proportional to the rate of supply of air and spray (N). The measurements showed this to be the case.

The above deduction would only hold strictly true in case there were no recombination between salt ions and flame ions within the flame. The fact that one gets such consistent results by treating the flame conductivity and the salt conductivity as simple additive quantities would indicate that within the flame there is no recombination between the two kinds of ions.

The Optical Properties of Exceedingly Thin Films.[1]

By Wm. B. Cartmel.

THIS work which was mostly done during the summer of 1905 was undertaken to determine the behavior with regard to light of films whose thickness was very much less than a wave-length. I experimented upon five fuchsine films varying in thickness from about a wave-length to $\frac{1}{600}$ of a wave-length. Wishing to determine the thickness by other than optical means I dissolved films whose area was known, in a definite quantity of alcohol and knowing the specific gravity of solid fuchsine, I could determine from the concentration the amount of fuchsine in solution and hence the thickness of the film.

The th nnest films had scarcely a measurable absorption for any color, but the amount of light reflected could be measured with a considerable degree of precision. The changes of phase produced by the thick films I have already measured, and I am engaged in measuring this from the thinner films.

The paper contains also a theoretical discussion of the reflection and refraction by thin films.

On the Velocity of Sound in Gases at Low Temperatures and the Ratio of the Specific Heats.[1]

By S. R. Cook.

THE purpose of the experiments set forth in this paper was primarily to determine the velocity of sound in air and oxygen at temperatures at which these gases would be in their vapor condition. Greely had made a series of experiments on the velocity of sound at temperature as low as — 79° F. Within the limit of accuracy of his experiments,

[1] Abstract of a paper presented at the New York meeting of the Physical Society, Dec. 29–30, 1905.

Greely found that the velocity of sound decreased 60.3 cm. per degree centigrade and that the ratio of the specific heats was constant.

Withkowski, Stevens, Kalahne and Lonncke, all have made observations or deductions on the variation of the specific heats, with temperature and pressure, and have come to different conclusions, when the variation was carried far enough. The paper deals only with the variation of the ratio of the specific heats with the variation of temperature.

The velocity of sound was measured, at the temperature of liquid air, by the usual Kundt method. The comparison sound tube was introduced into a Dewar bulb, filled with liquid air.

The apparatus was so arranged that the direct ratio of the wave-lengths could be measured, and the ratio of the specific heat computed from the formula,

$$\nu = \nu' \rho \left(\frac{\lambda}{\lambda'}\right),$$

where ν and ν' and λ and λ' are the ratios of the specific heats, and the wave-lengths of sound, respectively, in the gas at two different temperatures; and ρ is the relative density of the gas at the respective temperatures.

A series of measurements were made on air at the temperature of liquid air, and it was shown that the velocity decreased more than could be accounted for by the relative variation in the density, in accordance with the Boyle-Gay Lussac-Avagadro law.

Oxygen, at the temperature of liquid air, was below its critical temperature, at atmospheric pressure, and the measurements were made at reduced pressure. The same tendency was observed in oxygen as in air.

When the ratio of the specific heats was determined from the simple formula above, the measurements showed, that, when these gases were in their vapor state, the ratio of the specific heats decreased slightly. The ratio of the internal to the external energy of the molecule was also computed from the data.

The simple formula for connecting the ratio of the specific heat with the ratio of energies is,

$$\beta + 1 = \frac{2}{3} \frac{1}{\nu - 1},$$

where β is the ratio of the internal to the external energies of the molecules. As ν decreased at low temperature, β increased correspondingly. Formulæ were deduced by the application of the characteristic equation of Clausius and also of Van der Waals; and applied to the computation of β. The corrections were very small, much less in fact than the probable error in the determination of β.