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Acetylene from Hydrocarbons
Richard E. Gannon, Textron Defense Systems

1. Manufacture From Hydrocarbons

Acetylene production in Japan and Eastern Europe is still based on the calcium carbide process, the large production in the United States and Western Europe now rely on hydrocarbons as the feedstock. Now more than 80% of the acetylene produced in the United States and Western Europe is derived from hydrocarbons, mainly natural gas or as a coproduct in the production of ethylene. In Russia about 40% of the acetylene produced is from natural gas.

Development of the modern processes for the manufacture of acetylene from hydrocarbons began in the 1920s when Badische Anilin- und Soda-Fabrik (BASF) initiated an intensive research program based on Berthelot’s early (1860) laboratory investigations on the conversion of low molecular weight aliphatic hydrocarbons to acetylene by means of thermal cracking. BASF’s development of the electric arc process led to the first commercial plant for the manufacture of acetylene from hydrocarbons. This plant was put into operation at Chemische Werke Hüls in Germany in 1940. In the United States, commercial manufacture of acetylene from hydrocarbons began in the early 1950s; expansion was rapid until the mid to late 1960s, when acetylene was gradually supplanted by cheaper ethylene as the main petrochemical intermediate.

1.1. Theory

The hydrocarbon to acetylene processes that have been developed to commercial or pilot-plant scale must recognize and take advantage of the unique thermodynamic properties of acetylene. As the free energy data shown in Figure 1 indicate, the common paraffinic and olefinic hydrocarbons are more stable than acetylene at ordinary temperatures. As the temperature increased, the free energy of the paraffins and olefins become positive while that of the acetylene decreases, until at >140°C acetylene is the most stable of the common hydrocarbons. However, it is also evident that, although it has the lowest free energy of the hydrocarbons at high temperature, it is still unstable in relation to its elements C and H₂. Thus it is necessary to heat the feedstock extremely fast to minimize its decomposition to its elements and, for a similar reason, the quench must be performed rapidly to keep the temperature of the acetylene as low as possible.
Color Image Processing

**Figure 17.** Color charts. Hue varies with angle according to Fig. 13. Left: constant saturation and intensity. Middle: constant intensity, saturation goes to zero at the center. Right: constant saturation, intensity goes to zero at the center.

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**Analytical Chemistry, Physical Chemistry and Spectroscopy**

**Advances in Electrochemical Science and Engineering, Volume 7**

Editor(s): Prof. Richard C. Alkire, Prof. Dieter M. Kolb

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