

Each condenser may be moved vertically two or three inches without interfering with the flow of water. When in use the condenser is supported by the Soxhlet apparatus; when not in use the side tube resting upon the upper board supports it. (The condensers here shown have already been described in detail.)¹

Several hundred fat extractions have already been made with this apparatus using the electric lamp as a source of heat. It is regularly allowed to run over night and has given perfect satisfaction. Wherever a suitable electric current can be had the incandescent lamp will certainly be found preferable to the gas flame for use in ether extraction, and not only on account of its safety but also because of its greater simplicity, constancy, cleanliness, and convenience.

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[CONTRIBUTION FROM THE HAVEMEYER LABORATORIES OF COLUMBIA
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CLASSIFICATIONS OF THE CARBIDES: THEIR MODES OF FORMATION, AND REACTIONS OF DECOMPOSITION.²

By J. A. MATHEWS.

Received April 19, 1899.

DURING the preparation of an extended "Review and Bibliography of the Metallic Carbides,"³ the author examined with great care the literature bearing upon the chemistry of the carbides. References dating back to 1800 were examined and continuing down to the present, the bulk of the literature being confined to a portion of the present decade. It was found that a great many gaps exist in regard to the details concerning not only the methods of formation and properties, but also concerning the composition of certain compounds which have been from time to time described as binary compounds of carbon with a metal. A great deal of the earlier work seems to be inaccurate, and recent work along this line has not confirmed the existence of some of these earlier described compounds. Enough data has been obtained to warrant the preparation of a fairly thorough classification of these inter-

¹This Journal, 20, 965 (1898).

²Read at the meeting of the New York Section of the American Chemical Society, April 7, 1898.

³Smithsonian Miscellaneous Collections, No. 1090, Washington, D. C., 1898.

esting compounds. The information obtained by reviewing all this mass of literature upon the carbides has been condensed, and is here presented in three tabular statements. The first table is a classification of all the known carbides with their formulas so far as is possible. Doubtful ones are included, but the doubt is indicated by a question mark. In the first and second columns of this table all carbides which have not been made in the electric furnace are bracketed. The classification is based (1) upon the general mode of formation, and (2) upon some distinctions in regard to their decomposition with water or hydrochloric acid. The metals entering into the carbides are classed according to their periodic relations.

Following this table the various modes of formation are classified, and the carbides which have been made by each method are grouped. The last classification is based upon typical decompositions, those reacting in the same manner toward a given reagent being grouped together.

The question marks inserted throughout these three tables suggest many interesting subjects for research and investigation. Perhaps thus calling attention to them will result in some of the uncertain points being cleared up and the gaps in our positive knowledge filled.

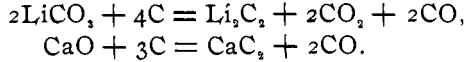
I. CLASSIFICATION OF THE CARBIDES.

Per- odic group.	Formed in dry way by heat.		Formed in wet way.
	Decomposed by H ₂ O.		Decomposed by H ₂ O.
	Decomposed by fusion with caustic and by powerful oxidation. Mostly burn in halogen gases at moderate temperatures.	Not decomposed	Decomposed by HCl. Explode at low heat.
I.	Li ₂ C ₂ , [Na ₂ C ₂ , NaHC ₂ , K ₂ C ₂]	[Ag ₂ C ₂ , Ag ₄ C, Ag ₂ C]	Cu ₂ C ₂ , H ₂ O, Ag ₂ C ₂ , H ₂ O Au ₂ C ₂ , H ₂ O? HgC ₂ .xH ₂ O
II.	[MgC ₂ ?] CaC ₂ , BaC ₂ , SrC ₂ , Be ₂ C ₃ (or Be ₃ C)	Zn?	
III.	Al ₄ C ₃ , YC ₂ , LaC ₂ , ThC ₂	B ₆ C, B ₂ C ₃	
IV.	[CeC ₃] Ce ₂ C	CSi [C ₃ Si], TiC ZrC, ZrC ₂ [Pb?]	
V.		VaC	
VI.	U ₂ C ₃	Cr ₃ C ₂ , [Cr ₄ C], Mo ₂ C, W ₂ C	
VII.	[MnC, Mn ₂ C] Mn ₃ C		
VIII.		[Fe ₂₄ C [?] , Fe ₃ C [?] , Fe ₄ C, Fe ₂ C ₃ , Fe ₃ C] Fe ₃ C [Ni and Co?] [IrC ₄ ?] [Pd?] [PtC ₂ ?]	

NOTE.—Peculiar double compounds, difficult to classify, find mention in chemical literature; *e. g.*, Al₃C₂B₄₈, 3CbC₂.2CbN, Fe₇(CrMo)₈C₄, Fe₇(CrW)₈C₄, Cr₂Fe₇C₃, Cr₃FeC₂, PtS₂C, Si₂AlC₇, Si₄C₄S, Ti₁₀C₂N₈.

II. REACTIONS OF FORMATION OF METALLIC CARBIDES.

1. From oxides or carbonates of metals heated with carbon in the electric furnace.



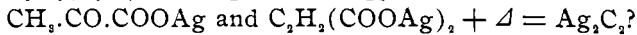
By parallel reactions are also formed the carbides of aluminum, barium, glucinum, boron, calcium, cerium, lanthanum, lithium, manganese, molybdenum, silicon, strontium, thorium, titanium, tungsten, uranium, vanadium, yttrium, and zirconium.

2. Directly from the metals and carbon, $2\text{K} + 2\text{C} = \text{K}_2\text{C}_2$, and similarly, in the electric furnace, carbides of aluminum, boron, chromium, and iron, also at lower temperatures it has been said that carbides of silver, copper, and nickel result, also the carbides of iron in the production of iron and steel.

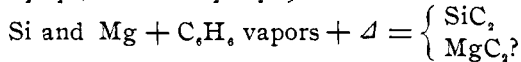
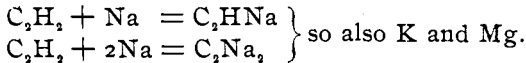
3. By the decomposition of certain organic compounds by heat,

(a) Thiocyanates of silver, bismuth, copper, iron, manganese, lead, tin, and zinc are said to decompose in this way: $\text{Fe}(\text{SCN})_2 + \Delta = \text{FeC} + \text{CS}_2 + \text{N}_2$, provided the operation is done with exclusion of air.

(b) By composition of certain salts of carboxy-acids, *e. g.*,



(c) By the decomposition of hydrocarbons by heated metals,

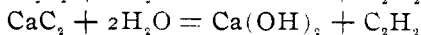
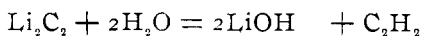


4. Acetylides: formed in wet way by passing acetylene through ammoniacal solutions of silver nitrate, cuprous chloride, and aurous thiosulphate ($\text{Au}_2\text{S}_2\text{O}_3$), or over freshly precipitated mercuric oxide.

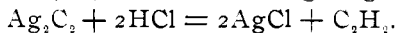
5. The carbides of silicon, titanium, tungsten, etc., have been made from the oxides using calcium carbide as the reducing agent instead of carbon.

III. REACTIONS OF DECOMPOSITION.

1. Decomposed by water giving mostly acetylene: lithium, sodium, potassium, calcium, barium, and strontium carbides.

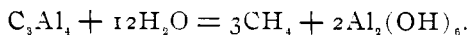


2. Decomposed by hydrochloric acid, giving acetylene.

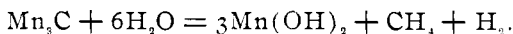


So also copper, mercury and gold (?) acetylides.

3. Decomposed by water yielding methane: aluminum and glucinum carbides.



4. Decomposed by water giving methane and hydrogen: manganese carbide.



5. Decomposed by water giving mixtures of acetylene, ethylene, methane and hydrogen: yttrium, lanthanum and thorium carbides.

6. Decomposed by water giving beside the above volatile products a residue of liquid and solid hydrocarbons; lanthanum, cerium and uranium carbides.

AN EXAMINATION OF COMMERCIAL FLOUR.¹

BY HENRY KRAEMER.

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IT is now nearly two years since Professor J. U. Lloyd asked the writer to take up the microscopical examination of flour and its adulterants, especially with the view of applying a method, already proposed by the author, at the meeting of the American Pharmaceutical Association in 1894,² for the quantitative determination of corn-meal in flour. A careful preliminary examination of the flour and corn-meal upon the market soon indicated that a detailed study of other cereals, as well as of starch grains, was necessary before reliable and practical results could be obtained. The work upon the starch grain itself was presented, at least in part, in a paper on "The Study of Starch Grains, etc.," to the Pure Food and Drug Congress, January, 1899. It is not necessary here to dwell either upon this study or upon the results of the morphological study of the cereals, as Tschirch and Oesterle have published monographs of

¹ Presented at the joint meeting of the Cincinnati Section with the Columbus Section, University of Cincinnati, April 15, 1899.

² Proceedings of American Pharmaceutical Association, 1894; and *Am. J. Pharm.*, 1894.