

DETERMINATION OF ENDOTHERMIC GASES BY COMBUSTION.

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Endothermic gases such as ethylene and acetylene, even when mixed with sufficient air to form an explosive mixture, may be accurately and safely determined by combustion in a gas pipette provided the following conditions are observed: (1) Presence of a considerable excess of oxygen; (2) admixture with an exothermic gas; (3) slow admission of the combustible gases to the combustion pipette; (4) application of heat from below on the entering combustible gases; (5) reduced pressure. These conditions are secured by using a Winkler-Dennis gas combustion pipette, the platinum spiral being placed as near the juncture of the capillary with the pipette as possible without endangering the glass; mixing the endothermic gases with one to two volumes of pure hydrogen; and slowly leading this mixture into oxygen instead of the reverse as is usually done in combustion of the methane and hydrogen of illuminating gas.

The combustion is carried out as follows: The hydrogen used as a diluent is generated in a Hempel hydrogen pipette from zinc free from carbon; the requisite quantity is drawn into a burette, measured and transferred to a mercury pipette; a measured volume of acetylene or ethylene is then driven over into the hydrogen and the gases thus mixed drawn back into the burette. About 10 cc. more than the theoretical amount of oxygen required for the combustion is measured and transferred to the combustion pipette. The burette containing the mixed combustible gases over mercury is connected with the pipette and the level bulb of the latter so placed that the oxygen in the pipette is under a reduced pressure of one or two centimeters of mercury. The current is then turned on and the resistance so adjusted that the spiral is maintained at a bright red heat. The pinch-cock on the rubber connection of the burette with the capillary arm of the pipette is opened; the expansion of the oxygen by the heat from the spiral approximately balances the reduced pressure and little or no gas enters the pipette on opening the pinch-cock. The screw pinch-cock on the connecting tube of the burette and its leveling tube is then slightly opened and so adjusted that the flow of gas into the pipette is about 2 cc. per minute. After proper adjustment is effected

the apparatus requires no further attention until the combustion is ended.

If the inflow of combustible gases much exceeds the rate prescribed, a series of small explosions is likely to occur at the juncture of the capillary side-arm with the pipette, traces of carbon deposition are evident and the results are slightly low.

Some analyses of acetylene and explosive mixtures of acetylene with air are appended :

Exp. No.	C ₂ H ₂ , cc.	H ₂ , cc.	O ₂ , cc.	Res. cc.	After KOH cc.	CO ₂ , cc.	O ₂ Con- sumed, cc.	C ₂ H ₂ , %.
1	20.0	30.0	80.0	55.0	15.0	40.0	65.0	100.0
2	10.0	30.0	54.2	34.3	34.2	20.1	40.0	100.5
3	2.0	50.0	52.6	26.8	22.8	4.0	29.8	100.0
4	30.0	30.0	100.0	70.3	10.8	59.5	89.2	99.2
5	30.0	15.0	100.0	77.8	18.4	59.4	81.6	99.0
6	15.0	30.0	69.0	46.6	16.6	30.0	52.4	100.0
7	15.0	30.0	70.0	47.4	17.4	30.0	52.6	100.0
8	10.2	25.0	50.9	33.4	13.0	20.4	37.9	100.0

Explosive mixtures of air and acetylene :

1	15.0	30.0	50.6	35.2	13.4	21.8		72.6
2	15.3	30.0	51.0	34.6	12.5	22.1		72.2

Absorption by fuming sulphuric acid gave 72.0% and 72.3%.

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