

LETTERS TO THE EDITOR

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EXCITATION OF LIGHT EMISSION FROM QUARTZ UNDER IMPACT WITH CANAL-RAYS OF HYDROGEN AND NITROGEN

EXCITATION has been observed with canal-rays of nitrogen and hydrogen of different energies lying between 4-12 kV., with time of exposure of 2 hours each. The discharge tube used is 3.5 cm. in diameter, with a canal of moulded aluminium 0.7 cm. in length and 0.2 cm. in diameter. The quartz window is fixed to the observation chamber of the discharge tube, at a distance of 5.0 cm. from the canal in such a manner as to make an angle of about 45° with the axis of the tube. Direct light from the canal-ray beam was eliminated by suitable precautions. For lower voltages, the intensity of the light given out by the bombarded portion of the window is very feeble. Visually the light given out appears to be predominantly rose-red in colour (in the case of canal-rays of hydrogen) with a tinge of greenish-blue. In the case of bombardment with canal-rays of nitrogen the greenish-blue colour is more prominent.

In the case of excitation by canal-rays of hydrogen, in addition to the atomic and molecular spectra of hydrogen, three groups of lines

lying approximately at λ 2870, 2150, 2210 are observed. The lines belong either to silicon or oxygen (or both). OI and SiII have nearly identical spectra in this region. The resolving instrument used is not qualified to allow a definite conclusion as to the emitter. The same lines are also obtained when the excitation is brought about by canal-rays of nitrogen.

Much more interesting is the remarkable change obtained in the intensity distribution of the hydrogen continuum, observed when the canal-rays of hydrogen are used for the excitation. Figs. 1 and 2 give the relative intensity distributions in the continuum here obtained and that observed with canal-rays of hydrogen when care is taken to eliminate the fluorescent light from the quartz window. The relative intensity distribution curve in the former case, shows two distinct maxima in the regions λ 4000 and λ 3200 with a shallow minimum in between the two, at about λ 3600. The maximum at λ 4000 can perhaps be seen with low intensity but the one at λ 3200 or the minimum at λ 3600 are certainly absent in Fig. 2. The fact that, with excitation by canal-rays of nitrogen, only the above three characteristic groups of lines are obtained, without the presence of the continuum shows that quartz

H β λ 2870 2510 2210
| | | |



Excitation of quartz by H₂ canal-rays of 8 kV.

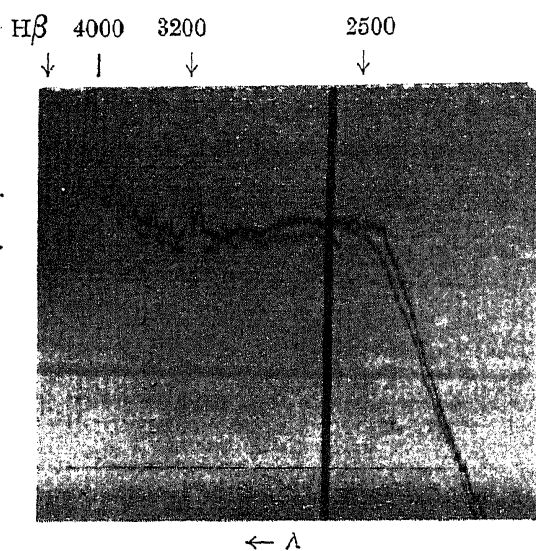


FIG. 2

The pure hydrogen canal-ray spectrum

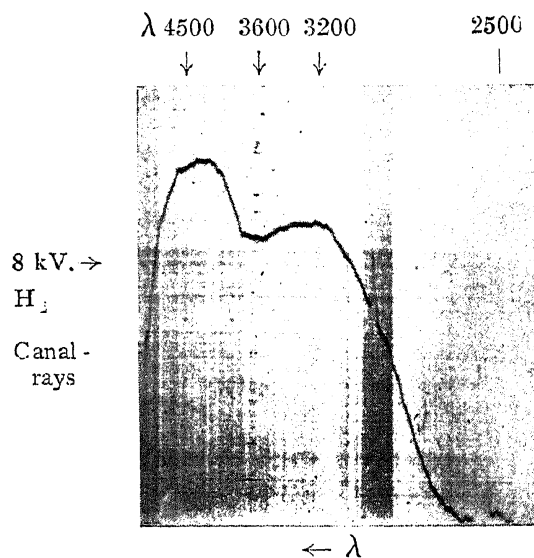


FIG. 1

Excitation of quartz by canal-rays of hydrogen

itself does not emit a continuum, and the continuum observed must therefore be ascribed to hydrogen itself. This conclusion finds some support in the observation of Goldstein¹ that the colour of the fluorescence produced under impact with canal-rays depends on the chemical nature of the canal-rays themselves.

The peculiar change observed in the intensity distribution must therefore be ascribed, either to an overlapping of the usual continuum by some other spectrum characteristic of hydrogen, excited under conditions here obtaining, or to an effect of the type described by Smith³ brought about by the presence of foreign gases. It may be interesting to note here, that Wien² had found a minimum in the intensity distribution of the continuous spectrum emitted by canal-rays of hydrogen at about λ 4000. It is still obscure under what conditions this minimum obtains, for it has been observed only in one other case, by Herzberg,⁴ in the case of an electrodeless discharge in hydrogen. The minimum observed in the experiments here described, lies at λ 3600, which is sensibly different from the value given by Wien. There

is a continuous spectrum observed by Herzberg and Brasefield⁵ extending from roughly H β to H γ with a maximum of intensity in between, obtained at extremely low pressures (\sim 0.0005 mm. Hg.). The presence of this spectrum, at the pressures here used (0.01 mm. Hg.) appears somewhat unlikely and secondly an overlapping of the usual molecular spectrum by the Herzberg-Brasefield continuum will not explain the observed intensity distribution. As for the other possibility, *viz.*, the effect of the presence of oxygen and silicon, on the intensity distribution of the continuous spectrum of hydrogen, there are unfortunately no available data on the subject.

The positions of the maxima and the minimum, in the intensity distribution here observed, do not show any appreciable dependence on the energy of the exciting canal-rays (for the range of energies here used). The relative values of the maxima, on the other hand, vary sensibly with the energy.

I take this opportunity to offer my grateful thanks to Prof. Dr. Asundi for his kind interest in the investigation, and to Dr. Nawazish Ali,

Muslim University, Aligarh, for kindly taking the microphotographs.

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¹ W. Wien, 'Kanalstrahlen', *Handbuch der Experimental Physik*, 1927, Band 14, 443.

² *Ibid.*, p. 693.

³ N. D. Smith, *Phys. Rev.*, 1936, 49, 345.

⁴ G. Herzberg, *Ann. d. Physik.*, 1927, 84, 553.

⁵ W. Finkelnburg, 'Kontinuierliche Spektren' *Struktur und Eigenschaften der Materie*, Band 20, Julius Springer, 1938, p. 184.

GRAVIMETRIC DETERMINATION OF MANGANESE WITH 8-HYDROXY- QUINOLINE

BERG¹ showed that manganese could be precipitated quantitatively by means of 8-hydroxyquinoline ("Oxine") as a dull yellow crystalline compound with the composition $Mn(C_9H_6ON)_2 \cdot 2H_2O$. The precipitation was carried out either from (1) a neutral or weakly acid solution containing sodium acetate and a small amount of sulphite or hydroxylamine by adding an excess of an alcoholic solution of the reagent, or (2) from a mineral acid solution containing an excess of an acetic acid solution of the reagent by adding dilute ammonia until weakly alkaline. The precipitates obtained by both methods, however, could not be satisfactorily dried to constant weight since at 110° C. drying was very slow and above this temperature appreciable decomposition occurred. The gravimetric determination was, therefore, carried out by Berg (*loc. cit.*) by igniting the precipitate to the oxide, Mn_3O_4 with oxalic acid and weighing.

Raikow and Tischkow² showed that the composition of the ignited tetroxide depends on the temperature and the nature of the atmosphere surrounding the precipitate during the ignition. Further the procedure adopted by Berg for the gravimetric determination suffers from the fact that no advantage is taken of the precipitation

of manganese as the heavier oxyquinolate molecule.

During the present investigation it was found that the heat stability of the precipitates during drying depended considerably on the method of precipitation. While precipitates obtained by Berg's first method were easily decomposed at temperatures higher than 110° C., those obtained by the second method were quite stable at temperatures as high as 150–170° C. Prolonged drying (20 hours) at 150° C. did not produce any decomposition in a large number of cases studied with amounts of manganese varying from 0.3 to 60 mg. In a few cases, however, a slight superficial discolouration of the precipitates was observed but this was not even when dealing with the small amounts of manganese. It was also found that discolouration did not occur when the drying was carried out in the presence of sulphurous acid. The temperature (170° C.) at which the precipitates were quite stable and no weight loss was appreciable. A temperature of 150° C. was, however, considered to be the most suitable for drying. Constant weight of the precipitates was attained in two to three hours at this temperature and the composition of the dried precipitates corresponded to $Mn(C_9H_6ON)_2$ containing 16.03 per cent. manganese.

The influence of large amounts of ammonium chloride, sodium chloride and ammonium oxalate, as occur in the filtrate from "lime and strontia" in rock analysis, on the precipitation of manganese was also studied with a view to adapt the "oxine" method for the precipitation of magnesium and residual manganese in rock analysis. It was found that both manganese and magnesium could be precipitated together quantitatively adopting Berg's second method provided ammonium salts, and oxalic acid which interfered with the precipitation of magnesium as the oxyquinolate, were removed by the nitric acid method.^{3,4} The precipitates thus obtained were dried to constant weight at 150° C. and weighed. To determine the manganese in these precipitates, the weighed