$$\eta_{\text{link plate}} + \eta_{\text{pin (bush)}} = 1. \quad (3)$$

We found that under the same tensile weight, $\eta_{\text{link plate}}$ decreases as the initial radial pressure P (above mentioned) increases. This shows that the pin (or bush) shares more of the tensile stress as the initial radial pressure P increases, (cf. eq. (3)).

The stress concentration at the narrowest part of the link plate, when a tensile weight is loaded, decreased as the initial radial pressure P increased and reached the value where there were no holes. From this we concluded that the link plate approached the condition, where there were no holes, as the radial pressure P increased.

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# 10. Studies on Silicone Resins. (VII)

## On the Dielectric Properties

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The dielectric properties of methyl-ethyl and methyl-ethyl-phenyl silicone resins for various frequencies and temperatures were measured. From these measured results following facts can be concluded.

(1) These dielectric properties qualitatively obey the Debye theory, namely these phenomena show the existences of dipolar radicals. Quantitatively, however, they considerably deviate from the Debye theory. (2) The higher the measuring frequency the higher the temperature is, at which the dielectric loss angle is max. (3) The changes of dielectric loss angle and constant are slower. (4) As the poly-condensation of silicone resin goes on, its dielectric loss angle and constant become smaller and their changes slower. (5) As it dries, the change of dielectric constant which becomes large as temperature rises, becomes smaller and at last extinguishes. (6) As it dries, the temperature at which the dielectric loss angle is max. becomes higher a little. (7) The temperature characteristics of dielectric loss angle does not show the "V-Curve."

For the above-mentioned items discussions will be given.

On the dipolar radicals, the OH-radical and siloxane bond are considered. As the poly-condensation of the silicone resin goes on, OH-radicals decrease and siloxane bonds increase. And how these two kinds of radicals take part each other in dielectric phenomena, is very interesting.

For the deviation from the Debye theory, applying Cole-Cole's theory the following results can be obtained.

$$\alpha = 0.71, \qquad \varepsilon_0 - \varepsilon_\infty = 0.35$$

Where $\alpha$ is a parameter in the Cole-Cole law which is zero in the Debye theory, $\varepsilon_0$ is dielectric constant in d.c. and $\varepsilon_\infty$ is in infinite frequencies.

From the theory of rate process of Eyring, the free energy $\triangle F\ddagger$, heat $\triangle E\ddagger$ and entropy $\triangle S\ddagger$ of activation in the dielectric relaxation process are evaluated as follows.

$$\triangle F\ddagger = 9.09\ K\ \text{cal/mol}, \qquad \triangle E\ddagger = 59.2\ K\ \text{cal/mol}$$

$$\triangle S\ddagger = 660\ \text{cal/}^\circ\text{c/mol}, \qquad \tau = \frac{1}{\pi} \times 10^{-6}\ \text{sec}$$

where $\tau$ is a relaxation time.

These results show that silicone resin is polymer and the rotations of the dipolar molecules accompany with a considerable increase of entropy.

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# 11. Studies on Silicone Resins. (VIII)

## On the X-Ray Diffraction Pattern

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The X-ray diffraction patterns of poly-condensated silicone resin taken by the powder method have been studied.

The anti-cathod of our X-ray apparatus is copper and its wave length is 1.54Å.

We used two kinds of samples: the one is gelatinized silicone resin and the other is normally poly-condensated one.

The X-ray pattern of the former shows only one ring and the latter shows four rings.

According to these rings the distance between lattices which diffract the X-ray is evaluated as follows. The value of the former is 4.22Å and the latter is 4.22Å, 3.14Å, 2.525Å and 2.25Å.

Comparing these results with the X-ray diffraction pattern of silica which is already well-known, the remarkable resemblance is found. That is, the X-ray pattern of the vitreous silica assembles as the gelatinized silicone resin and that of $\alpha$-cristobalite assembles as the normally poly-condensated silicone resin. The position of the band obtained from vitreous silica indicated a spacing of diffraction centers (4.33Å) close to that in the $\alpha$-cristobalite (4.11Å). As above-mentioned, our X-ray diffraction pattern of the gelatinized silicone resin and the longest spacing of the pattern of crystallined silicone resin shows 4.22Å. The spacing of 2.525Å and 2.14Å of crystalline silicone resin may well be understood from their siloxane bond, but the existence of 2.25Å can not be explained yet.

It can be seen from the above that the difference of the structure between