Compounds of the Halogens with each other, and with the Halogen Hydrides.-- By Keith Huestis Butler, M. A. and Douglas McIntosh, M. A., D. Sc., Dept. of Chemistry, Dalhousie University, Halifax, N. S.

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During the study of the rise in boiling points of substances dissolved in liquefied chlorine, the ebuilloscopic constant for bromine was found to be much higher than for other sub-stances. This may be due to dissociation of the bromine molecule, although the solution exhibited no electrical conduction, or to deviations from Raoult's law, due to combinations between solvent and solute. On this account, and in an effort to complete the studies made of the two component systems of the halogens and halogen hydrides, we have examined the freezing-point curve of the system cholorine-bromine. The results are given in this paper and show that combination does not take place.

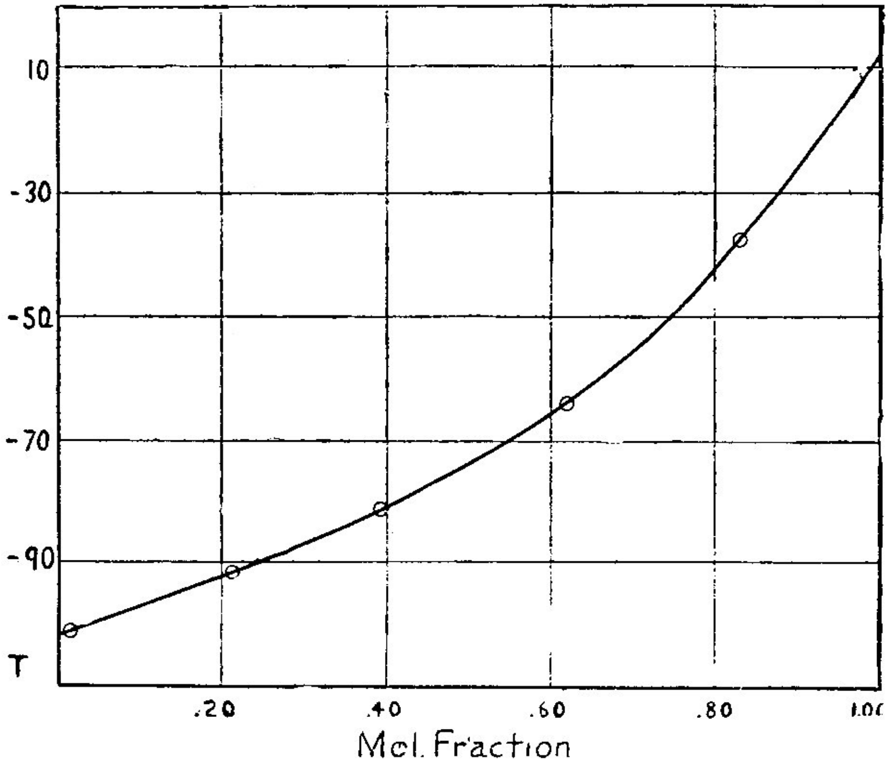
Of the many investigations undertaken on this subject, the following may be briefly mentioned; Chlorine and hydrogen chloride; no compounds (Maass and McIntosh). Bromine and hydrogen bromine; no combination (Buechner and Karsten). Iodine and hydrogen iodine; no compounds (Beckmann and Wentig and Maass and McIntosh). Chlorine and iodine; two compounds, ICI and ICI^3 (Stortenbeker). Bromine and iodine; no compounds[1]. Bromine and chlorine; no compounds (Butler and McIntosh). It should be possible by the aid of the electron theory of valence to fix the constitutions of these few compounds, and to obtain a better knowledge of the interaction of halogens and organic substances.

In view of the few combinations formed it is not without interest that the ions of the halogens seem particularly active in forming compounds with the halogens. Potassium iodide dis-

1 Recent work by Mueller, Bodenstein and Schmidt indicates the existence of compounds of these two halogens at high temperature.

solved in water apparently unites with iodine to form KII^2, and probably other compounds act in a similar way. (Jakowkin).

Experimental. The apparatus consisted of a vacuum jacketed freezing-point tube with a stirrer and platinum resistence thermometer, and a Leeds and Northrup potentiometer. Temperatures could be determined to one-tenth of a degree.



The solutions were cooled with a mixture of solid carbon dioxide and ether, so arranged that it could be evaporated under reduced pressure, and temperatures as low as —105°C obtained.

The results are given in the table and shown on the curve. Apparently there is no maximum point, the freezing temperature changing gradually from that of bromine to chlorine, indicating that no compounds are formed. This conclusion is in agreement with the views of Berthelot, LeBeau and Karsen, but is opposed to the work of Thomas and Depuis.

Finally, it is difficult to explain the combination of iodine with three atoms of chlorine, and the iodine ion with two atoms of iodine by the electron theory.

Mol. Fraction, Bromine.	Freezing Temperature.	Mol. Fraction Bromine.	Freezing Temperature.
0.000	–101.5	0.508	– 72.7
0.012	–101.0	0.554	– 69.2
0.025	–101.3	0.566	– 67.3
0.049	–101.0	0.614	– 63.9
0.102	– 98.2	0.621	– 62.5
0.135	– 97.0	0.657	– 59.0
0.172	– 94.8	0.673	– 57.6
0.216	– 92.2	0.704	– 53.7
0.262	– 90.2	0.705	– 53.6
0.305	– 86.7	0.733	– 51.4
0.332	– 86.0	0.745	– 49.3
0.363	– 83.3	0.763	– 46.3
0.384	– 82.3	0.775	– 45.6
0.394	– 81.3	0.798	– 40.5
0.399	– 81.0	0.820	– 36.6
0.436	– 79.4	0.852	– 30.8
0.463	– 77.0	0.931	– 22.8
0.477	– 74.4	0.944	– 21.1
0.486	– 74.7	0.983	– 12.4
0.504	– 73.4	1.000	– 8.1