192 .121	56.4 Smyth et al.
		55	∞ 10.0 3.22 1.25	4.56 2.844 2.585 2.427	.525 .327 .201	
		85	∞ 10.0 3.22 1.25	4.00 3.323 2.80 2.539	.644 .44 .312	
		20 to 60	9.0 3.22	(*)	(*)	54 Brot.
		—50 to 50	1.25	(*)	(*)	55 Brot.
		25 to 50	3.12×10 ³			50 Klages.
		40	1.08×10 ³			
	C ₁₃					
154....	C ₁₃ H ₁₀ O Benzophenone.....	50	∞ 3.22 1.25	11.4 3.72 3.23	1.60 1.25	* 56.6 Smyth et al.
		70	∞ 3.22 1.25	11.3 4.10 3.30	2.23 1.26	
		85	∞ 3.22 1.25	10.12 4.45 3.41	2.55 1.38	
		60	∞ 10.4 3.22 1.24	10.91 6.21 3.82 3.37	3.92 1.91 0.95	† 56.1 Smyth et al.
		70	∞ 10.4 3.22 1.24	10.54 6.96 3.91 3.38	3.86 2.10 1.10	
		80	∞ 10.4 3.22 1.24	10.23 7.51 4.24 3.38	3.56 2.33 1.22	
		90	∞ 3.22 1.24	9.99 4.44 3.39	2.52 1.33	
155....	C ₁₃ H ₂₆ O ₂ Methyl laurate.....	20	9.	3.44	0.18	52.2 Bruma.
	C ₁₄					
156....	C ₁₄ H ₂₉ Br 1-Bromotetradecane.....	1	∞ 10.0 3.22 1.27	4.04 2.52 2.37	0.37 .19	52.5 Smyth et al. 52.1 52.7 52.4
		25	∞ 10.60 3.22 1.27	3.84 3.08 2.64 2.40	.53 .47 .26	

*Graphs. †mp=48.2 (mp 48.1, Timmermans (50)).

†mp=47.4.

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References	
C₁₄—Continued							
156	C ₁₄ H ₂₉ Br	1-Bromotetradecane—Continued	40	∞ 10.60 3.22 1.27	3.73 3.10 2.69 2.40	0.45 .49 .30	
			55	∞ 10.60 3.22 1.27	3.61 3.11 2.75 2.42	.40 .50 .33	
			75	10.60	3.26	.29	
157	C ₁₄ H ₃₀ O	1-Tetradecanol	40	∞ 10.0 3.22 1.25	4.66 2.632 2.45 2.381	.320 .18 .132	56.4 Smyth et al.
			60	1.25	2.43	.16	
			80	∞ 10.0 1.25	3.69 3.01 2.515	.44 .26	
C₁₅							
158	C ₁₅ H ₃₀ O	8-Pentadecanone	45	∞ 10.0 3.22 1.25	----- ----- 2.74	----- ----- .833	56.6 Smyth et al.
			50	∞ 10.0 3.22 1.25	----- 5.137 3.43	1.60 1.4	
			65	∞ 10.0 3.22 1.25	----- 5.240 3.62	1.30 1.46	
			80	∞ 10.0 3.22 1.25	----- 5.116 3.76	1.05 1.41	
			82	∞ 10.0 3.22 1.25	----- 2.81	1.02	
159	C ₁₅ H ₃₀ O ₂	Methyl myristate	20	9.	3.24	0.16	52.2 Bruma.
C₁₆							
160	C ₁₆ H ₃₂ O ₂	Hexadecanoic acid (Palmitic)	19 to 75	254			47 Aref'ev.
				8 to 50	(*)	(*)	54 Buchanan.
161	C ₁₆ H ₃₃ Br	1-Bromohexadecane	25	∞ 10.0 3.22 1.27	3.68 2.96 2.52 2.35	0.38 .37 .21	52.5 Smyth et al. 52.1 52.7 52.4
			40	∞ 10.0 3.22 1.27	3.57 3.00 2.57 2.38	.34 .40 .25	
			55	∞ 10.0 3.22 1.27	3.46 3.02 2.62 2.39	.30 .41 .28	
			75	10.0	3.04	.25	
162	C ₁₆ H ₃₃ Cl	1-Chlorohexadecane	24.5	8 to 150			42 Kla ges.
163	C ₁₆ H ₃₄ O	1-Hexadecanol	55	∞ 10.0 3.22 1.25	3.77 2.689 2.482 2.37	.338 .234 .163	56.4 Smyth et al.
			70	∞ 10.0 3.22 1.25	3.50 2.837 2.573 2.41	.390 .287 .209	
			82	1.25	2.44	.241	
			50 to 70	1.08×10 ³	(*)	(*)	50 Kla ges. 52 Hamon.
C₁₇							
164	C ₁₇ H ₃₄ O	9-Heptadecanone	55	∞ 10.0 3.22 1.25	5.43 4.49 3.19 2.60	1.34 1.11 0.67	56.6 Smyth et al.

*Graphs.

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	<i>t</i> (°C)	λ (cm)	ϵ'	ϵ''	References
C_{17} —Continued						
164....	$C_{17}H_{34}O$ 9-Heptadecanone—Continued.....	70	∞ 10.0 3.22 1.25	5.13 4.56 3.32	1.13 1.15	
		80	∞ 10.0 3.22 1.25	4.93 4.58 3.44 2.74	0.903 1.12 0.79	
165....	$C_{17}H_{34}O_2$ Methyl palmitate.....	31 to 65	3.2 to 30	(*)	(*)	54 Buchanan.
C_{18}						
166....	$C_{18}H_{32}O_2$ Linoleic acid.....	—85 to 120 —10 to 40	344 64			45 Stepanenko, 53 Bogdanov.
167....	$C_{18}H_{34}O_2$ Oleic acid.....	—110 to 100	344			45 Stepanenko.
168....	$C_{18}H_{34}O_4$ Dibutyl sebacate.....	25	∞ 3×10^1 3×10^3 100 10	4.59 4.58 4.56 4.55 3.80	0.0014 .0073 .174 .81	53 MIT.
169....	$C_{18}H_{36}O_2$ Ethyl palmitate.....	26 to 75	3.2 to 30	(*)	(*)	54 Buchanan.
170....	Cetyl acetate.....	35	∞ 10.0 3.22 1.25	3.19 2.97 2.76 2.56	0.22 .27 .27	52.8 Smyth et al.
		55	∞ 10.0 3.22 1.25	3.09 2.94 2.76 2.56	.20 .25 .27	
		75	∞ 10.0 3.22 1.25	2.99 2.89 2.75 2.56	.15 .22 .27	
171....	$C_{18}H_{38}O$ 1-Octadecanol.....	60	∞ 10.0 1.25	3.34 2.661 2.356	.293 .152	56.3 Smyth et al.
		85	∞ 10.0 1.25	3.124 2.853 2.448	.285 .214	
172....	$C_{20}H_{40}O$ Phytol.....	—150 to 50	3.33×10^3	(*)	(*)	46.2 Schallamach.
173....	$C_{20}H_{40}O_2$ Octadecyl acetate.....	35	∞ 10.0 3.22 1.25	3.07 2.92 2.68 2.51	0.21 .22 .25	52.8 Smyth et al.
		55	∞ 10.0 1.25	2.98 2.85 2.52	.17 .25	
		75	∞ 10.0 1.25	2.89 2.80 2.52	.14 .14	
174....	$C_{20}H_{42}O$ Di-dihydrocitronellyl ether.....	—130 to 20	1.50×10^5	(*)	(*)	46.1 Schallamach.
175....	$C_{20}H_{42}O_2$ Decyl ether.....	20	∞ 10.0 3.22 1.25	2.644 2.357 2.238 2.193	0.144 .103 .13	56.6 Smyth et al.
		40	∞ 10.0 3.22 1.25	2.565 2.392 2.247 2.181	.146 .114 .13	
		60	∞ 10.0 3.22 1.25	2.489 2.256 2.169	.116 .13	
C_{21}						
176....	$C_{21}H_{42}O_4$ Monostearin.....	80	∞ 10.0 3.22 1.25	4.84 3.75 3.13 2.87	.81 .64 .45	52.8 Smyth et al.
		90	∞ 10.0 3.22 1.25	4.74 3.87 3.22 2.87	.73 .68 .48	
C_{22}						
177....	$C_{22}H_{32}O_2$ Ethyl abietate.....	—70 to 20	3×10^5 to 3×10^7			40 Morgan.
178....	$C_{22}H_{42}O_2$ Phytol acetate.....	—190 to 50	1.12×10^2 to 1.09×10^5	(*)	(*)	46.2 Schallamach.

*Graphs.

TABLE 4. Dielectric dispersion data for pure organic liquids—Continued

No.	Substance	t (°C)	λ (cm)	ϵ'	ϵ''	References
	C_{26}					
179....	$C_{26}H_{54}O_4$ Dioctyl sebacate.....	26	∞ 3×10^4 3×10^3 100 10	4.05 4.01 4.00 3.77 2.75	0.0028 .022 .39 .36	53 MIT.
	C_{28}					
180....	$C_{28}H_{56}O_2$ Decyl stearate.....	40	∞ 10.0 3.22 1.25	2.81 2.58 2.40 2.29	.181 .168 .178 .140	52.8 Smyth et al.
		60	∞ 10.0 3.22 1.25	2.73 2.58 2.41 2.29	.164 .178 .140	
		80	∞ 10.0 1.25	2.65 2.56 2.26	.143 .140	
	C_{30}					
181....	$C_{30}H_{58}O_4$ Ethylene dimyristate.....	70	∞ 10.0 3.22 1.25	2.98 2.87 2.64 2.44	.23 .28 .26	52.8 Smyth et al.
		80	∞ 10.0 3.22	2.98 2.87 2.66	.22 .20	
182....	$C_{30}H_{60}O_2$ Tetradecyl palmitate.....	50	∞ 10.0 1.25	2.66 2.52 2.30	.176 .156	52.8 Smyth et al.
		82	∞ 10.0 1.25	2.72 2.54 2.28	.152 .16	
	C_{32}					
183....	$C_{32}H_{64}O_2$ Tetradecyl stearate.....	50	∞ 1.25	2.67 2.28	.126	52.8 Smyth et al.
		82	∞ 1.25	2.57 2.28	.145	
	C_{34}					
184....	$C_{34}H_{68}O_4$ Ethylene dipalmitate.....	75	∞ 10.0 3.22 1.25	2.89 2.77 2.58 2.41	.20 .22 .21	52.8 Smyth et al.
185....	$C_{34}H_{68}O_2$ Octyl stearate.....	60	∞ 10.0 3.22 1.25	2.61 2.46 2.35 2.28	.130 .141 .126	52.8 Smyth et al.
		80	∞ 10.0 3.22 1.25	2.54 2.47 2.36 2.26	.118 .138 .140	
	C_{38}					
186....	$C_{38}H_{74}O_4$ Ethylene distearate.....	80	∞ 10.0 3.22 1.25	2.79 2.69 2.53 2.39	.18 .19 .15	52.8 Smyth et al.
	C_{39}					
187....	$C_{39}H_{76}O_5$ Distearin.....	80	∞ 10.0 3.22 1.25	3.25 2.88 2.65 2.48	.305 .272 .204	52.8 Smyth et al.
		90	∞ 10.0 3.22 1.25	3.22 2.92 2.67 2.49	.272 .282 .226	
	C_{51}					
188....	$C_{51}H_{95}O_6$ Tripalmitin.....	-45 to 120	63.8			52 Bogdanov.
	C_{57}					
189....	$C_{57}H_{110}O_6$ Triolein.....	-50 to 93	344			45 Stepanenko.
190....	$C_{57}H_{110}O_6$ Tristearin.....	80	∞ 10.0 3.22 1.25	2.74 2.49 2.39 2.31	.124 .124 .089	52.8 Smyth et al.
		90	∞ 10.0 3.22 1.25	2.735 2.49 2.39 2.31	.124 .122 .088	
		-40 to 83	344			45 Stepanenko.

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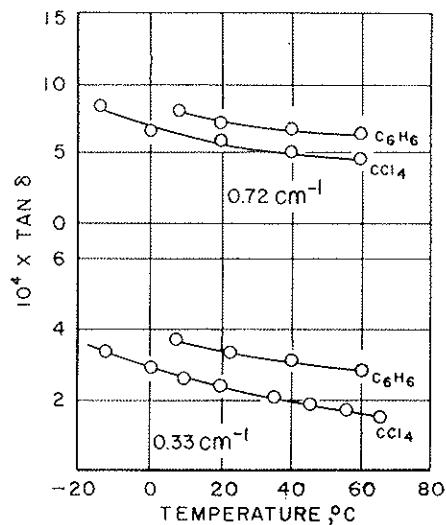
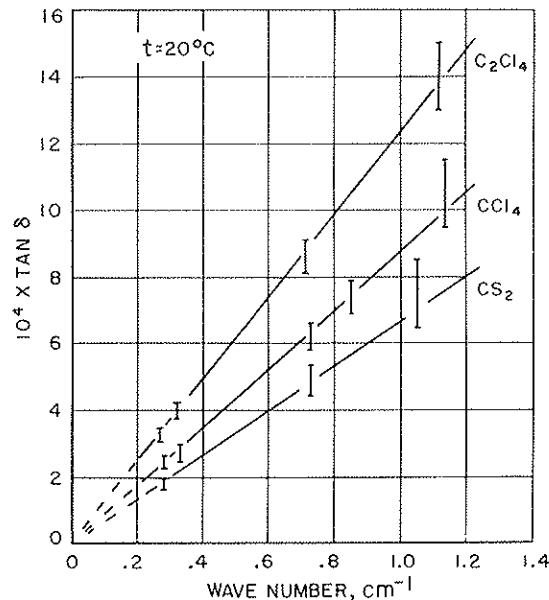
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Graphical Representations of Dielectric Data for Pure Liquids

The graphs are placed in the order of the ordinal numbers assigned in tables 1 to 4.

The graphs are reproductions from the literature, but have been relabeled to conform to a consistent nomenclature.

No. 7. CCl_4 , Carbon tetrachloride. Whiffen (50).



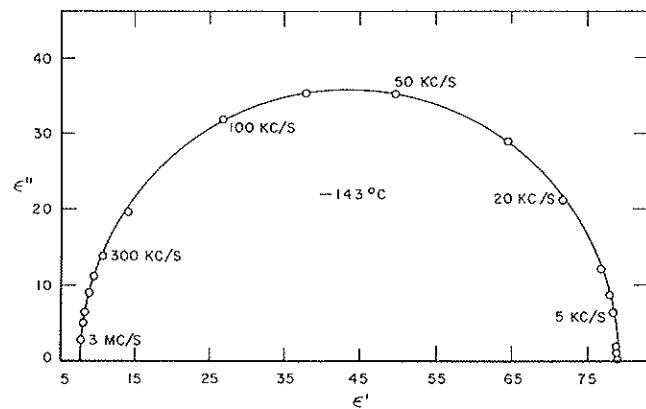
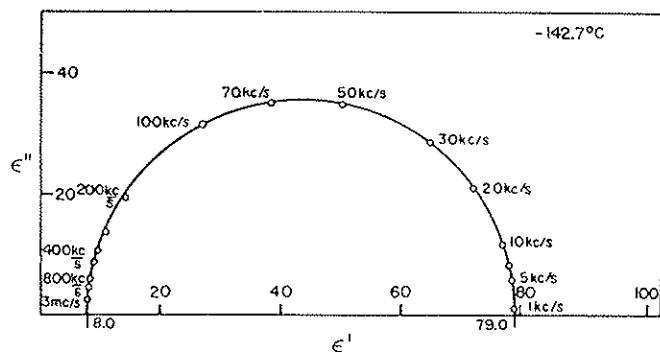
No. 8. CS_2 , Carbon disulfide. Cf. No. 7.

No. 13. C_2Cl_4 , Tetrachloroethylene. Cf. No. 7.

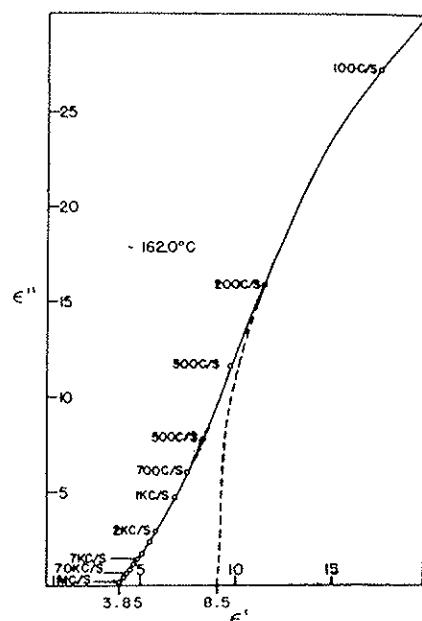
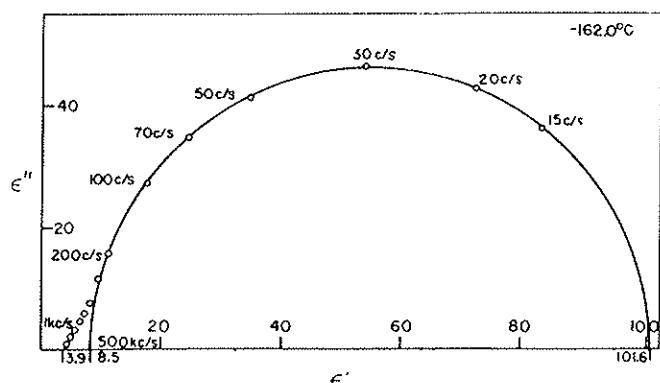
No. 21. $\text{C}_2\text{H}_6\text{O}$, Ethanol.

Hassion (55).

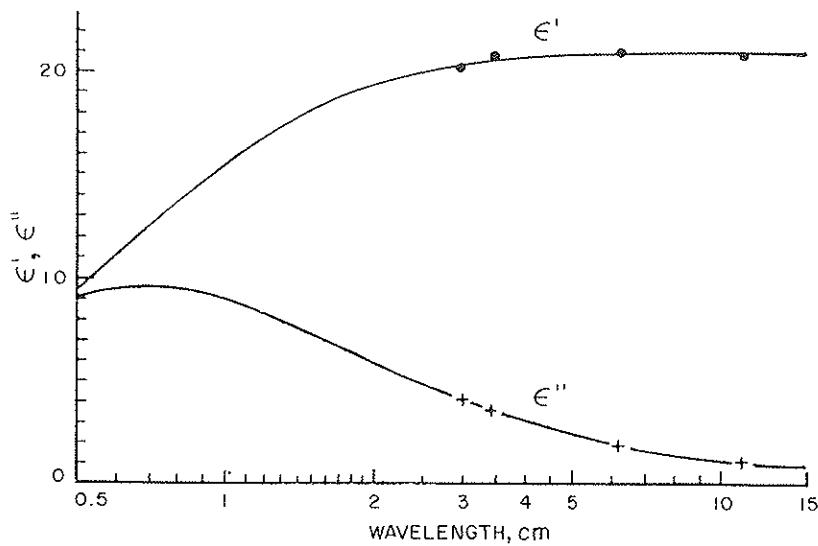
Hassion (53).



$\text{C}_2\text{H}_6\text{O}$, Ethanol (1% H_2O). Hassion (53).

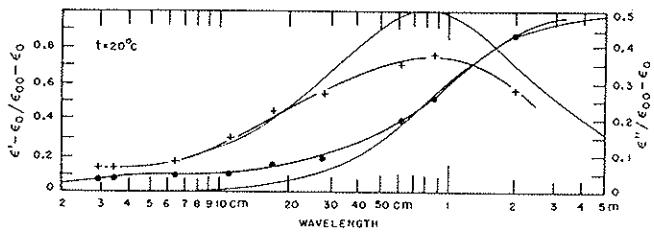


No. 29. $\text{C}_3\text{H}_6\text{O}$, Acetone. Abadie (46).

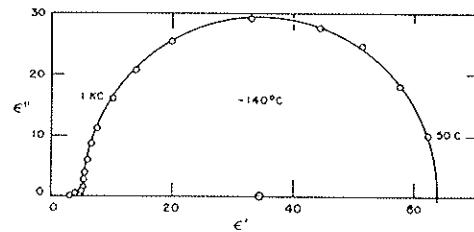


No. 35. $\text{C}_3\text{H}_8\text{O}$, 1-Propanol.

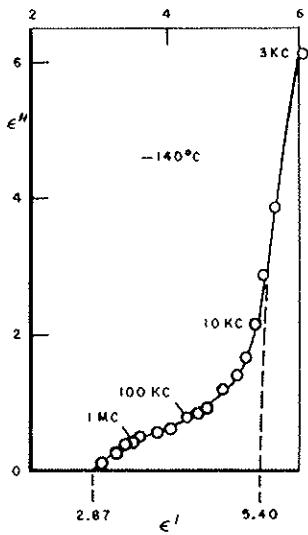
Girard (42).



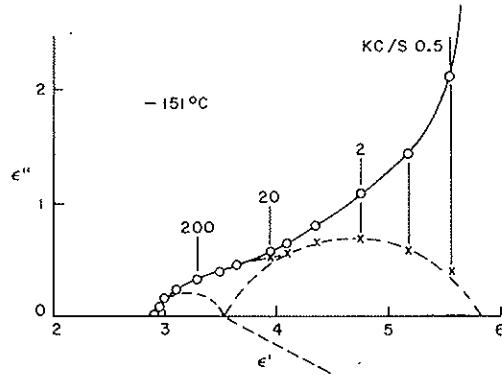
Davidson (51).



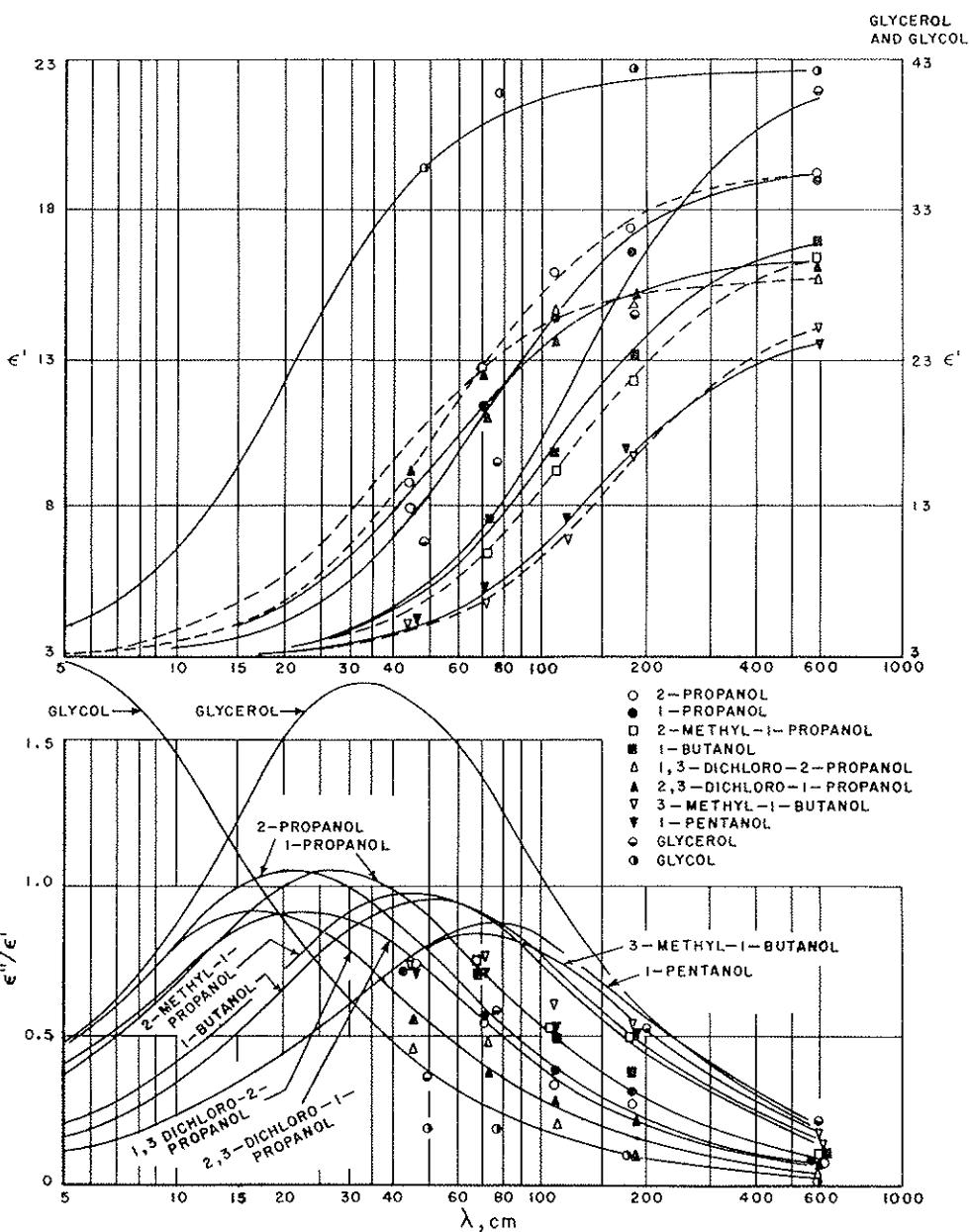
Davidson (51).



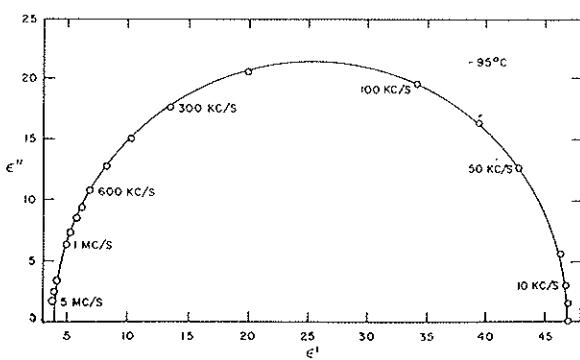
Cole (52).



No. 35. C_3H_8O , 1-Propanol—Continued. Girard (32).

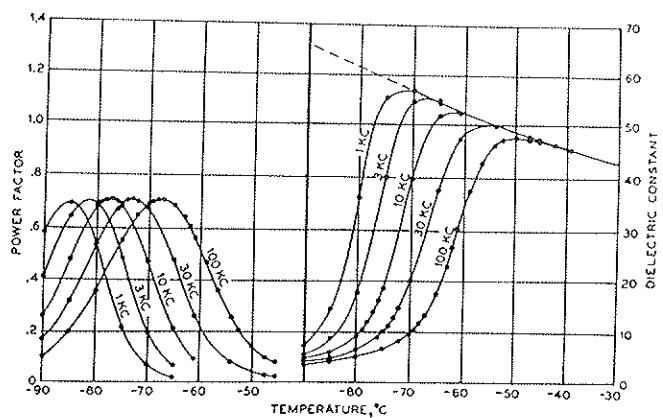


No. 36. C_3H_8O , 2-Propanol. Hassion (55).

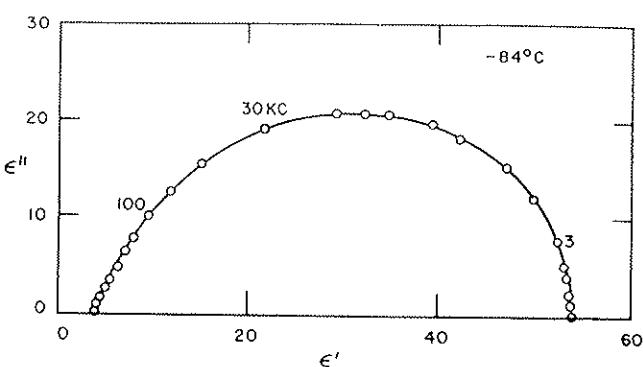


No. 37. $C_3H_8O_2$, 1,2-Propanediol.

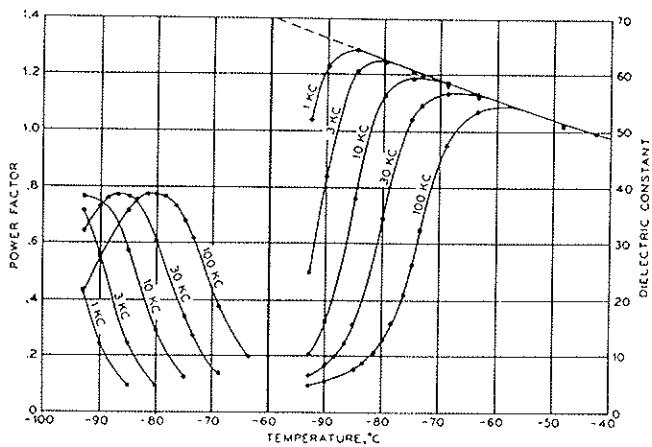
White (32).



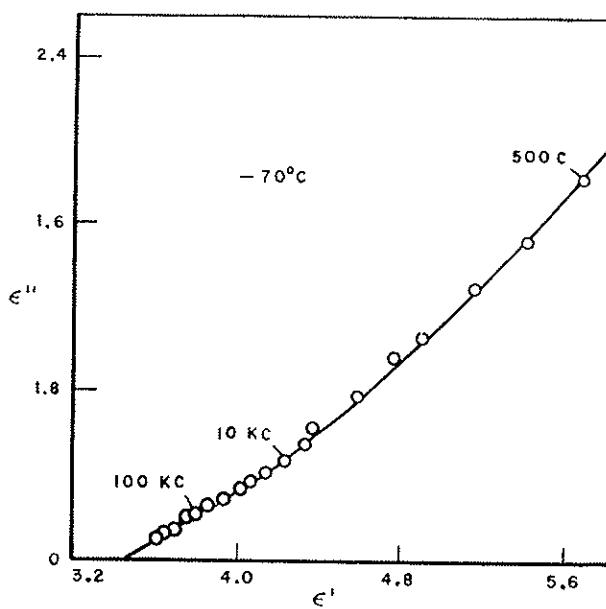
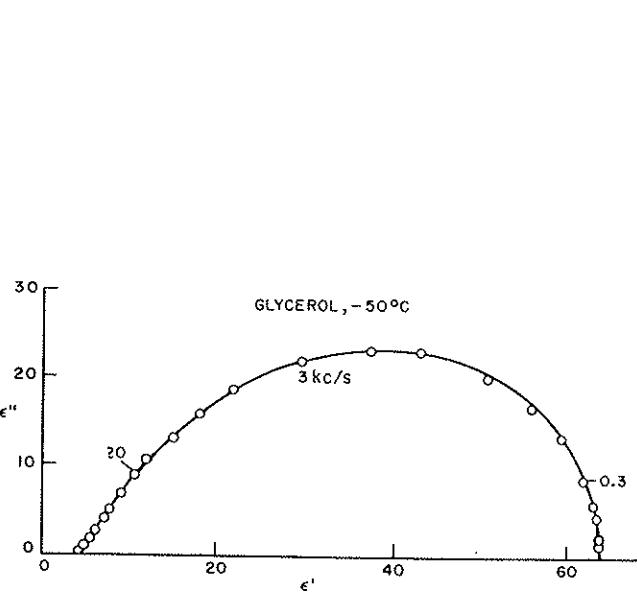
Davidson (51).



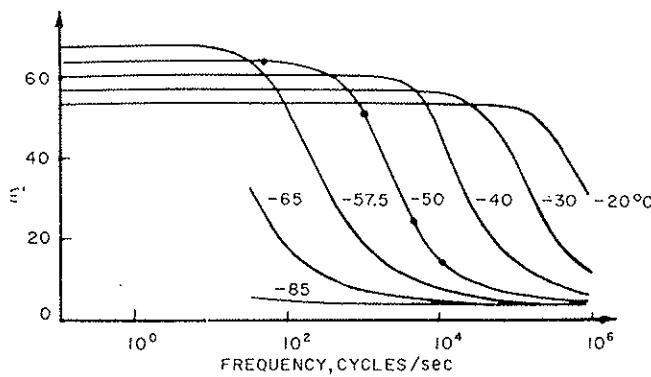
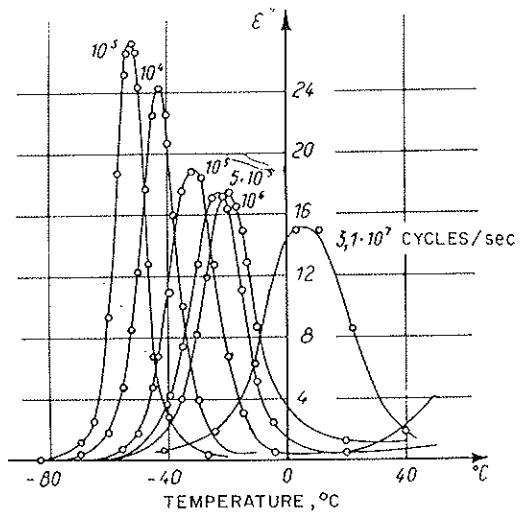
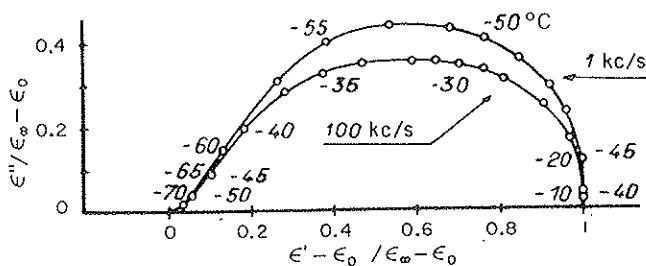
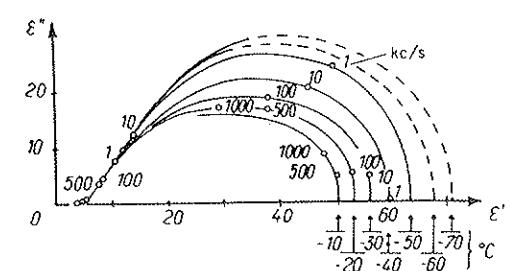
No. 38. $C_3H_8O_2$, 1,3-Propanediol. White (32).



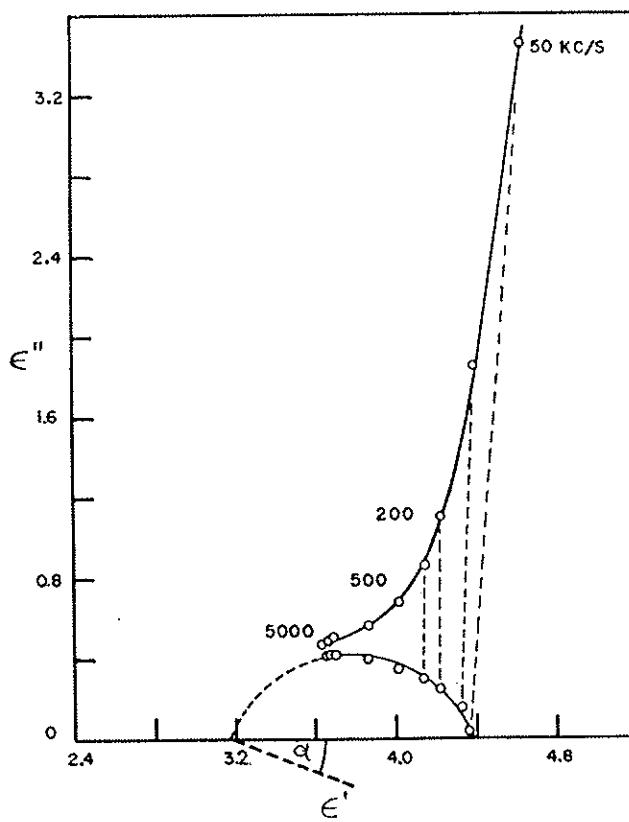
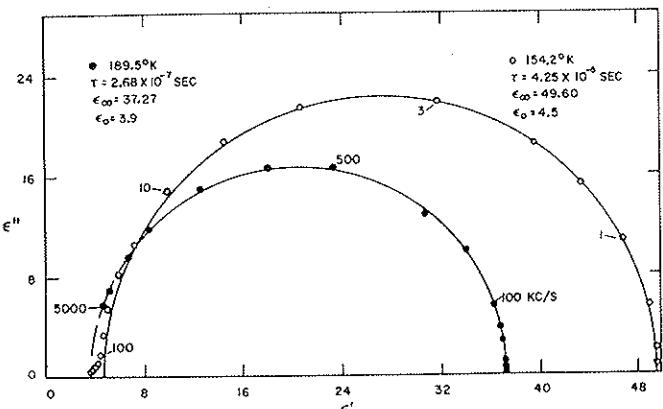
No. 39. $C_3H_8O_3$, Glycerol. Davidson (51).



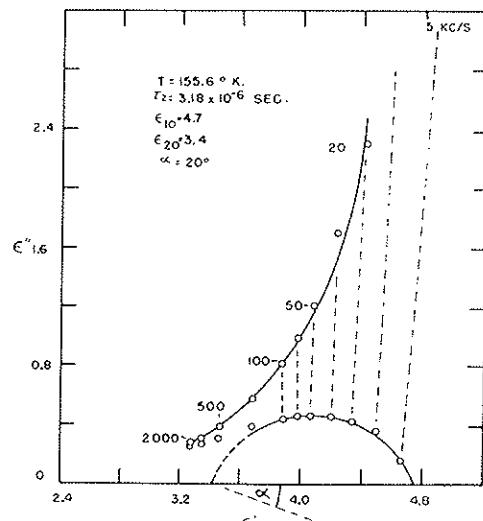
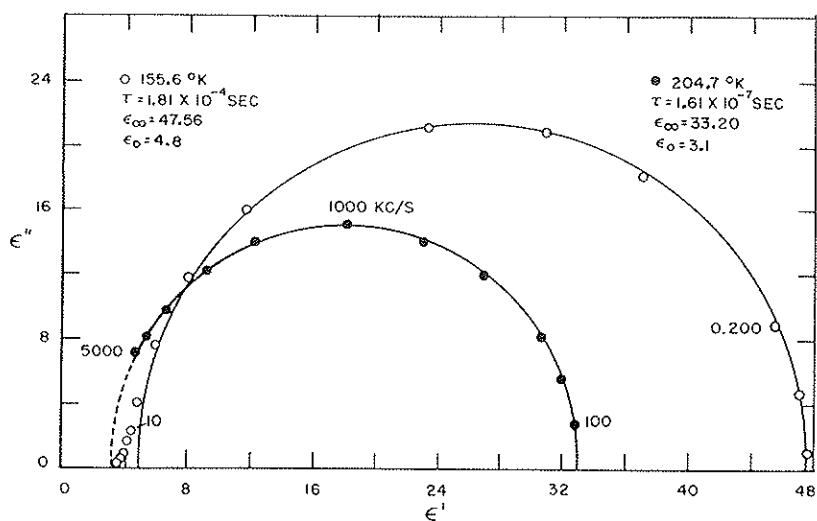
No. 39. $C_3H_8O_3$, Glycerol—Continued. Schulz (54).



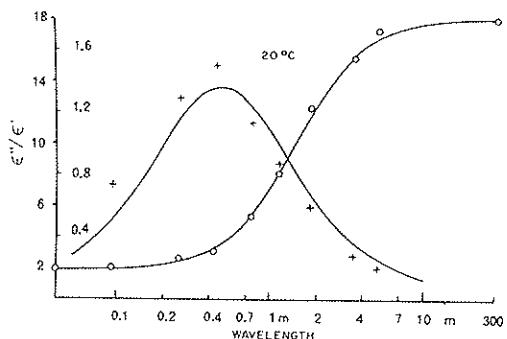
No. 59. $C_4H_{10}O$, 1-Butanol. Dannhauser (55).



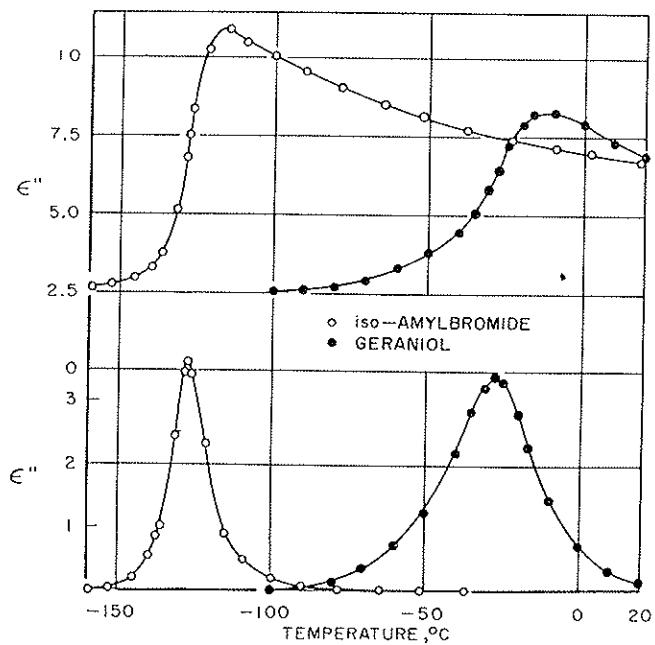
No. 61. C₄H₁₀O, 2-Methyl-1-propanol. Dannhauser (54).



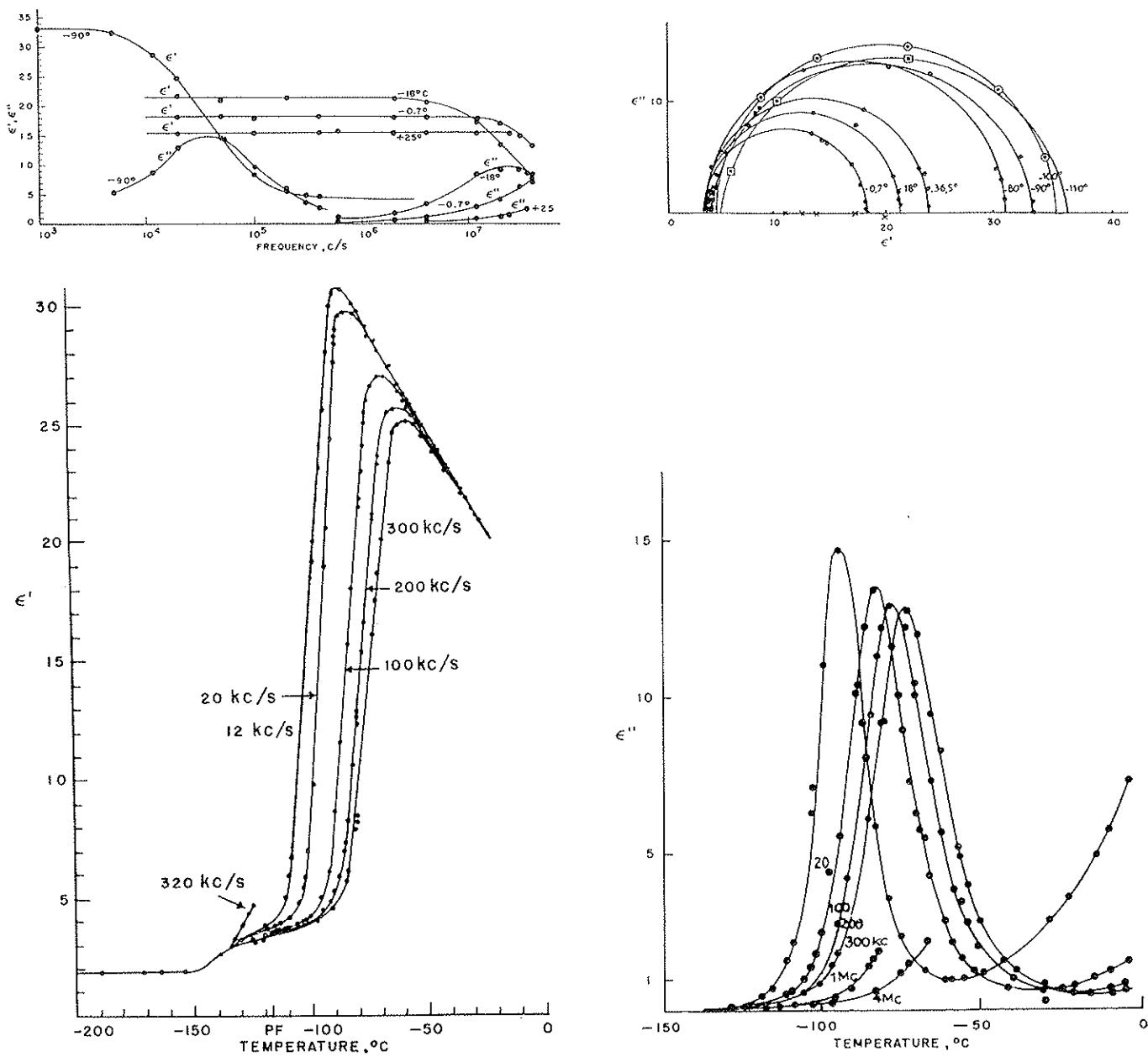
Häselin (46)



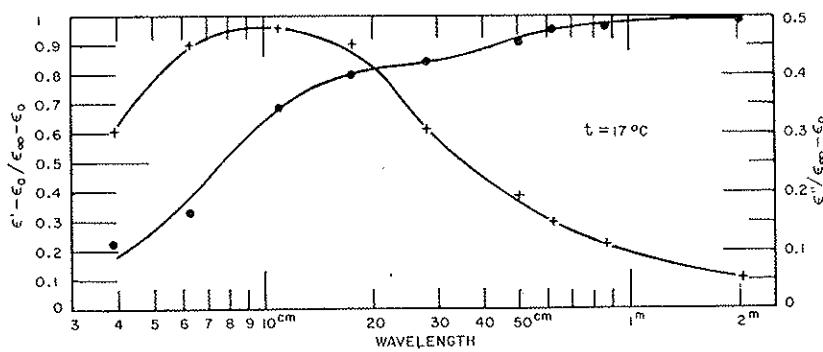
No. 67. C₅H₁₁Br, 1-Bromo-3-methyl butane. Schallamach (46.0).



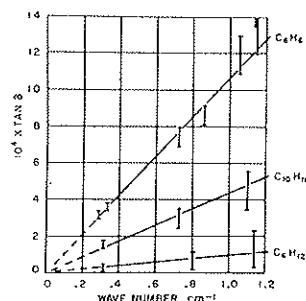
No. 71. $C_6H_{12}O$, 3-Methyl-1-butanol. Reinisch (54).



No. 79. $C_6H_5NO_2$, Nitrobenzene. Girard (43).

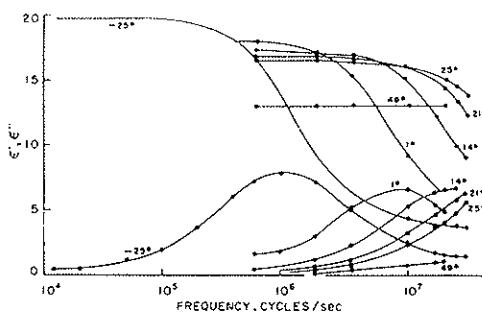


No. 80. C_6H_6 , Benzene. Whiffen (50)

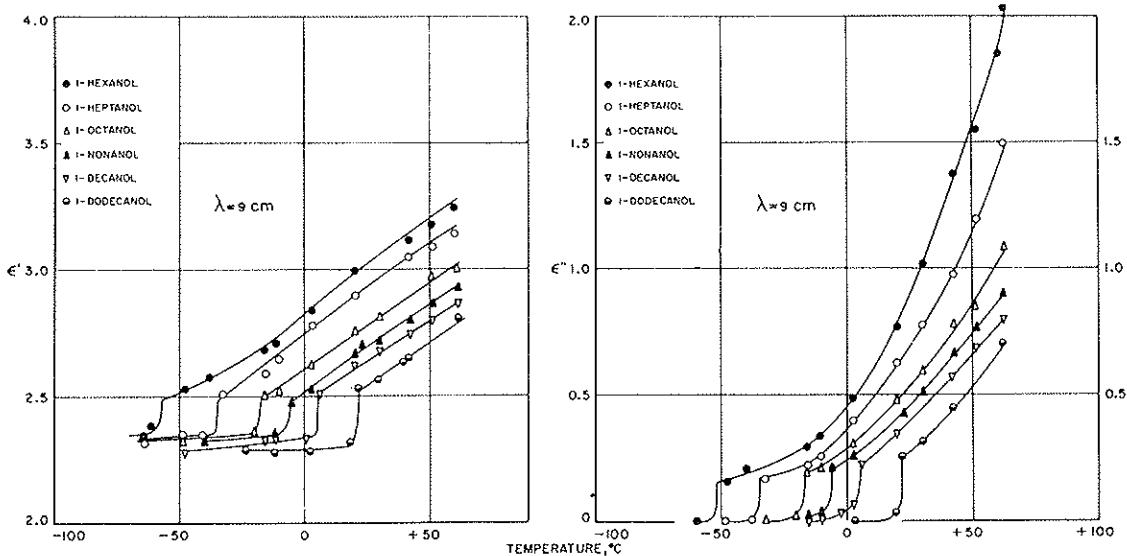
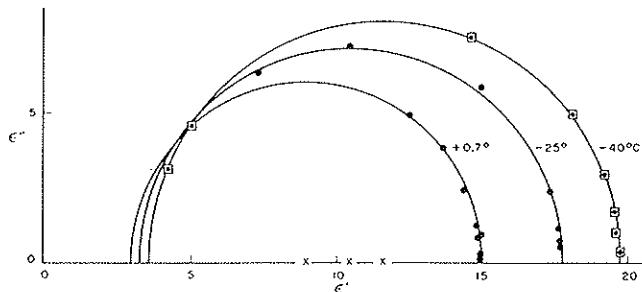


No. 88. C₆H₁₂, Cyclohexane. Cf. No. 80.

No. 89. C₆H₁₂O, Cyclohexanol. Reinisch (53).

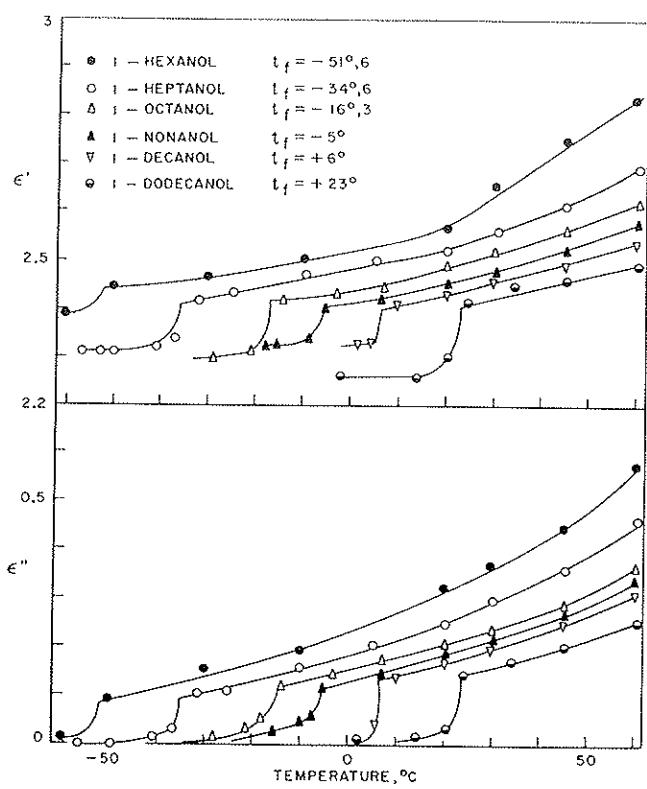


No. 93. C₆H₁₄O, 1-Hexanol. Reinisch (54).

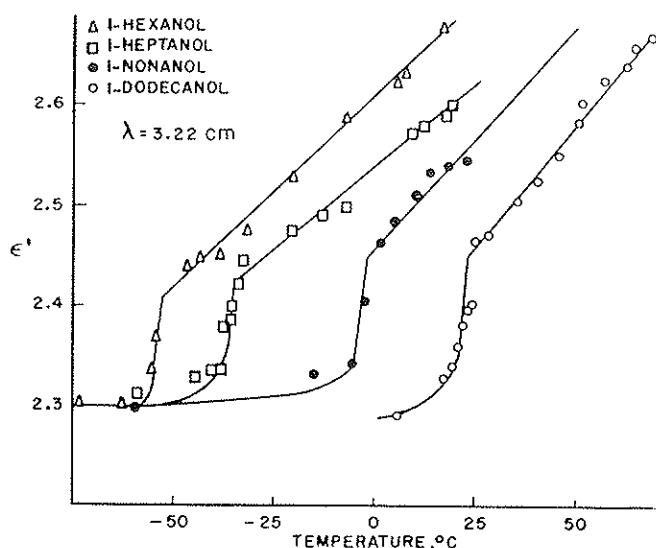


No. 93. $C_6H_{14}O$, 1-Hexanol—Continued.

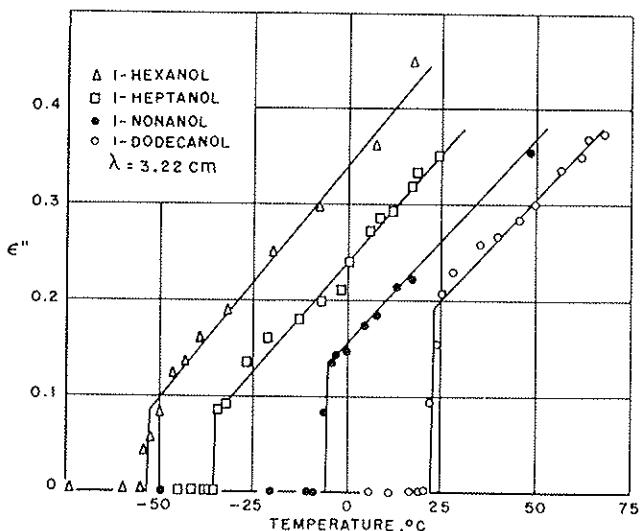
Brot (54).



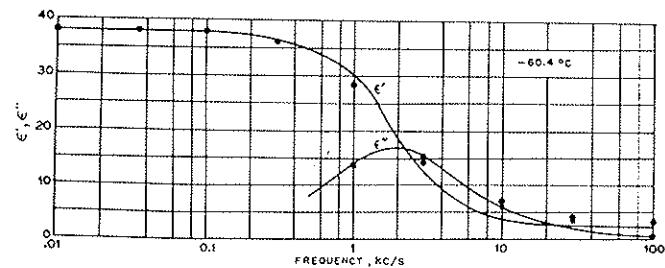
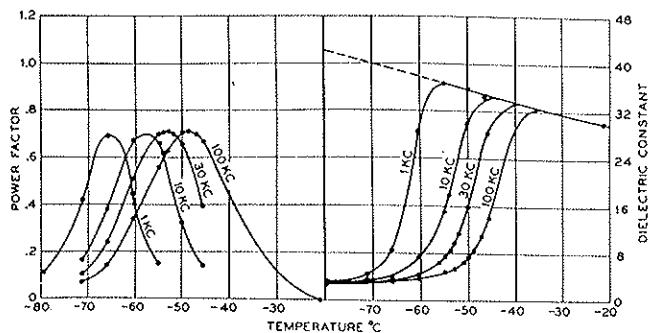
Brot (55).



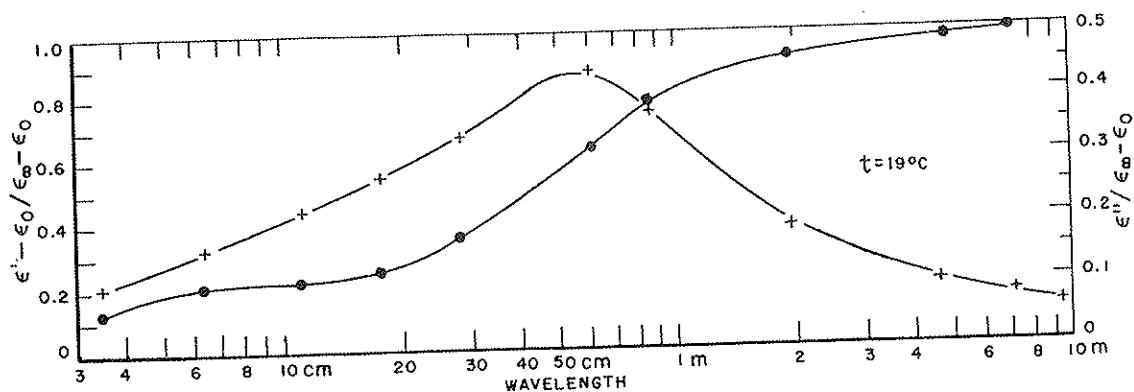
Brot (58).



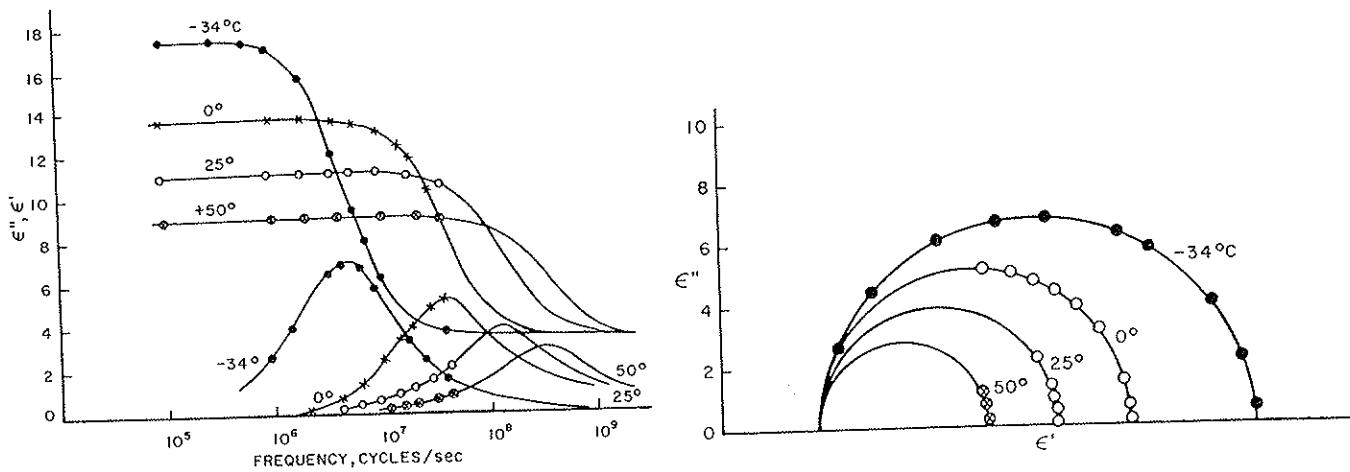
No. 94. $C_6H_{14}O_2$, 2-Methyl-2,4-pentanediol. White (32).



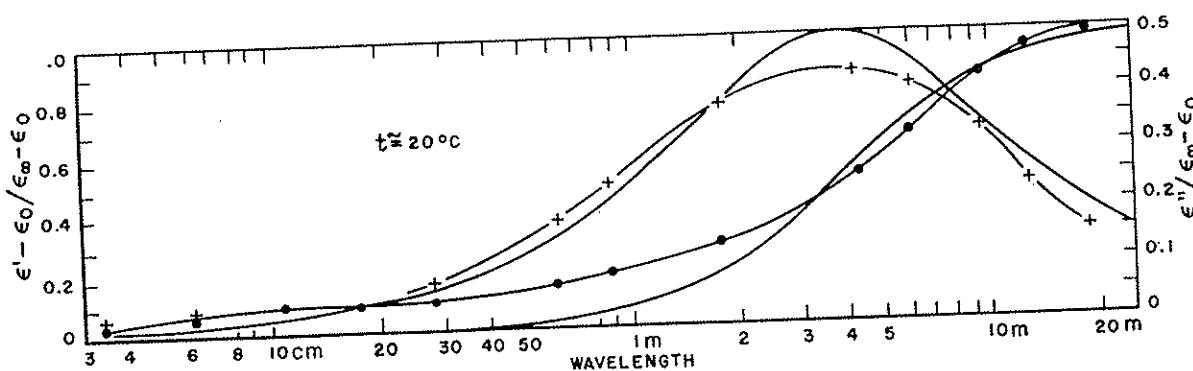
No. 100. C_7H_8O , Benzyl alcohol. Girard (43).



No. 114. $C_7H_{16}O$, 1-Heptanol. Oppenheim (51). Cf. No. 67.

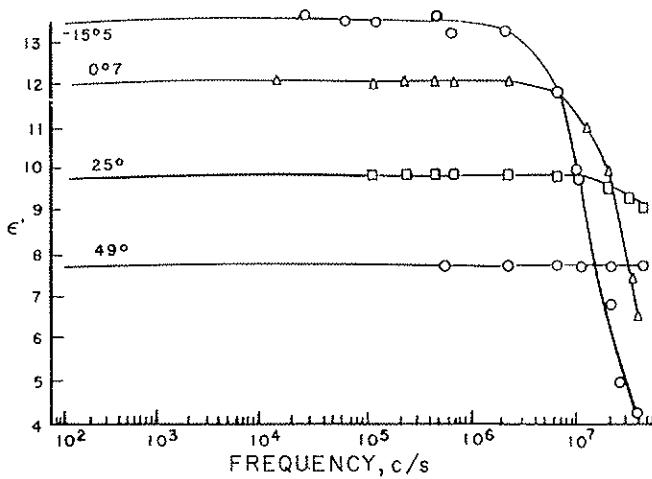


No. 124. $C_8H_{17}DO$, 1-Octanol-D-1. Corval (52).

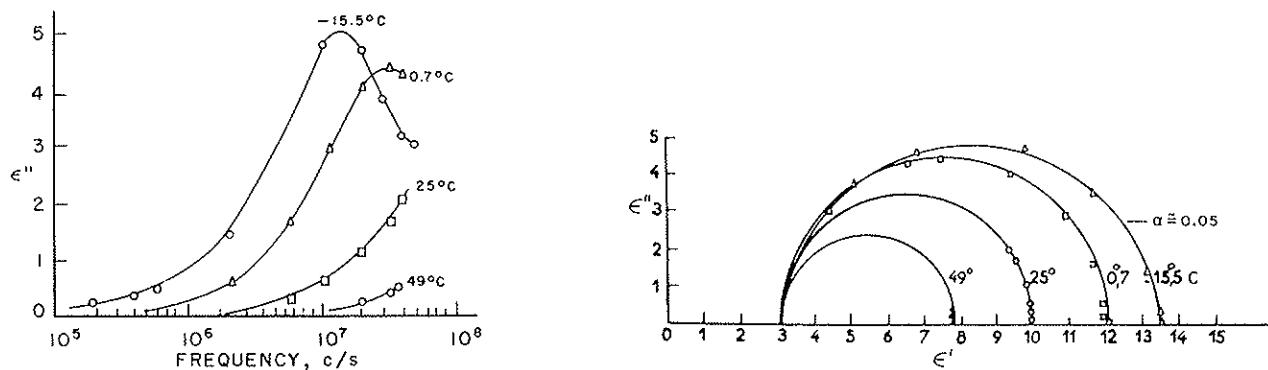


No. 125. C₈H₁₈O, 1-Octanol.

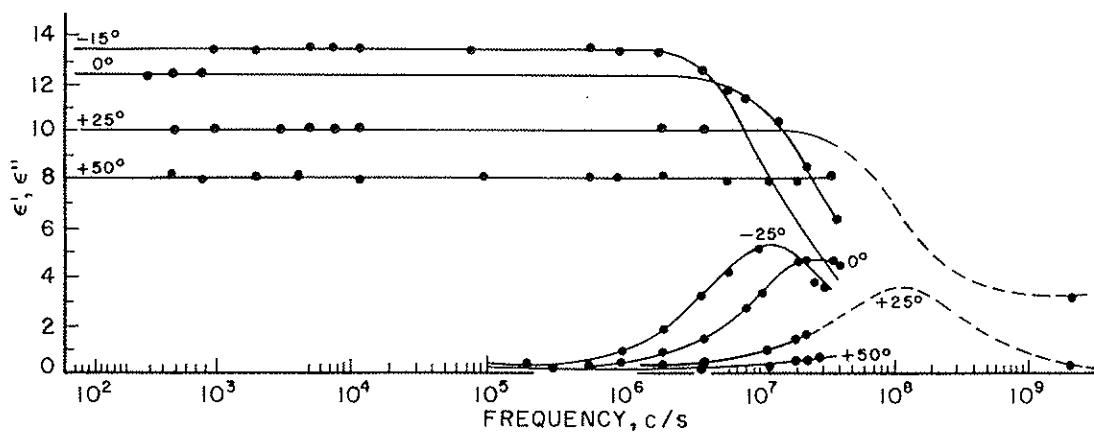
Girard (42). Cf. No. 70.



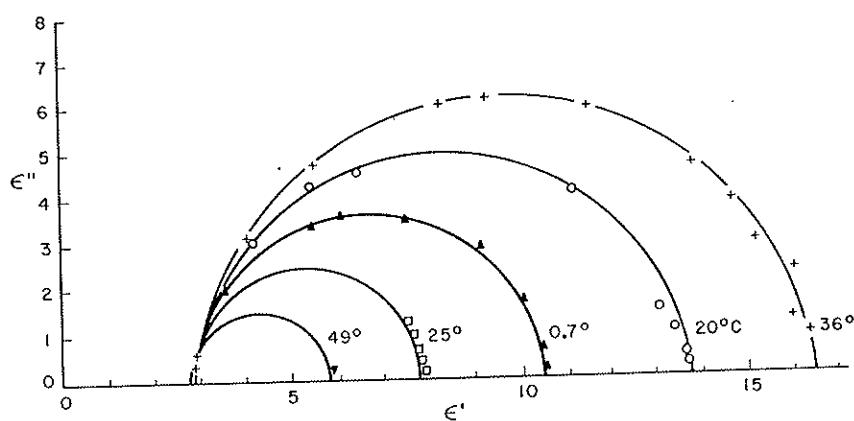
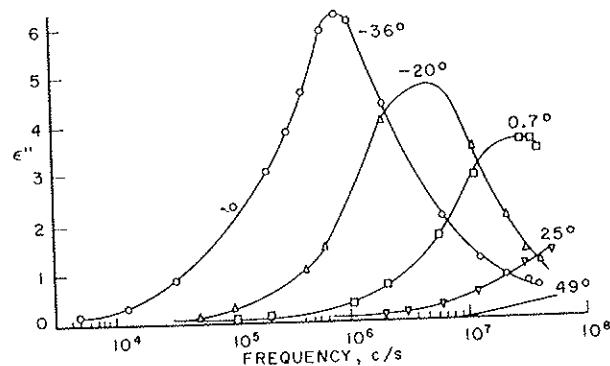
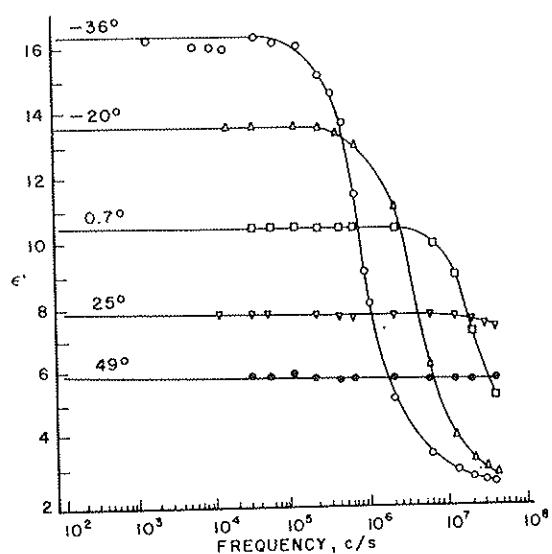
Dalbert (53). Cf. No. 67.



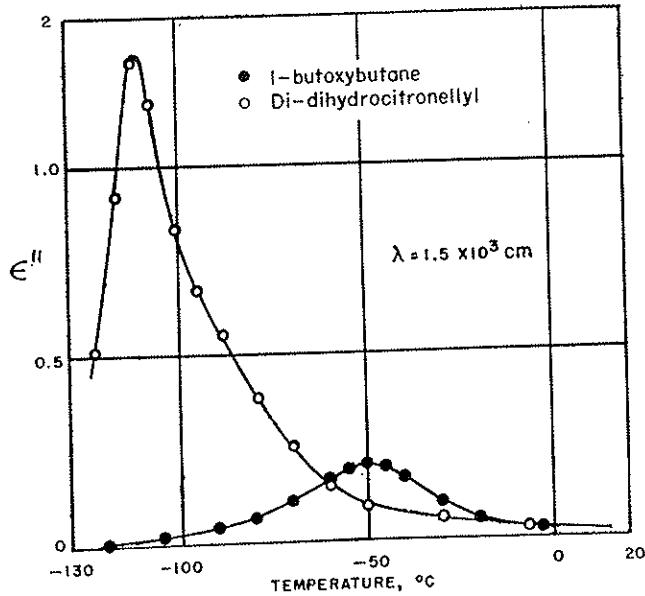
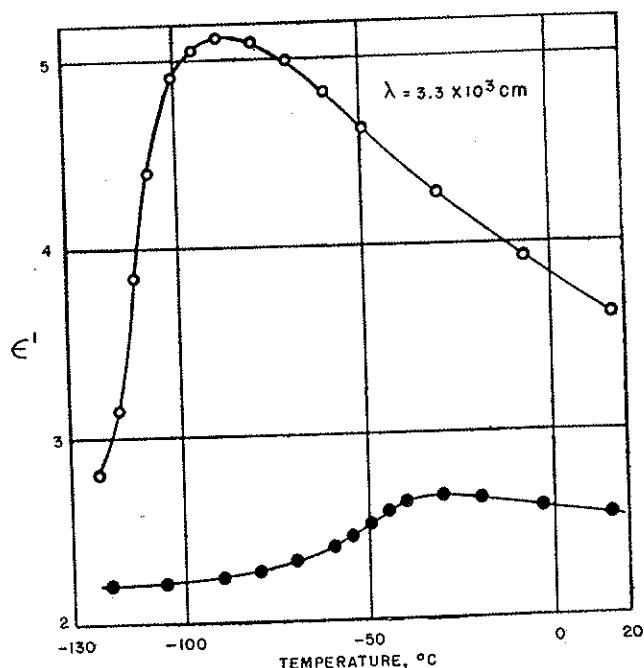
Dalbert (53).



No. 126. $C_8H_{18}O$, 2-Octanol. Dalbert (53). Cf. No. 70.

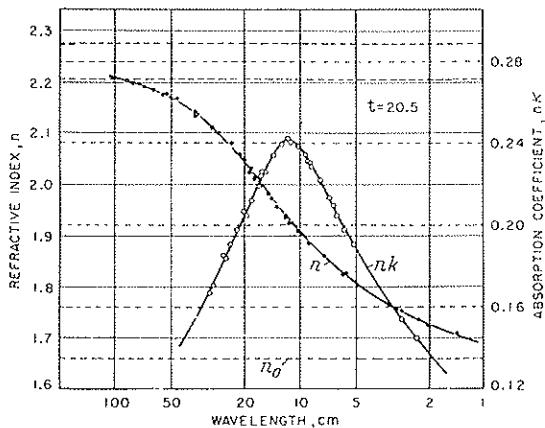


No. 127. $C_8H_{18}O$, Butyl ether. Schallamach (46.1).

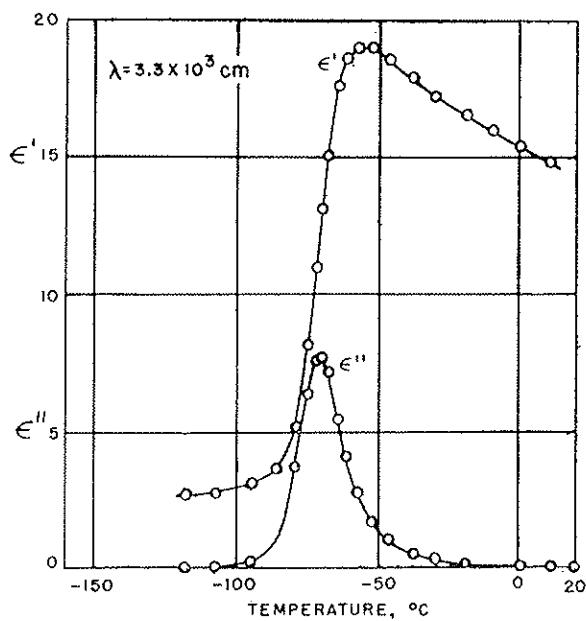


No. 131. $C_9H_{20}O$, 1-Nonanol. Cf. No. 93.

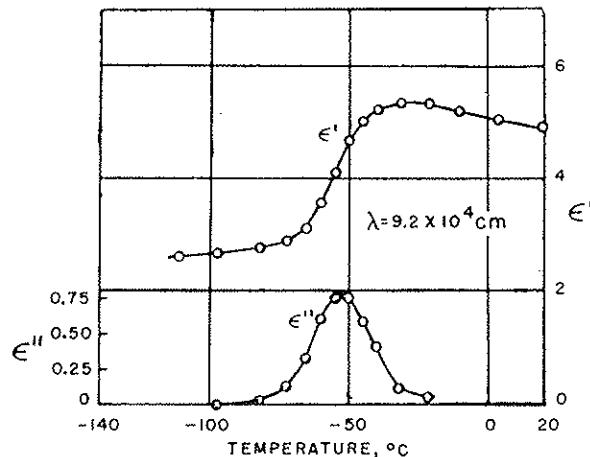
No. 132. $C_{10}H_7Br$, 1-Bromonaphthalene. Meckbach (52).



No. 136. $C_{10}H_{16}O$, Citral. Schallamach (46.1).

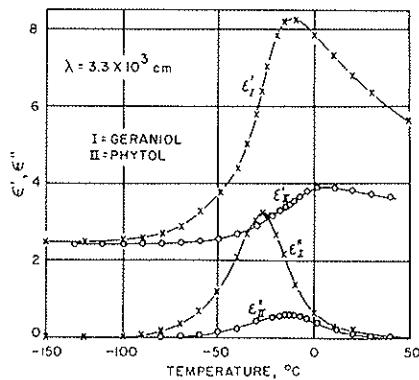


No. 137. $C_{10}H_{16}O_2$, Geranic acid. Schallamach (46.1).

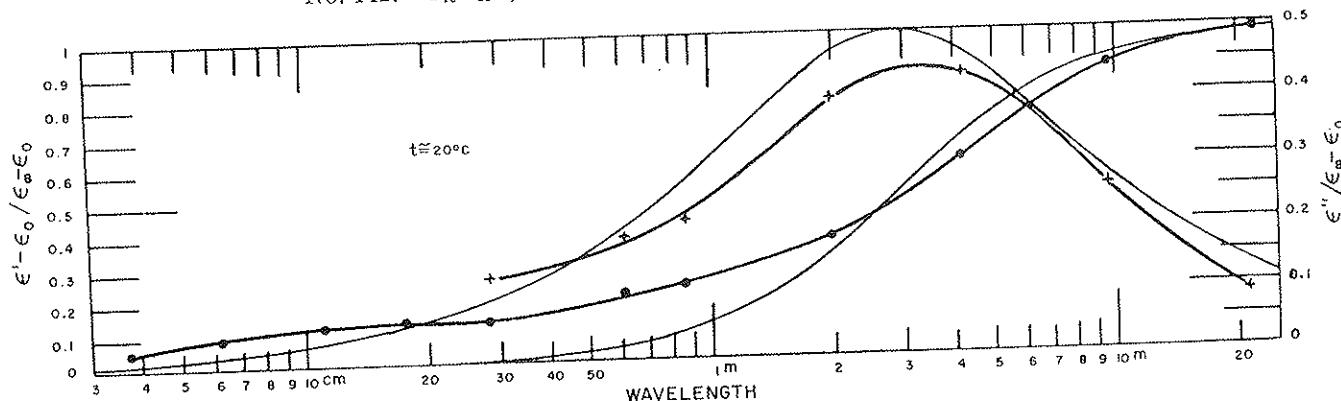


No. 138. $C_{10}H_{18}$, *trans*-Decahydronaphthalene. Cf. No. 80.

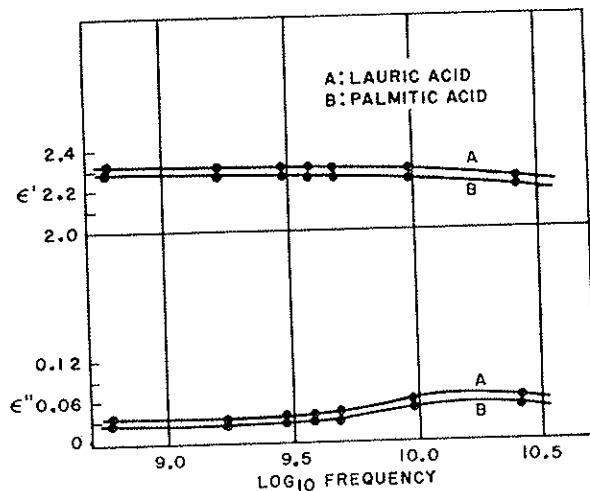
No. 139. $C_{10}H_{18}O$, Geraniol. Schallamach (46.2).



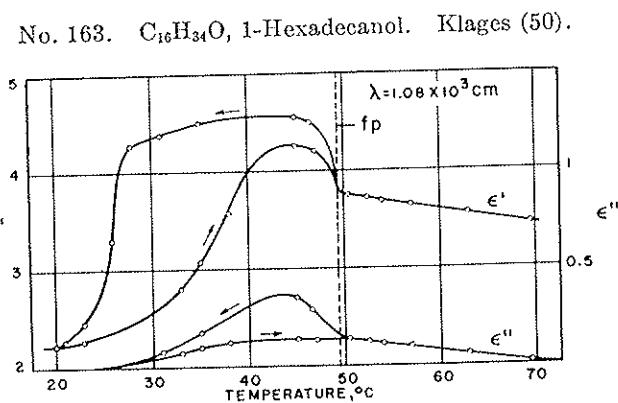
No. 142. $C_{10}H_{22}O$, 1-Decanol. Girard (45.1, 45.2). Cf. No. 93.



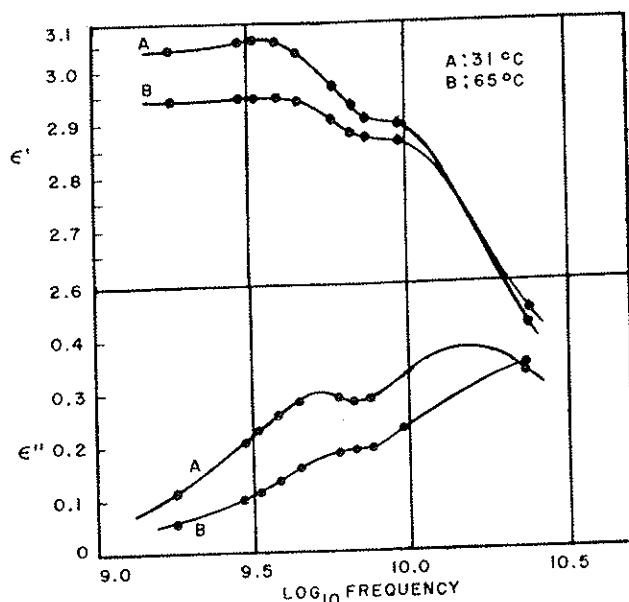
No. 150. $C_{12}H_{24}O_2$, Dodecanoic acid (Lauric). Buchanan (54).



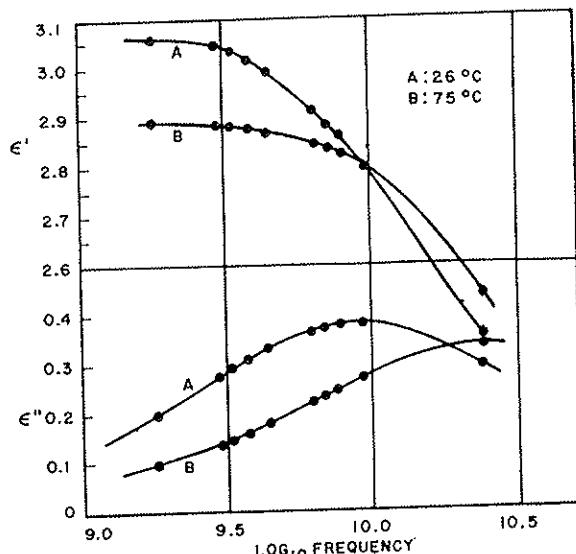
No. 153. $C_{12}H_{26}O$, 1-Dodecanol. Cf. No. 93.



No. 165. $C_{17}H_{34}O_2$, Methyl palmitate. Buchanan (54).



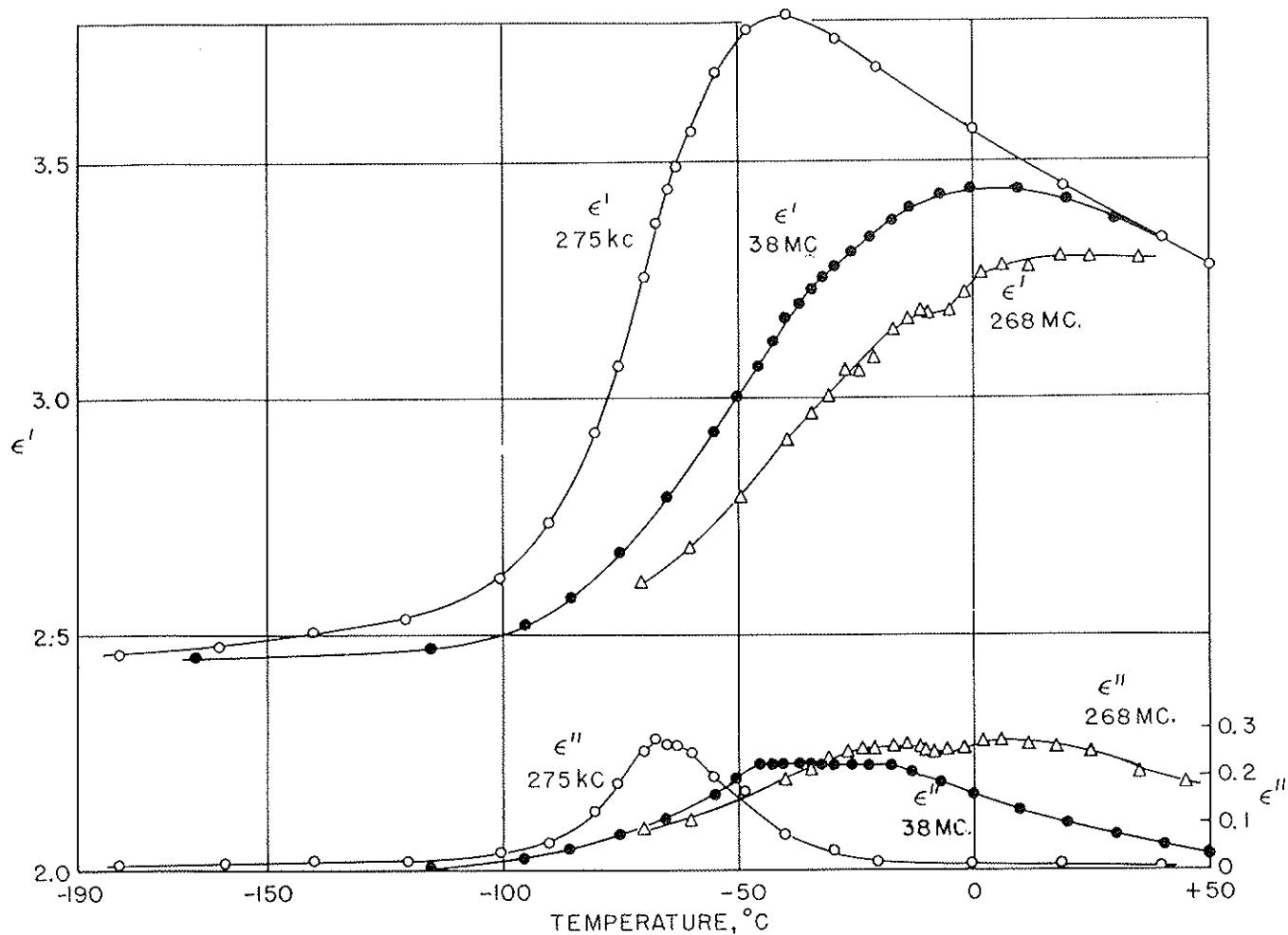
No. 169. $C_{18}H_{36}O_2$, Ethyl palmitate. Buchanan (54).



No. 172. C₂₀H₄₀O, Phytol. Cf. No. 139.

No. 174. C₂₀H₄₂O, Di-dihydrocitronellyl ether. Cf. No. 127.

No. 178. C₂₂H₄₂O₂, Phytol acetate. Schallamach (46.2).



5. Dilute Solutions

Table 5. Dielectric dispersion parameters and numerical data for dilute nonaqueous solutions

Table 6. Dielectric dispersion parameters and numerical data for dilute aqueous solutions

Chemical Formulas and Order of Listing of Compounds

The listing of solutes follows the scheme described for tables 1 to 4. The same scheme is adopted for the solvents under a given compound.

Dispersion Parameters for Nonaqueous Solutions

Treatment of data: The data for most solutions are either so limited or varied that a critical evaluation of the dispersion parameters is impractical. The values listed in tables 5 and 6 are in most instances those reported by the authors. They have been determined in the great majority of cases from Cole-Cole plots.

Tabulated quantities:

$(\Delta\epsilon/c)_{\infty}$ =the value of the incremental dielectric constant for $\lambda=\infty$.

$(\Delta\epsilon/c)_0$ =the value of the incremental dielectric constant for $\lambda=0$.

$\Delta\epsilon'/c$ =the incremental dielectric constant defined by the relation $\epsilon'_{12}=\epsilon'_1+(\Delta\epsilon'/c)\cdot c$, where c is the concentration, and the subscripts 12 and 1 refer to the solution and solvent, respectively.

$\Delta\epsilon''/c$ =the incremental dielectric loss defined by the relation $\epsilon''_{12}=(\Delta\epsilon''/c)\cdot c$.

$\Delta \tan \delta/c$ =the incremental loss tangent defined by the relation $\tan \delta_{12}=(\Delta \tan \delta/c)\cdot c$.

α =the distribution parameter of the Cole-Cole representation.

λ_c =the critical wavelength characteristic of the dispersion.

Notations:

$(\Delta\epsilon'/c)()$, $(\Delta\epsilon''/c)()$: The symbols m, x, and w in the parentheses following the data listed for $\Delta\epsilon'/c$ and $\Delta\epsilon''/c$ denote the concentration units, molarity, mole fraction, and weight fraction, respectively.

[]: Brackets denote that the value is assumed.

Dispersion Parameters for Aqueous Solutions

The quantities tabulated are the Debye parameters for the individual solutions.

References and Bibliography

All references are collected in a bibliography at the end of the tables.

TABLE 5. Dielectric dispersion parameters and numerical data for dilute nonaqueous solutions

TABLE 5. Dielectric dispersion parameters and numerical data for dilute nonaqueous solutions—Continued

Solution	<i>t</i> (°C)	λ (cm)	$(\frac{\Delta\epsilon'}{c})_\infty$	$(\frac{\Delta\epsilon'}{c})_0$	$\frac{\Delta\epsilon'}{c}$	$\frac{\Delta\epsilon''}{c}$	$\frac{\Delta\tan\delta}{c}$	α_{cale}	λ_e (cm)	References
C ₁ —Continued CH ₃ NO ₂										
Nitromethane										
Solvents:										
Carbon tetrachloride...	22	9.66				0.84(w)	[6]	0.58		54 LeFevre.
	10	0.866				.207	[6]	1.14		56 Clark.
	20					.216				
	30					.219				
	40					.214				
Benzene.....	19	3.26				.091(m)	[6]	0.74		46.1 Whitten.
		1.27				.196				
	18.5	3.25				.102(m)	0	.82		46 Cripwell.
		1.25				.197				
	10	0.866				.231(m)	[6]	.80		56 Clark.
	20					.228				
	30					.211				
	40					.186				
CH ₃ O	Methanol									
Solvent:										
Benzene.....	23	430								49.1 Fischer.
	(20)	400 to 450								39 Fillipov.
		1.25; 3.20								55 Poley.
C ₂										
C ₂ H ₅ Cl ₃	1,1,1-Trichloroethane									
Solvents:										
Carbon tetrachloride...	4	10.7	4.48	0.00	3.68(x)	0.18(x)	0.19	.86		56 Holland.
		1.24			2.54	1.63				
	20	30	3.58	—.09	3.60	0.09				
		10.7			3.62	.16				
		1.24			2.65	1.41				
	40	10.7	3.18	.00	3.18	0.13				
		1.24			2.68	1.29				
1-Heptane.....	20	3.22	2.50	.19	2.4(x)	0.32(x)				
		1.27			1.97	.76				
	40	3.22	2.23	.19	2.12	.26				
		1.27			1.85	.63				
	60	3.22	1.99	.19	1.95	.20				
		1.27			1.73	.52				
Paraffin.....	20	10.0	2.43	.04	2.25(w)	.23(w)				
		3.22			2.16	.54				
		1.27			1.45	.90				
	40	10.0	2.18	.04	2.08(w)	.17(w)				
		3.22			1.98	.42				
		1.27			1.38	.82				
	60	10.0	2.00	.04	1.92(w)	.15(w)				
		3.22			1.82	.33				
		1.27			1.14	.74				
C ₂ X ₃ N	Acetonitrile									
Solvents:										
Carbon tetrachloride...	22	9.65				1.35(w)	[6]	.53		54 LeFevre.
Benzene.....	18.5	3.25				0.0919(m)	[6]	.47		46 Cripwell.
		1.25				.213				

TABLE 5. Dielectric dispersion parameters and numerical data for dilute nonaqueous solutions—Continued

Solution	<i>t</i> (°C)	λ (cm)	$(\frac{\Delta\epsilon'}{c})_\infty$	$(\frac{\Delta\epsilon'}{c})_0$	$\frac{\Delta\epsilon'}{c}$	$\frac{\Delta\epsilon''}{c}$	$\frac{\Delta \tan \delta}{c}$	$\alpha_{C_6H_6}$	λ_e (cm)	References
C ₂ H ₆ Cl ₂	C ₆ —Continued									
	2,2-Dichloropropane—Con.									
Solvents—Continued										
Nujol *	40	30, 10, 7	3.71	0.17	3.51(x)	0.10	0.0	0.0	0.51	
		6, 6			3.68	.28				
		3, 22			3.68	.44				
		1, 24			2.78	.55				
						1.22				
	60	30, 10, 7	3.14	.17	3.04	0.07	.0	.41		
		6, 6			3.17	.22				
		3, 22			3.15	.31				
		1, 24			3.02	.34				
					1.08	1.08				
C ₃ H ₆ O	Acetone									
Solvents*										
Benzene.....	23	430								
	24	380								
	19	9, 09				0.0256(m)	0	.625		
		3, 06				.0834				
		1, 23				.170				
	19	3, 26				.067(m)	0	.60		
		1, 27				.143				
	18, 5	3, 25				.0778(m)	0	.63		
		1, 27				.168				
	19	1, 22				.154(m)				
	{30}	3, 15								
C ₃ H ₆ N ₂ O ₄	1-Hexane.....									
	2,2-Dinitropropane.....									
Solvents*										
1-Hexane	2	30, 10, 7	11, 00	.06	10, 9(x)	0.26(x)				
		6, 6			11, 4	.95				
		1, 24			10, 8	1.44				
	20	30, 10, 7	10, 14	.06	10, 2	4.46				
		6, 6			10, 2	.70				
		3, 22			9, 9	1.05				
		1, 24			9, 59	2.14				
	40	30, 10, 7	9, 11	.06	9, 15	0.15				
		6, 6			9, 10	.55				
		1, 24			9, 1	.76				
					7, 9	3.15				
	Nujol *									
	20	30, 10, 7	12, 13	—, 11	11, 7(x)	0.62(x)		.22	1.35	
		6, 6			11, 2	1.78				
		3, 22			11, 3	2.44				
		1, 24			9, 6	2.84				
	40	30, 10, 7	11, 34	—, 21	5, 7	4.33				
		6, 6			11, 1	0.44				
		3, 22			11, 0	1.27				
		1, 24			9, 6	1.82				
	60	30, 10, 7	10, 27	—, 14	6, 2	2.22				
		6, 6			6, 2	4.10				
		3, 22			6, 7	1.26				
		1, 24			6, 7	1.44				
						3.81				

* Purified mineral oil.

TABLE 5. Dielectric dispersion parameters and numerical data for dilute nonaqueous solutions—Continued

Solution	<i>t</i> (°C)	λ (cm)	$(\frac{\Delta\epsilon'}{c})_{\infty}$	$(\frac{\Delta\epsilon'}{c})_0$	$\frac{\Delta\epsilon'}{c}$	$\frac{\Delta\epsilon''}{c}$	$\frac{\Delta \tan \delta}{c}$	α_{col}	λ_{col} (cm)	References
C ₄ H ₉ Cl	C ₁ —Continued 2-Chloro-2-methylpropane— Continued	0	5.59 3.22 1.27	4.00 .22	3.70(x) 3.74 3.45	0.34(x) .56 .93	0.3	... ... ...	50	Franklin.
	Solvents—Continued 1-Hexane.....	20	5.59 3.22 1.27	3.56 .20	3.50 3.50	.26 .45	.2	0.3		
		40	5.60 3.22 1.27	3.26 .19	2.90 2.45	.75 .64	.2	...		
		Hexadecane.....	20	3.22 1.27	1.85 .06	1.64(x) 1.70	.27(x) .50		50	Franklin.
		30	3.22 1.27	1.80 .06	1.54 1.60	.24 .43				
		40	3.22 1.27	1.70 .05	1.46 1.55	.22 .36				
C ₄ H ₉ I	2-Iodo-2-methylpropane									
	Solvent:									
	Carbon tetrachloride...	20	9.65							54 LeFevre.
	1-Butanol									
	Solvent:									
	Benzene.....	(20)	400 to 450							39 Filimonov.
	2-Methyl-1-propanol									
	Solvent:									
	Benzene.....	20	10 to 500							
	C ₃									
C ₄ H ₉ N	Pyridine									
	Solvents:									
	Carbon tetrachloride...	25	340							53 Hase.
	1,4-Dioxane.....	25	340							53 Hase.
	Benzene.....	25	340							53 Hase.
	Cyclohexane.....	25	340							53 Hase.
	1-Hexane.....	25	340							53 Hase.
	1-Heptane.....	1	33.3 10.7 6.6 1.24	4.08 .20	4.08(x) 4.16 3.90 3.35 1.26	0.06(x) .19 .15 .25 1.26	0.05	0.46	.55	Holland.
		20	33.3 10.7 6.6 1.24	3.67 .17	3.68(x) 3.70 3.66 3.26	0.05(x) .15 .25 1.06	.04	.42		
		40	33.3 10.7 6.6 1.24	3.37 .17	3.38(x) 3.40 3.32 3.00	0.04(x) .11 .17 .86	.06	.36		
C ₄ H ₉ O	Cyclopentanone									37 Holzmüller.
	Solvent:									
	Benzene.....	24.1	380							37 Holzmüller.
	1-Hexane.....	24.1	380							

TABLE 5. Dielectric dispersion parameters and numerical data for dilute nonaqueous solutions—Continued

Carbon tetrachloride-----	23.42	25	340
			3.32

20	3.65 1.65 1.41 0.885 .625	.388(m) .337 .289 .220 .177	0	2.87
	Carbon disulfide-----			50.2 Whitten.
20	3.65 1.65 1.41 0.885 .625	.290(m) .412 .389 .312 .270	0	1.62
	Benzene-----			50.2 Whitten.
25	340	.0350(m) .0833 .1736 .440 .367	0	2.18
	1,4-Dioxane-----			49.1 Fischer.
25	340	.181(m) .419 .400	0	2.15
	Benzene-----			53 Hase.
19	48.5 25.2 9.00 3.06 1.23	.375(m) .399 .269 .217	0	2.41
				46 Jackson.
20	10.2 3.26 1.25	.358(mn) .332 .414 .347	0	2.17
				46.1 Whitten.
20	1.25 to 3.99	1.30(w) [0]	0	2.45
				46 Cripwell.
20	3.65 1.65 0.885 .625	0.3386(m) .408 .386 .330 .279	0	2.07
				54 LeFevre.
19	3.26 1.27			55.1 Marty.
18.5	3.25 1.25			53 Hase.
20	0.65			50.2 Whitten.
(20)	3.15			53 Hase.
25	340			53 Hase.
	Cyclohexane-----			53 Hase.
20	3.65 1.65 1.41 0.885 .625			50.2 Whitten.
	1-Hexane-----			53 Hase.
25	340			50.2 Whitten.
	1-Methane-----			53 Hase.
	$\text{C}_6\text{H}_5\text{NO}_2$			54 Fischer.
	<i>Solvent:</i>			
	Carbon tetrachloride--			53.1 Fischer.
	Phenol			53.2 Fischer.
	<i>Solvent:</i>			49.1 Fischer.
	Carbon tetrachloride--			49.2 Fischer.
	Antiline			49.3 Fischer.
	<i>Solvent:</i>			48.1 Fischer.
	Carbon tetrachloride--			48.2 Fischer.
	Benzene-----			48.3 Fischer.
	1,4-Benzenediamine-----			48.4 Fischer.
	<i>Solvent:</i>			
	Benzene-----			

TABLE 5. Dielectric dispersion parameters and numerical data for dilute nonaqueous solutions—Continued

Solvent:	Carbon tetrachloride.....	25.42	476	9.65	
		1 $\frac{1}{4}$			

C ₇ H ₆ O	Benzene.....	23	430		
	Benzaldehyde				49.1 Fischer.
	Solvent:	Benzene.....	23	430	49.1 Fischer.
C ₇ H ₆ O ₂	Salicylaldehyde				49.1 Fischer.
	Solvent:	Carbon tetrachloride.....			54 Fischer.
C ₇ H ₅ Cl	α -Chlorotoluene (benzyl chloride)	25	454		
	Solvent:	Benzene.....	23	430	49.1 Fischer.
C ₇ H ₅ I	<i>p</i> -Iodotoluene				
	Solvent:	Carbon tetrachloride.....	25	340	53 Hase.
		1,4-Dioxane.....	25	340	53 Hase.
		Benzene.....	25	340	53 Hase.
		Cyclohexane.....	25	340	53 Hase.
		1-Hexane.....	25	340	53 Hase.
C ₇ H ₅ NO ₂	<i>p</i> -Nitrotoluene				
	Solvent:	Benzene.....	22	9.65	2.31 (w) [9]
C ₇ H ₈	Toluene			3.6	54 LeFerte.
	Solvent:	Carbon tetrachloride.....	22	9.65	0.015(w) [9]
		Toluene.....	19	3.26	1.26
		Methoxybenzene (Anisole)		1.27	.00175 (m) 0
	Solvent:	Carbon tetrachloride.....	25	458	.0024
		o-Cresol	25	340	1.38
		Benzene.....	23	430	46.1 Whitten.
C ₇ H ₈ O	Carbon tetrachloride.....				49.1 Fischer.
	<i>o</i> -Methoxyphenol (Guaicol)				53.2 Fischer.
	Solvent:	Carbon tetrachloride.....	25	454	53 Hase.
		Benzylamine			49.1 Fischer.
C ₇ H ₈ O ₂	<i>o</i> -Toluidine				54 Fischer.
	Solvent:	Benzene.....	23	430	49.1 Fischer.
		<i>m</i> -Toluidine			49.1 Fischer.
	Solvent:	Benzene.....	23	430	49.1 Fischer.
		<i>p</i> -Toluidine			49.1 Fischer.
	Solvent:	Benzene.....	23	430	

TABLE 5. Dielectric dispersion parameters and numerical data for dilute nonaqueous solutions—Continued

TABLE 5. Dielectric dispersion parameters and numerical data for dilute nonaqueous solutions—Continued

Solution	<i>t</i> (°C)	λ (cm)	$(\frac{\Delta\epsilon}{c})_\infty$	$(\frac{\Delta\epsilon}{c})_0$	$\frac{\Delta\epsilon'}{c}$	$\frac{\Delta\epsilon''}{c}$	$\frac{\Delta \tan \delta}{c}$	$\alpha_{C_6H_6}$	λ_e (cm)	References
C_3 —Continued										
1-Heptane—Continued										
Solvents—Continued	60	10.0 5.59 3.22 1.27	2.66 ^b	0.30	2.65 2.44 1.96 1.60	0.38 0.53 .72 .73			0.16	1.39
1-Hexadecane	20	5.59 3.22 1.27	1.50 1.27	.10	1.04 (x) .73 .35	.41 (x) .20 .27			.30	3.64
	40	5.59 3.22 1.27	1.40 1.27	.10	1.00 0.78 .40	.36 .37 .33			.39	3.00
	60	5.59 3.22 1.27	1.30 1.27	.10	.96 .79 .44	.32 .33 .35			.29	2.65
$C_8H_{11}Cl$	1-Chlorooctane									
Solvent:										
Benzene	23	430								
$C_8H_{18}O$	1-Octanol									
Solvent:										
Benzene	23	430								
	24	382								
Butyl ether										
Solvent:										
Benzene	23									
$C_8H_{18}N$	Dibutylamine									
Solvent:										
Benzene	23									
C_9										
$C_8H_{10}O_2$	Ethyl benzoate									
Solvent:										
Benzene	23	430								
	20	3.65 1.65 0.885 .625								
	19	3.26 1.27								
	18.5	3.25 1.25								
Cyclohexane	20	3.65 1.65 1.41 0.885 .625								
$C_8H_{11}Cl$	3-Chloropropylbenzene									
Solvent:										
Benzene	23	430								

^aFischer.^bReference 40.1.

TABLE 5. Dielectric dispersion parameters and numerical data for dilute nonaqueous solutions—Continued

Solution	<i>t</i> (°C)	λ (cm)	$(\frac{\Delta \epsilon'}{c})_\infty$	$(\frac{\Delta \epsilon'}{c})_0$	$\frac{\Delta \epsilon'}{c}$	$\frac{\Delta \epsilon''}{c}$	$\frac{\Delta \tan \delta}{c}$	λ_e (cm)	References
C ₁₀ —Continued									
2-Chloronaphthalene									
<i>Solvent:</i>									
Carbon tetrachloride--	12	9.65							54 LeFevre.
1-Fluoronaphthalene									
<i>Solvent:</i>									
Carbon tetrachloride--	14	9.65							54 LeFevre.
2-Fluoronaphthalene									
<i>Solvent:</i>									
Carbon tetrachloride--	15	9.65							54 LeFevre.
1-Iodonaphthalene									
<i>Solvent:</i>									
Carbon tetrachloride--	12	9.65							54 LeFevre.
2-Iodonaphthalene									
<i>Solvent:</i>									
Carbon tetrachloride--	12	9.65							54 LeFevre.
C ₁₀ H ₁₁ F									
1-Nitronaphthalene									
<i>Solvent:</i>									
Carbon tetrachloride--	20	9.65							54 LeFevre.
Benzene-----	15	9.65							
C ₁₀ H ₁₁ N									
1-Naphthylamine									
<i>Solvent:</i>									
Benzene-----	23	430							49.1 Fischer.
C ₁₀ H ₁₂ O ₂									
4-Allyl-1-hydroxy-2-methoxybenzene (Eugenol).									
<i>Solvent:</i>									
Carbon tetrachloride--	25	455							54 Fischer.
C ₁₀ H ₁₆ O									
Camphor									
<i>Solvent:</i>									
Carbon tetrachloride--	20	3.34							50.2 Whitten.
		1.65							
		1.41							
		0.885							
		.625							
Carbon disulfide-----	20	3.34							0 1.41
		1.65							
		1.41							
		0.885							
		.625							
Tetrachloroethylene	20	3.34							
		1.65							
		1.41							
		0.885							
		.625							
Methyl cyclopentane--	20	3.34							
		1.41							
		0.885							
		.625							

a Purified mineral oil.
b From interpolated data.
c Calculated from the dilute solution approximation of the Debye equation with $\kappa = 3,000$.

TABLE 5. Dielectric dispersion parameters and numerical data for dilute nonaqueous solutions—Continued

Solution	<i>t</i> (°C)	λ (cm)	$(\frac{\Delta \epsilon}{c})_{\infty}$	$(\frac{\Delta \epsilon}{c})_0$	$\frac{\Delta \epsilon'}{c}$	$\frac{-\Delta \epsilon''}{c}$	$\frac{\Delta \tan \delta}{c}$	λ_c (cm)	References
C ₁₁ —Continued									
6-Undecanone									
Solvent:									
Benzene.....	24.1	380							37 Holznüller.
1-Hexane.....	24.1	380							37 Holznüller.
C ₁₂									
C ₁₂ H ₁₀ Cl	4-Chlorobiphenyl								
Solvent:									
Benzene.....	22	9.65							
C ₁₂ H ₉ I	Iodobiphenyl								
Solvent:									
Carbon tetrachloride.....	25	340							53 Hase.
1,4-Dioxane.....	25	340							53 Hase.
Benzene.....	25	340							53 Hase.
Cyclohexane.....	25	340							53 Hase.
1-Hexane.....	25	340							53 Hase.
C ₁₂ H ₉ NO ₂	4-Nitrobiphenyl								
Solvent:									
Benzene.....	22	9.65							
C ₁₂ H ₁₀ O	Phenyl ether								
Solvent:									
Benzene.....	23								49.3 Fischer.
C ₁₂ H ₁₁ N	Diphenylamine								
Solvent:									
Benzene.....	23								49.3 Fischer.
C ₁₂ H ₁₂ N ₂	4,4'-Diaminobiphenyl								
Solvent:									
Benzene.....	23	430							49.1 Fischer.
C ₁₁ H ₂₂ Cl	1-Chlorododecane								
Solvent:									
Carbon tetrachloride.....	25	340							53 Hase.
1,4-Dioxane.....	25	340							53 Hase.
Benzene.....	23	450							49.1 Fischer.
Cyclohexane.....	25	340							53 Hase.
n-Hexane.....	25	340							53 Hase.
C ₁₃									
C ₁₃ H ₁₀ O	Benzophenone								
Solvent:									
Carbon tetrachloride.....	10	3.25							56 Clark.
		20							
		30							
			0.219(m)						
			.225						
			.217						

TABLE 5. Dielectric dispersion parameters and numerical data for dilute nonaqueous solutions—Continued

60	10.0	2.79	.59	2.63	.65	.19
	6.59	2.79	.59	2.16	.66	
	3.22	2.79	.59	1.94	.75	
	1.27	2.79	.59	1.23	.81	
	Paraffin.....	4	3.22	1.60	.11	0.22(x)
			1.27		.22	.21(x)
20	10.0	1.46	.11	.59	.36	.19
	6.59	1.46	.11	.51	.34	
	3.22	1.46	.11	.31	.25	
	1.27	1.46	.11	.21	.16	
40	10.0	1.32	.11	.66	.34	
	5.59	1.32	.11	.59	.32	
	3.22	1.32	.11	.33	.30	
	1.27	1.32	.11	.20	.21	
60	10.0	1.15	.11	.73	.32	
	5.59	1.15	.11	.65	.35	
	3.22	1.15	.11	.42	.32	
	1.27	1.15	.11	.20	.24	
	C ₆					
	C ₁₆ H ₃₂ O ₄	3,5,3',5'-Tetramethoxybiphenyl				
		Solvent:				
		Carbon tetrachloride--	25	340		
	C ₁₆ H ₃₂ O ₂	3,3'-Dithoxybiphenyl				
		Solvent:				
		Carbon tetrachloride--	25	340		
	C ₁₆ H ₃₂ Br	1-Bromohexadecane				
		Solvent:				
		Benzene--	23	430		
	C ₁₆ H ₃₂ Cl	1-Chlorohexadecane				
		Solvent:				
		Benzene--	23	430		
	C ₁₆ H ₃₂ O	1-Hexadecanol				
		Solvent:				
		Benzene--	23	430		
	C ₂₄ H ₃₂ O ₄	Dioctyl phthalate				
		Solvent:				
		Benzene--	20	(1 to 10)		
	C ₂₄ H ₃₂ O	C ₈				
		2',3',3'',3'''-Tetramethyl,p-				
		quaterphenyl				
		Solvent:				
		Carbon tetrachloride--	25	340		
	C ₂₄ H ₃₂ O ₄	2',3',3'',3'''-Tetramethyl-p-				
		quaterphenyl				
		Solvent:				
		Carbon tetrachloride--	25	340		
	C ₂₄ H ₃₂ O ₄	2',3',3'',3'''-Tetramethoxy-p-				
		quaterphenyl				
		Solvent:				
		Carbon tetrachloride--	25	340		

TABLE 6. Dielectric dispersion parameters and numerical data for dilute aqueous solutions

Solute	<i>t</i> (° C)	<i>λ</i> (cm)	Concen-tration, moles per liter	$ε'$	$ε''$	$ε_{λ=∞}$	$ε_{λ=0}$	$α_{Coie}$	$λ_e$ (cm)	References	
C_2H_7N Ethyl amine-----	25	9.22	0.6	72.4	12.0	• 75.0	5.5	0	1.77	52 Haggis.	
		3.175		57.6	30.0						
	25	1.264		30.1	33.1						
		3.175	1.16	55.2	30.8	• 72.5	5.5	0	1.84		
$C_2H_8N_2$ Ethylenediamine-----	25	9.22	0.525	74.3	12.0	• 75.5	5.5	0	1.75		
		3.175		59.7	29.2						
	25	1.264		31.3	33.0						
		9.22	1.05	71.0	12.5	• 73.0	5.5	0	2.06		
C_3H_8O 1-Propanol-----	25	9.22	0.33	72.6	12.5	• 75.5	5.5	0	1.69		
		3.175		61.3	29.3						
		1.264		31.6	33.3						
		9.22	.66	70.7	13.0	• 73.9	5.5	0	1.81		
	25	3.175		58.2	30.2						
		1.264		29.5	32.0						
		9.22	1.0	70.0	14.6	• 72.3	5.5	0	1.94		
		3.175		54.9	30.3						
	25	1.264		27.1	31.3						
2-Propanol-----		9.22	0.33	74.8	11.5	• 75.9	5.5	0	1.63		
		1.264		31.6	33.8						
25	9.22	.66	72.3	11.0	• 73.4	5.5	0	1.73			
	1.264		28.9	32.3							
$C_3H_5O_2$ Propionic acid-----	25	1.264	1.0	26.2	30.7	• 70.9	5.5	0	1.85		
		9.22	0.5	73.3	12.7	• 75.0	5.5	0	1.66		
		3.175		59.1	28.5						
		1.264		31.4	33.3						
	25	9.22	1.0	69.4	13.4	• 71.5	5.5	0	1.77		
		3.175		55.4	28.5						
		1.264		28.9	31.4						
		9.22	1.5	65.7	13.0	• 68.4	5.5	0	1.91		
C_3H_9N 1-Propylamine-----	25	1.264	0.33	31.8	33.7						
		9.22	.66	28.8	31.6						
		3.175		28.8	31.6						
C_4H_10O 2-Methyl-2-propanol-----	25	9.22	.33	73.7	12.9	• 75.9	5.5	0	1.74		
		3.175		59.9	29.6						
		1.264		31.6	33.3						
	25	9.22	.66	71.6	14.6	• 73.5	5.5	0	1.90		
		3.175		55.1	30.1						
		9.22	1.0	69.9	15.3	• 71.5	5.5	0	2.06		
$C_5H_8O_4$ Glutaric acid-----	25	9.22	0.33	73.6	13.1	• 74.9	5.5	0	1.63		
		3.175		60.6	28.4						
		1.264		32.5	33.1						
	25	9.22	1.0	65.6	13.1	• 68.0	5.5	0	1.71		
		3.175		53.5	26.2						
		1.264		28.6	28.8						
$C_6H_{10}O$ 1-Pentanone-----	25	9.22	0.17	75.2	10.6	• 77.0	5.5	0	1.62		
		3.175		62.2	29.0						
	25	1.264		33.2	35.0						
		9.22	.33	74.6	10.8	• 70.5	5.5	0	1.67		
C_6H_8O Phenol-----	25	9.22		61.1	29.3						
		3.175		31.6	34.1						
	25	9.22	.25	74.6	11.5	• 75.0	5.5	0	1.62		
		3.175		61.3	28.2						
C_6H_7N Aniline-----	25	9.22	.5	71.3	12.1	• 73.0	5.5	0	1.67		
		3.175		58.4	27.9						
	25	1.264		29.1	31.2						
		9.22	.125	75.5	10.3	• 77.1	5.5	0	1.58		
	25	3.175		62.9	28.4						
		1.264		33.6	35.2						
	25	9.22	.25	74.1	10.4	• 76.0	5.5	0	1.61		
		3.175		61.9	28.3						
		1.264		32.5	34.2						

* Adjusted.

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