

2) The electrical conductivity of the detergent solution was measured at 18° C. by adding KCl. And it was observed that the conductivity value of this solution agreed with that of KCl solution at a low concentration of the detergent, but above a certain concentration the conductivity value was smaller than that of KCl solution. The concentration in question in this case was one at which the deviation was first observed.

The results obtained by these methods were summarized in the following table.

22. Physico-chemical Properties of Surface Active Agents. (IV)

Dielectric Properties of Polyoxyethylene Glycol mono-Alkyl Ethers

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As the PEGAE is a non-ionic surface active agent and its hydrophilic property is due to a large polar group, i.e. the chain of polyethylene oxide, it is desirable to examine the dielectric properties of the PEGAE. So in the present work the dielectric constant ϵ' and loss ϵ'' for each sample were measured with the susceptance variation method over the frequency range 3-30 Mc. and at a range of temperatures from 35° to 65°C. The observed values of ϵ' were given in the following table.

	Temp. (°C)	Sample							
		Freq. (Mc)	PO-8	PO-20	PC-10	PC-13	PC-18	PL-6	PL-20
ϵ'	40	3	6.00	7.77	6.70	6.81	6.39	7.31	7.81
		10	5.87	7.40	6.45	6.48	6.41	6.93	7.29
		30	5.46	6.53	5.90	5.83	6.04	5.89	6.79
	65	3	5.67	7.31	6.31	6.26	6.12	6.78	7.29
		10	5.49	7.02	6.00	6.09	5.91	6.52	7.04
		30	5.19	6.27	5.60	5.50	5.55	5.61	6.38

As shown in the table, the interesting features were found in values of ϵ' ; the more the number of carbon atom in the alkyl group, the lower the value of ϵ' for the PEGAE with a given chain length of ethylene oxide, and the longer the polyethylene oxide chain, the higher the value of ϵ' for samples with a definite alkyl group.

Considering that the alkyl group is non-polar and polyethylene oxide is a large polar group, it may be reasonable that the dielectric constant ϵ' of PEGAE varied with the lengths of ethylene oxide and methylene chain.

The dielectric constant ϵ' for each sample gradually decreased with increasing the frequency and temperature, but the maximum of the dielectric loss ϵ'' was not found over the present frequency and temperature range. Hence it appears that the critical frequency in the dielectric relaxation of the PEGAE is much higher than 30 Mc.

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23. Studies on the Relation between the Composition and the Surface States in Binary Alloys

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For the binary alloy (composition: atom I: atom II = $m:1$, $n(m+1)$ th atoms from the surface are always the atom II, n is any positive integer) a general equation giving energies of surface states E ,

$$\sin(m+1)\mu_1 (\cos^2 y - 2\cos y \cos\mu_2 + 1) = 2\sin m\mu_1 (\cos\mu_1 - \cos\mu_2),$$

was derived using an assumed one-dimensional well-type periodical potential field, where

$$\begin{aligned} \cos y &= \cos \beta a + (a/\beta) \sin \beta a, & a &= (-2mE/\hbar^2)^{\frac{1}{2}}, \\ \cos \mu_1 &= \cos \beta a - (P_1/\beta) \sin \beta a, & \beta &= (2m(E+W_a)/\hbar^2)^{\frac{1}{2}}, \\ \cos \mu_2 &= \cos \beta a - (P_2/\beta) \sin \beta a, \end{aligned}$$

P_1, P_2 : constants relating to the area of well,

a : lattice constant,

W_a : potential jump at the surface.

As these states should be exponentially damped on both sides of the surface, we had to add another restriction

$$|\{\cos y \sin(m+1)\mu_1 - \sin m\mu_1\} / \sin \mu_1| < 1.$$

Following conclusions were derived from these equations, taking only the energy range $0 > E > -W_a$ into consideration.

(a) The changes of surface levels with the interior compositions were very small in comparison with the changes with the modification of surface potential curves.