

Physics. — *Vapour tensions of liquid ethylene.* By C. A. CROMMELIN and H. GARFIT WATTS. (Communication N^o. 189*b* from the Physical Laboratory at Leiden.) (Communicated by Prof. W. H. KEESOM).

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§ 1. *Introduction.* The critical pressure and temperature of ethylene have been measured by CARDOSO and ARNI ¹⁾ (50.65 atm. and 9°.50 C. respectively); vapour pressures between —103° and —150° C. were determined by HENNING and STOCK ²⁾ with an accuracy of 0.1 mm. But between the critical point and boiling point so far only VILLARD's ³⁾ figures were known, which did not give a greater accuracy than 0.1 atm. The determination of the densities of the liquid and of the saturated vapour ⁴⁾ furnished the opportunity (while also rendering it essential) for making a new series of determinations of vapour pressure, the results of which are given in this paper.

§ 2. *Apparatus.* Pressures above 20 atm. were measured with the closed hydrogen manometer ⁵⁾, those above 20 atm. with an open standard manometer ⁶⁾. The ethylene was compressed and liquefied in a small reservoir provided with an electro-magnetic stirrer.

Measurements above —20° C. were made in a bath of liquid ethyl-chloride, those below this temperature in a bath of liquid methyl-chloride. The temperatures of the ethyl-chloride were determined by means of two mercury thermometers, those of the methyl-chloride by two platinum resistance thermometers.

§ 3. *Purity of the ethylene.* Our ethylene was prepared from alcohol and sulphuric acid; it was then lead through a spiral cooled in solid carbonic acid and alcohol (\pm —90° C.) and finally solidified in a glass bulb plunged in liquid air, after which the volatile impurities (e.g. air) were very thoroughly expelled with a diffusion pump; after partial heating the middle portion was pumped off, the less volatile constituents remained

¹⁾ E. CARDOSO and E. ARNI, Journ. de chim. phys. **10** (1912) p. 504.

²⁾ F. HENNING and A. STOCK, Zeitschr. f. Phys. **4** (1921) p. 226.

³⁾ P. VILLARD, Ann. d. Chim. et de Phys. (7) **10** (1897) p. 387.

⁴⁾ E. MATHIAS, C. A. CROMMELIN and H. GARFIT WATTS, These Proceedings, p. 1054, Comm. Leiden N^o. 189*a*.

⁵⁾ Comm. Leiden, Nos 78, 97, 118, etc.

⁶⁾ Comm. Leiden, Nos 44 and 146.

behind in the last fraction. This treatment was repeated three times. The gas thus purified was then compressed in a small steel cylinder.

§ 4. *Accuracy.* The mercury thermometers were standardized in the Physikalisch-Technische Reichsanstalt within an accuracy of 0.01 degree; the platinum thermometers were compared with the helium thermometer within an accuracy of 1/50 degrees. At points 6, 7 and 9 the difference in indication of the two platinum thermometers was less than 0.01 degrees, at points 8 and 10 this difference was 0.03 degrees. The accuracy of the pressure measurements may be taken at about 1/4000.

§ 5. *The results* are given in the table below. The temperatures are given in Kelvin degrees on the Celsius scale, and on the absolute scale, where $-273^{\circ}.09$ C. is taken as the absolute zero. The pressures are given in international atmospheres (1 int. atm. = 75.9529 local cm at Leiden).

N ^o .	θ	T	p (int. atm.)
1	+ 7.90 C.	280.99 K.	48.162
2	0.00	273.09	40.276
3	- 7.54	265.55	33.923
4	-10.01	263.08	31.971
5	-20.01	253.08	24.905
6	-30.53	242.56	18.851
7	-41.01	232.08	13.907
8	-52.09	221.00	9.774
9	-60.90	212.19	7.206
10	-69.27	203.82	5.259