



Fig. 2. Effect of surface activity on charge

tion of electrical charges. It may be that water owes its effectiveness for this purpose to the comparatively high dielectric constant ($D = 81.5$). Liquids of the surface-active type appear to give a second class of curve. Two examples, chosen from a large number, are illustrated in Fig. 2. These curves follow the general trend of those of the first class, but show a peculiar periodicity, often with a reversal of sign of the electrical charge. This would seem to be an expression of the existence of molecular layers, since the change in amount of liquid between the peaks and valleys on the curve approximates to that required to deposit a monomolecular layer on the nylon. From the reversals in sign it would seem that the dipoles are oriented alternately in direction. Electrical charge is finally eliminated when the layer of antistatic agent is sufficiently thick to allow the outer surface to behave as an isotropic liquid. This effect is illustrated by triethanolammonium oleate. Potassium oleate, on the other hand, appears to be laid down in much more rigid layers and, in the example given, is not present in sufficient quantity to behave as an isotropic liquid. The most effective of this class of antistatic agent seem to be those which combine (a) a dipole of such a strength as to limit the field due to the nylon within several layers of the surface, and (b) a degree of surface activity which allows random orientation at small amounts.

The experimental results allow us to speculate on the mechanism by which antistatic agents function. If a body, covered by a film of antistatic agent, meets a second body, a thin film of antistatic agent

voltages seem to be due to dipoles fixed in position by orientation with the nylon acting as a support only. Therefore, one might conclude that one type of generation of static electricity, at least, is due to the action of dipoles in fixed orientation at or near the interface of bodies in contact.

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¹ Coehn, A., *Wied. Ann.*, **64**, 217 (1898).

² Richards, H. F., *Phys. Rev.*, **22**, 122 (1923).

³ Gill, E. W. B., and Alfrey, G. F., *Nature*, **163**, 172 (1949).

⁴ Havenhill, R. S., O'Brien, H. C., and Rarkin, J. J., in "High Polymer Physics", a symposium edited by H. A. Robinson (Chemical Pub. Co., 1948).

Temperature Dependency of Half Line-Width in Ferrite

AN experimental investigation of half line-width in ferromagnetic resonance absorption at various temperatures has been carried out by Bloembergen¹, using some ferromagnetic metals. The results were compared with the theory by Van Vleck².

In order to clear up the real nature of half line-width in the ferromagnetic resonance experiment, it is desirable to investigate the temperature dependency of line shape in an insulator.

In the present work, half line-widths have been determined for some ferrites, $MgOFe_2O_3$, $CuOFe_2O_3$, $MnOFe_2O_3$ and $NiOFe_2O_3$, in a resonance experiment over a temperature-range of -195° to the Curie point, using thin specimens in the form of disks, and a wave-length of 3.2 cm.

The results for these materials show almost the same tendency with varying temperature; the changes of line-width for $MgOFe_2O_3$ and $CuOFe_2O_3$ only are shown in the accompanying tables.

| | | MgOFe ₂ O ₃ . Curie point, 432° C. | | | | | | | | | | | | | | | | | | |
|------------|------------------|--|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Temp. ° C. | Line-width (Oe.) | -190 | -130 | -110 | -82 | -50 | 16 | 51 | 79 | 124 | 164 | 204 | 242 | 281 | 320 | 356 | 390 | 398 | | |
| | | 840 | 680 | 640 | 588 | 502 | 435 | 388 | 338 | 316 | 270 | 240 | 200 | 160 | 157 | 118 | 98 | 97 | | |
| | | CuOFe ₂ O ₃ . Curie point, 430° C. | | | | | | | | | | | | | | | | | | |
| Temp. ° C. | Line-width (Oe.) | -176 | -145 | -122 | -99 | -87 | -65 | -50 | -20 | 20 | 62 | 102 | 110 | 147 | 210 | 260 | 310 | 362 | 400 | 410 |
| | | 800 | 700 | 609 | 550 | 520 | 482 | 465 | 420 | 350 | 315 | 258 | 265 | 240 | 200 | 190 | 170 | 137 | 122 | 122 |

separates the two. The antistatic agent limits the fields of the bodies to a short distance within the film, so that interaction of the fields is impossible and no contact potential is created within the body of the film. If, on subsequent separation, the division takes place within this section of the film, then no significant static charge results since, in effect, like materials have been separated. The more effective the antistatic agent is in limiting the field the more effective it is in reducing static charges.

Examination of the curve for potassium oleate seems to give information on the mechanism of generation of static electricity as well as that concerning antistatic action. It will be noted that considerable voltages are indicated at points where the influence of the nylon must be comparatively small. These

Generally speaking, the half line-width decreases monotonously with increase of temperature; the line-width becomes narrower at temperatures near the Curie point; afterwards the resonance suddenly disappears above the Curie point. The results are quite contrary to the case of ferromagnetic metals.

Details of the apparatus and procedure will be published in *Sci. Rep. RITU*.

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¹ Bloembergen, N., *Phys. Rev.*, **78**, 572 (1950).

² Van Vleck, J. H., *Phys. Rev.*, **78**, 266 (1950).