

Homogeneous Dissociation of Hydrogen Molecules by Collision with Positive Ions

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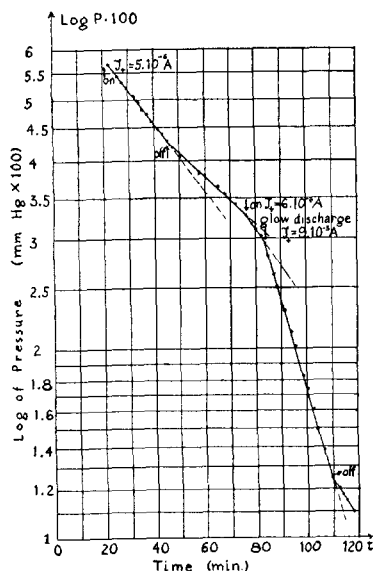


Fig. 2.

Finally to discover the described effect we had to choose the conditions (gas pressure, temperature of the source) so as to make the thermal dissociation on the source and the corresponding clean-up a minimum in comparison with the additional homogeneous effect. One must also remember, that the clean-up process of H atoms, generated only by thermal dissociation does not follow a linear, but rather a logarithmic law. Therefore, to find the additional clean-up due to the action of ions, and to calculate the efficiency of an ion, we must plot $\log p$ against t , and not simply p against t . In doing so with a part of curve (I) in Fig. 3 of the article of Kunsman and Nelson we get the curve, shown on Fig. 2 of the present article. Here we can see a rather marked increase of the clean-up rate at the time the field was turned on, and a slowing up of the clean-up at the time the field was turned off. Probably in this experiment of Kunsman and Nelson there happened to exist a sufficient coincidence of the required experimental conditions.

It appears therefore, that the experiments of Kunsman and Nelson do not entirely contradict our explanation of the effects we have observed, but on the contrary, seem, in part, to prove the correctness of our experiments.

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May 17, 1935.

¹ Leipunsky and Schechter, *Zeits. f. Physik* **59**, 857 (1930); Schechter, *Zeits. f. Physik* **75**, 671 (1932); Semenov and Schechter, *Nature* **126**, 436 (1930).

² F. Fedoroff, Mochm. Roginsky and Schechter, *Bildung von NH₃ durch Stoss positiver Ionen*, Comptes rendus de l'Académie de Sciences de l'URSS, 1934, p. 367.

³ Mitchell, *J. Frank. Inst.* **210**, 269 (1935).

⁴ Kunsman and Nelson, *J. Chem. Phys.* **2**, 752 (1934).

Index of Refraction of HCl from 1 to 10 μ

In view of the recent discussion in the literature concerning the effective charge of HCl,^{1,2} we believe it advisable to communicate immediately the results we have obtained from dispersion measurements between 1 and 10 μ . The dispersion curve is matched best by using a value of $1.00 \cdot 10^{-10}$ e.s.u. for the effective charge of the rotator-vibrator, and a value of $1.18 \cdot 10^{-18}$ e.s.u. for the electric moment of the rotator. The values for the effective charge and the electric moment are not mutually dependent to any great extent since the contribution of the pure rotation in the region near the rotation-vibration band is small, and *vice versa*. The uncertainty in the value of the effective charge of the rotator-vibrator is less than five percent. The value of the effective charge for the rotator-vibrator is in good agreement with Bourgin's³ result obtained from measurements of the absorption intensities in the band at 3.46 μ .

Beyond about 4.5 μ , the contribution of the rotator to the index of refraction exceeds that of the rotator-vibrator, and at 10 μ the effect of pure rotation is nearly as great as that of the rotator-vibrator as near the 3.46 μ absorption band as we could accurately measure it. The measurements between 5 and 10 μ thus afford an excellent check of the negative terms of the Kramers dispersion formula, since the majority of the molecules are in excited states and the number in each state can be accurately computed. If the negative terms are omitted and a reasonable value of the electric moment is used, one obtains by computation a contribution due to pure rotation which is more than twice as large as that obtained by experiment.

The value of the electric moment required to match the dispersion measurements is slightly larger than the value obtained by Zahn⁴ ($1.034 \cdot 10^{-18}$ e.s.u.) from dielectric constant measurements. This indicates that the low intensities obtained by Badger⁵ and by Czerny⁶ for the pure rotation spectrum are to be explained by the extreme difficulty of making absolute intensity measurements, especially in the far infrared. A complete report of the work will be published shortly.

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The University of Wisconsin,
Madison, Wisconsin,
May 18, 1935.

¹ E. C. Kemble, *J. Chem. Phys.* **3**, 317 (1935).

² R. S. Mulliken, *J. Chem. Phys.* **2**, 400, 712 (1934).

³ D. G. Bourgin, *Phys. Rev.* **32**, 237 (1928).

⁴ C. T. Zahn, *Phys. Rev.* **24**, 400 (1924).

⁵ R. M. Badger, *Proc. Nat. Acad. Sci.* **13**, 408 (1926).

⁶ M. Czerny, *Zeits. f. Physik* **34**, 227 (1926).

An Attempted Concentration of the Heavy Nitrogen Isotope

Urey and Greiff¹ have theoretically demonstrated that isotopic exchange reactions might be used for the separation or concentration of some of the isotopes of the lighter elements. The isotopic reaction,

