in the gas, to decide whether the rate of dissociation corresponds to either one of these limiting cases or has some intermediate value.

Calculation of $d\rho/dp$

Symbols used:

T = absolute temperature.
p = pressure of nitrogen peroxide in mm mercury.
p_1 = pressure of air in mm mercury.
V = volume in cc of 92.08 grams nitrogen peroxide at p.
V_1 = volume in cc of 28.97 grams air at p_1.
d = density of nitrogen peroxide compared with air, at T and p.
$\rho = \frac{92.08}{V}$ (density of nitrogen peroxide, in grams per cc).
$\rho_1 = \frac{28.97}{V_1}$ (density of air in grams per cc).
R = 62340.
$\alpha = 92.08/28.97d - 1$ ("degree of dissociation").
c'_v = sp. heat per formula weight, at constant volume, of NO_2.
c''_v = sp. heat per formula weight, at constant volume, of N_2O_4.
$c_v = \frac{(1-\alpha)c''_v + 2\alpha c'_v}{1+\alpha}$
κ_1 = 1.405 (Ratio of specific heats at constant pressure and constant volume for air).
K = dissociation constant of nitrogen peroxide, defined by $\frac{4\alpha^2}{V(1-\alpha)} = K$.
h = heat given out, in cal., when N_2O_4 changes to $2NO_2$ at constant volume.
λ = wave length in cm of stationary sound waves in nitrogen peroxide.
λ_1 = wave lengths in cm of stationary sound waves in air.
ν = no. of vibrations per second of rod forming sound waves.

Calculation of $\frac{d\rho}{dp}$ from wave lengths. From the formulae for the velocity of sound.[1]

$$\frac{d\rho}{dp} = \frac{\text{const.}}{\lambda^2\nu^2},\quad \frac{d\rho_1}{dp_1} = \frac{\text{const.}}{\lambda_1^2\nu^2},$$

$$\frac{d\rho}{dp} = \frac{\lambda_1^2\rho_1}{\lambda_1^2 p\kappa_1}. \tag{1}$$

This gives an experimental method for determining $\frac{d\rho}{dp}$

[1] Clausius: Mech. Wärmetheorie, p. 52 (1876).