increase in temperature in the adiabatic process, the number of particles in the system increases as a result of the ionization. This effect, in turn, increases the pressure of the gas. The figure shows that at high temperatures, the pressure in an adiabatic process, computed by Eq. (9) is almost 100 times smaller than the pressure computed by the equation in which ionization has been considered. This circumstance should be very significant for the consideration of adiabatic processes in gases taking place at high temperatures.

[1] B. L. Timan, J. Exper. Theoret. Phys. USSR 27, 2 (1954)

[2] L. D. Landau and E. M. Lishitz, *Statistical Physics*, GITTL, Moscow, 1952

Translated by R. T. Beyer
144

Stable Dipole Moment of Aerosol Particles

A. A. SPARTAKOV AND N. A. TOLSTOI
Leningrad Technical Institute

(Submitted to JETP editor May 12, 1955)
J. Exper. Theoret. Phys. USSR **29**, 385
(September, 1955)

NEW methods of investigation of electro-optical phenomena in hydrophobic colloids[1,2] based on the measurement of the modulation of light passing perpendicularly to the lines of the electric field through a parallel plate condenser (Fig. 1, *b*, *c*) upon which a square-wave voltage is impressed, show that the colloidal particles in aqueous media possess a stable dipole moment of a very considerable magnitude[2]. It is assumed that this stable dipole moment is caused by spontaneous orientation of water molecules possessing a stable dipole adsorbed on the surface of the particle[2]. The unipolarity (in the mean effect) of this orientation makes it possible to treat the film of water adsorbed on the particle as a surface electret[2].

We have carried out an analogous experiment with an aerosol. Light, passing through 3–5 cm of tobacco smoke is modulated by the field of a square-wave voltage (see Figure). The modulation curve shows a periodic decrease in the transparency of the medium. This effect can be observed for any direction of polarization of light. Each reversal of the field produces a reiteration of the modulation wave. Since the field intensity E in the condenser (of the order of 300 v/cm) is of constant magnitude ($E^2 = \text{const}$), the re-orientation of smoke particles brought about by light modulation is possible only when the smoke particle is itself polar, i.e. it possesses a stable dipole moment.

The electro-optical properties of smoke may therefore be similar to those of hydrophobic colloids. It should be mentioned that, for the case of smoke, modulation of light is maintained up to much higher frequencies than is the case for an aqueous colloid. Undoubtedly, this is connected with the difference in viscosity of the respective media. It is our opinion that the origin of the stable dipole moment of smoke particles is likewise connected with the orientation of adsorbed polar molecules on the surface of particles. The influence of moisture on the magnitude of the observed effect implies that, in this case also, polar molecules of water are involved.

The establishment of polarity of smoke particles may be important in the explanation of aggregation mechanism of uncharged particles in smoke.

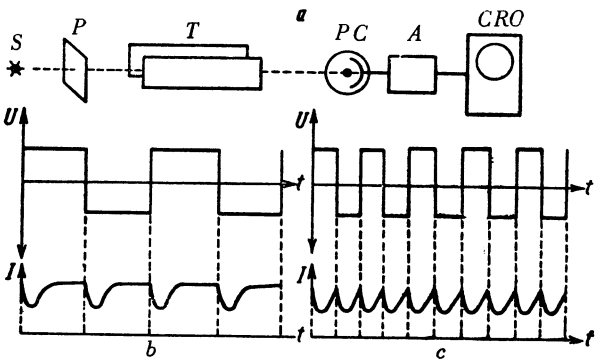

FIG. 1. *a)* Simplified diagram of the experimental setup: *S*-light source; *P*-polaroid; *T*-tank with the parallel plate condenser, filled with tobacco smoke; *PC*-photoelectric cell; *A*-amplifier; *CRO*-cathode ray oscilloscope (Russian type EO-7).

b) Modulation of light by low-frequency square-wave (10-100 cps): *U*-voltage on the condenser; *I*-intensity of passing light.

c) Modulation of light by high-frequency square-wave (~ 1000 cps).

[1] N. A. Tolstoi and P. P. Feofilov, Dokl. Akad. Nauk SSSR **66**, 617 (1949)

[2] N. A. Tolstoi, Dokl. Akad. Nauk SSSR **100**, 893 (1955)

Translated by H. Kasha
214