The Dielectric Constant of Cetyl Alcohol Near its Melting Point.

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Using a heterodyne beat apparatus(1) of 3000 kilocycles, we studied the temperature dependence of the dielectric constant of cetyl alcohol.

The dielectric constant of this substance increases on solidification, passes through a maximum at a temperature a little below the melting point and then drops to a nearly constant value at lower temperatures, which is the same order of the magnitude as non-polar substances (Cf. Table 1 and the figure).

Table 1.
The Dielectric Constant of Cetyl Alcohol ($\lambda = 100$ m.)

t (°C.)	ε	t (°C.)	ε	t (°C.)	ε (liquid)
−13.5	2.55	25.0	4.19	50.0	3.86
−12.6	2.56	29.7	5.65	50.0	3.86
3.5	2.77	29.8	5.65	57.0	3.74
4.2	2.75	34.9	5.70	57.1	3.74
13.8	2.85	35.0	5.70	63.7	3.65
14.1	2.85	42.0	5.27	64.0	3.64
20.8	3.25	42.0	5.27		
20.9	3.28	45.4	4.81		
25.0	4.10	45.7	4.78		

Methyl alcohol(2) and normal long chain ketones(3) are reported to show a considerable increase in the dielectric constant in a wide range below their melting points. But any of them differs from cetyl alcohol in that it gives lower dielectric constant in solid state than in liquid state. Piekara's observation(4) on oleic acid reveals a feature similar to that by our experiment, but in the case of cetyl alcohol it is exhibited much more distinctly.

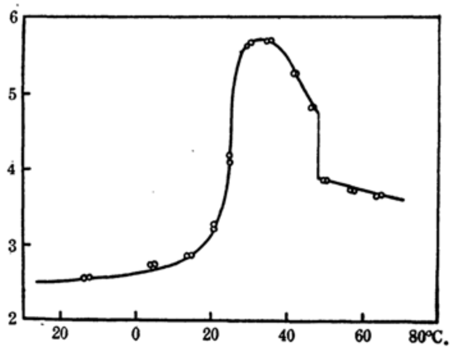
(1) The same apparatus used in the determination of the dielectric constant of gases, was employed in the present work with a slight modification. See M. Kubo, *Sci. Papers Inst. Phys. Chem. Research* (Tokyo), **26** (1935), 242; **27** (1935), 65.

(2) C. P. Smyth and S. A. McNeight, *J. Am. Chem. Soc.*, **58** (1936), 1597.

(3) A. Müller, *Proc. Roy. Soc.* (London), A, **158** (1937), 403.

(4) B. Piekara, *Physik. Z.*, **37** (1936), 624.

In Table 2, the dipole moment[5] of this substance in solution are recorded. Excepting the values in hexane solution, which are not free from the errors of association, the observed moments are remarkably constant. It is clear from this that no abnormality occurs in the dipole moment in the range of the temperature observed.



Temperature dependence of the dielectric constant of cetyl alcohol

Table 2. The Dipole Moment of Cetyl Alcohol

t (°C.)	benzene		hexane	
	P	μ	P	μ
20	140.0	1.70	114.3	1.30
30	137.3	1.70		
40	135.8	1.70	122.0	1.48
50	132.7	1.68		
60	131.8	1.69	125.0	1.58

$P_E + P_A = P_{solid}$[6] $= 78.5$ c.c.

According to the X-ray studies by Malkins,[7] two lattice constants are given to this alcohol and a transition between them is supposed to occur when it is near room temperature. If this observation be correct, has this transition any relation with the observed anormaly in the dielectric constant?

No satisfactory explanation can be given at the present stage of the investigation. And in the following paper a fuller discussion on this problem will be given.

In conclusion, the writers wish to express their cordial thanks to Prof. M. Katayama and Prof. S. Mizushima for their kind guidance and encouragement throughout this experiment.

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(5) From the result of our previous work, which was published in Japanese: K. Higasi, *Bull. Inst. Phys. Chem. Research* (Tokyo), **12** (1933), 780.

(6) P_{solid} used here is the polarisation obtained by using an apparatus of shorter wave-length at very low temperature.

(7) T. Malkins, *J. Am. Chem. Soc.*, **52** (1930), 3739.