[CONTRIBUTION FROM THE CHEMICAL LABORATORY OF HARVARD UNIVERSITY]

THE TRANSMISSIONS OF THE OLDENBERG CHLORINE FILTER FOR λ 2537

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RECEIVED APRIL 6, 1926 PUBLISHED JULY 6, 1926

As λ 2537 of the mercury spectrum is quite active photochemically, it is desirable to have a filter which would transmit this line alone and separate the rest of the ultraviolet radiation which is emitted by a quartz mercury lamp. For this purpose Peskov[2] measured the extinction coefficients of chlorine and bromine by microscopic densitometry and calculated therefrom the optimum concentrations (Br_2, 0.0046 *M;* Cl_2, 0.176 *M*—about 4 atm.) for a monochromatic filter. As bromine[3] absorbs λ 2537 appreciably, Oldenberg[4] used a filter containing pure chlorine at a pressure of 6.5 atmospheres and this absorbs the lines from 2654 to 4078 Å., inclusive. Quantitative information concerning the transmissions of such a filter is desirable and so I have measured the absorptions by the method of photographic photometry.

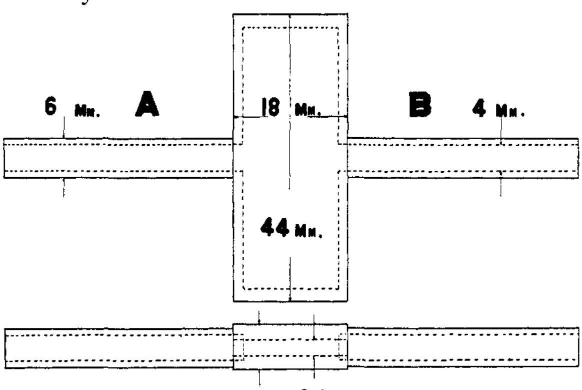

Fig. 1.

The filter was made as follows. Along the edge of a clear Vitreosil plate 44 × 18 × 2.5 mm. was fused a quartz ribbon about 2 mm. thick and to the top of this was sealed another plate of equal size. To appropriate places on opposite edges where some of the ribbon had been omitted, 4mm. quartz tubing was connected (Fig. 1). This quartz work was done by the Macalaster Bicknell Company. The walls of the quartz tubing near the cell were thickened at A and B and the end B was joined to a long tube,

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[2] Peskov, *Z. wiss. Phot.*, **18**, 235 (1919); *J. Russ. Phys.-Chem. Soc.*, **47**, 918 (1915).

[3] Coehn and Stuckardt, *Z. physik. Chem.*, **91**, 722 (1916).

[4] Oldenberg, *Z. Physik*, **29**, 328 (1924).

the other end of which was connected by a DeKhotinsky seal to a small chlorine tank kept at the constant temperature of 15°. To displace the air, chlorine was passed through the cell which was then sealed off at A. The valve was opened and closed, and after being immersed in liquid nitrogen the cell was sealed off at B. Liquid chlorine was present in the completed filter at room temperature, because it had condensed into the cell from the long delivery tube during the sealing operation. The drops disappeared at a temperature of 47.1° (corresponding to a pressure of 13.8 atm.). The cell was heated successfully to 90° without explosion.

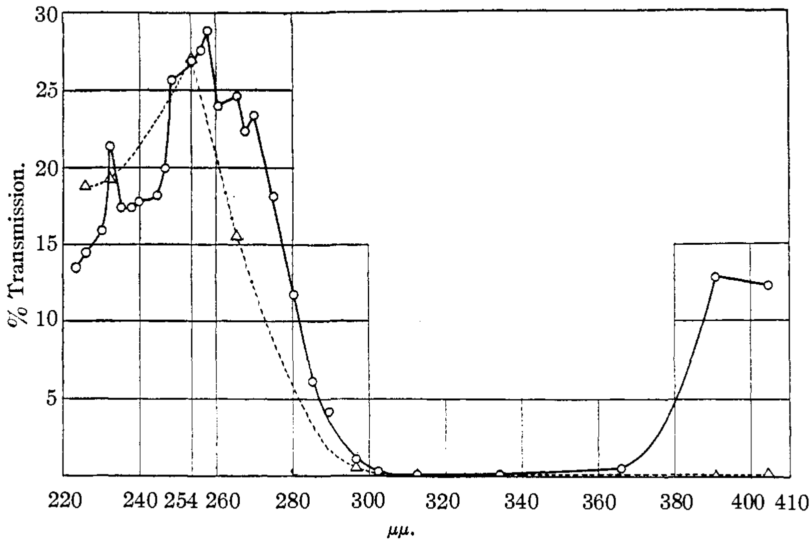

Fig. 2.———— Oldenberg filter. Average depth of Oldenberg filter = 0.21 cm. - - - - Calculated transmissions of a similar Peskov filter. Concn. of Cl_2 = 0.269*M* (19.0°).

The method of photographic photometry used was that developed by Harrison.[5] Nine exposures of equal time intervals were made on the same plate and the intensity I of the light was varied by inserting in the light path oscillating calibrated screens or the chlorine filter. From the D-log I characteristic curve for each wave length and the D (density of the negative) corresponding to the chlorine filter can be calculated $-\log I/I_0 = A$, from the latter the per cent. transmission T. Table I gives values of A and T for wave lengths between 2232 and 5461 Å. In Fig. 2, T is plotted against λ. The dotted curve represents the calculated transmissions of a Peskov filter of such thickness (0.584 cm.) as to give the same transmission of λ 2537 as the Oldenberg filter I used. A comparison of the two curves indicates that the Peskov filter is more nearly monochromatic.

[5] Harrison and Hesthal, *J. Optical Soc. Am.*, **8**, 471 (1924). Harrison, *ibid.*, **10**, 157 (1925); **11**, 113 (1925); *Phys. Rev.*, **24**, 466 (1924).

Table I

Transmissions of Oldenberg and Peskov Filters

λ	A_1	A_2	A_{Av}	T_0	T_P
2232	0.85	0.89	0.87	13.5	
2259	.81	.86	.84	14.5	18.8
2302	.79	.80	.80	15.9	
2323	.66	.68	.67	21.4	19.24
2352	.75	.77	.76	17.4	
2378	.74	.77	.76	17.4	
2399	.74	.76	.75	17.8	
2447	.74	.74	.74	18.2	
2464	.68	.71	.70	20.0	
2482	.58	.59	.59	25.7	
2537	.57		.57	26.9	27.0
2560	.56	.55	.56	27.6	
2576	.53	.55	.54	28.9	
2603	.62	.62	.62	24.0	
2653	.58	.63	.61	24.6	15.53
2675	.66	.63	.65	22.4	
2699	.62	.64	.63	23.4	
2752	.74	.74	.74	18.2	
2804	.93	.93	.93	11.8	
2853	1.15	1.26	1.21	6.17	
2894	1.36	1.39	1.38	4.17	
2967	1.93	1.96	1.95	1.12	0.52
3024	2.54	2.57	2.56	0.28	0.04
3128	>3.42	>3.42	>3.42	< 0.04	0.00
3341	>2.95	>3.02	>2.99	< 0.10	
3660	2.31	2.28	2.30	0.50	0.01
3907	0.90	0.87	0.89	12.9	
4047	.77	1.04	.91	12.3	0.06
4354					0.89
4938	.56	0.64	.60	25.2	
5461	.43	.42	.43	37.2	

A_1 = —log I/I_0 for exposure No. 1.
T_0 = % transmission of Oldenberg filter.
T_P = calcd. % transmission of Peskov filter.
d = 0.21 cm. = thickness of Oldenberg cell.
C = 0.269 M = concn. of chlorine in cell at temp. at which measurements were made (19.0°).

I wish to acknowledge my indebtedness to Dr. J. B. Green of the Jefferson Physical Laboratory, Harvard University, who checked the values of the wave lengths recorded on the photographs.

Summary

The transmissions of the Oldenberg chlorine (6.45 atm. or 0.269 M) filter are given for wave lengths between 2232 and 5461 Å. and compared with those of a Peskov filter (Cl_2, 0.176 M + Br_2, 0.0046 M). The former filter is more readily made but the latter is more nearly monochromatic.

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