VISCOSITY OF LIQUID pH_2 AND oH_2

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THE viscosity of solutions of pH_2 has been measured by the method of capillary viscosimetry[1] in the temperature range 14.5-20.4°K at concentrations of 25%, 50% and 99.8% pH_2. The viscosity was computed from these data under the assumption that the coefficients of viscosity are an additive quantity for these solutions. The data on the coefficients of viscosity are given in the Table.

T, °K	$10^6 \cdot \eta_{pH_2}$	$10^6 \cdot \eta_{oH_2}$	T, °K	$10^6 \cdot \eta_{pH_2}$	$10^6 \cdot \eta_{oH_2}$
15.0	204	215	18.0	149	156
16.0	182	191	19.0	138	142
17.0	164	172	20.0	129	132

For T = 15°K, the viscosity coefficient of pH_2 was smaller by ~4.5% than that of oH_2. The difference in the viscosity coefficients decreases upon increase in temperature. The densities of these solutions were obtained from data on the molar volumes of pH_2 and oH_2.[2]

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[1] N. S. Rudenko and V. G. Konareva, ZhFKh, J. of Phys. Chem. 37, 2761 (1963).

[2] Woolley, Scott and Brickwedde, J. Res. NBS 41, 379 (1948).

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ON THE STATISTICS OF LASER EMISSION

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IT has been pointed out in a number of papers (cf. for example,[1,2]) that the coherent emission from lasers is not the same as the emission in a narrow frequency band from an extremely bright, small black body. The difference is in the statistics which describe the fluctuations of the radiation field. The characteristic property of light from a thermal source, which may be considered to be Gaussian white noise[3], is the fact that the amplitude (of the envelope) of the electric component of the light field is a Rayleigh random process. Hence measurements of the amplitude probability density provide information on the differences between laser light and Gaussian noise from thermal light sources$^{1)}$. The measurement procedure is the following.

Two light sources $E_1(t)$ and $E_2(t)$, at distinct frequencies f_1 and f_2, are incident on a photocathode which heterodynes the two signals. The beat signal $I(t)$ at frequency $\Delta f = f_1 - f_2$, has an amplitude $B(t)$ which is proportional to the product of amplitudes $A_1(t)$ and $A_2(t)$ of the incident light signals. This beat signal is applied to an amplitude analyzer which measures the amplitude distribution function $W(B)$. For two light beams with completely correlated amplitude fluctuations ($A_1(t) = cA_2(t)$) the amplitude distribution of the beat signal $W(B)$ is related to the amplitude distribution $w(A)$ of the incident light beams by the expression

$$W(B) = (B/c)^{-1/2} w[(B/c)^{1/2}]. \qquad (1)$$

When the two Gaussian light beams (for which $w(A)$ is the Rayleigh distribution) are mixed we have

$$W(B) = \psi^{-1} \exp(-B/2c\psi), \qquad \psi = \overline{A_1^2}/2 \qquad (2)$$

For the case of mixing two light beams with Gaussian amplitude fluctuations $A(t) = A_0(1 + \alpha(t))$ ($\bar{\alpha} = 0$, $\overline{\alpha^2} = \sigma$) we have

$$W(B) = (2\pi B\psi\sigma^2/c)^{-1/2} \exp\left[-\left(\sqrt{\frac{B}{2c\psi}} - 1\right)^2 \Big/ 2\sigma^2\right]. \qquad (3)$$

The experimental set-up is shown in Fig. 1. To obtain two light beams with different frequencies but with correlated amplitude fluctuations we used

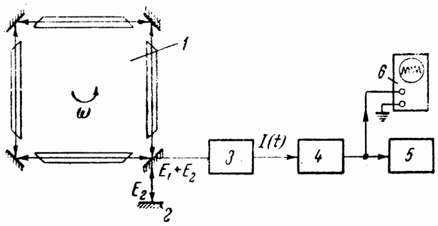

FIG. 1. Experimental set-up: 1) ring laser, 2) mirror, 3) photodetector, 4) amplifier, 5) amplitude analyzer, 6) oscilloscope.