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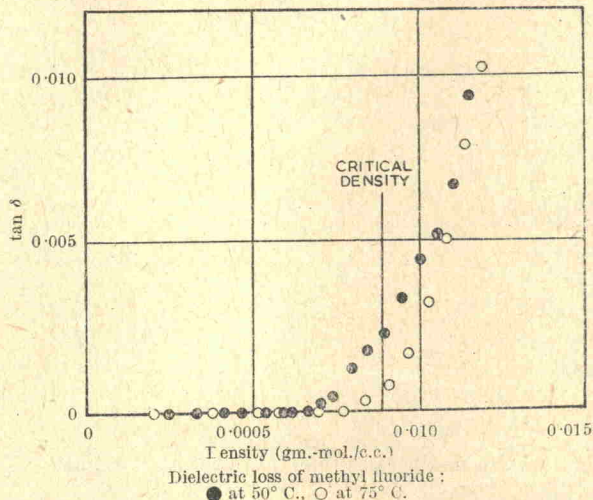
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Dielectric Loss in a Polar Gas near its Critical Point

IN the course of some measurements of the dielectric polarization of compressed methyl fluoride, we have noticed the appearance of strong dielectric absorption near the critical point. The absorption increases rapidly with the density of the gas and it rises with increasing frequency over the range we investigated (1-5 megacycles).

Using the apparatus described elsewhere¹, we have measured the loss factor at 1 Mc./s. and at the temperatures 50° C. and 75° C. The range of density covered was 0.001-0.012 moles/c.c. and the pressures were between 30 and 120 atmospheres. The critical data for methyl fluoride² are: T_c , 44.55° C.; P_c , 58.0 atm.; ρ_c , 0.00883 moles/c.c. Our results are shown in the accompanying graph, where the tangent of the loss angle is plotted against the density of the gas.

A remarkable feature of the results is the suddenness with which the dielectric loss develops as the density of the gas approaches the critical value. The absorption is almost certainly associated with the energy expended in rotating the dipolar molecules and it might be expected to conform to Debye's



theory³. The bulk viscosity of supercritical methyl fluoride is not known, but that of carbon dioxide⁴ shows no singularity at the critical density; if methyl fluoride were to behave similarly, the Debye theory would call for a monotonous variation of $\tan \delta$ with density. This is obviously not the case.

A plausible interpretation of the results is that the rapid increase in power loss is brought about by a fairly sharp transition from a state in which the ellipsoidal molecules are rotating freely to one in which they are aligned like cigars in the way that Hirschfelder and his colleagues⁵ picture them in the critical state. This sort of change would not necessarily be reflected in the bulk viscosity.

A fuller account of these measurements will be published later.

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¹ David, H. G., Hamann, S. D., and Pearse, J. F., *J. Chem. Phys.* (in the press).

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⁵ Bird, R. B., Spotz, E. L., and Hirschfelder, J. O., *J. Chem. Phys.*, **18**, 1395 (1950).