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## INTRODUCTION

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Two known butane isomers – normal butane and isobutane – are hydrocarbons of the paraffin series  $C_nH_{2n+2}$ . The molecule of *n*-butane ( $H_3C-CH_2-CH_2-CH_3$ ) is a highly symmetric one.

Normal butane was first obtained by the English chemist E. Frankland in 1849 by interaction of zinc and ethyl iodide ( $C_2H_5I$ ). Butane is obtained on an industrial scale from oil gas and natural gas, and from crude oil cracking. Butane in a mixture with other hydrocarbon gases, mainly propane, is used widely as a fuel. Butane is a raw material for the production of acetic acid, maleic anhydride, isobutane, and other chemical products. The main product, among others, is butadiene, which is used in the production of synthetic (butadiene) rubber.

At normal conditions *n*-butane is a colorless, odorless gas. It is a solvent of oil products and is used in such processes as deparaffining and deasphalting. It is soluble well enough in alcohols and ethers. Its solubility is approximately 15 ml in 100 ml of water at 20°C.

Butane is a highly combustible gas (its flash and self-ignition temperatures are –60°C and 405°C respectively). Its mixtures with air are explosion hazards at volumetric ratios from 1.5 to 8.5%. The greater density of gaseous *n*-butane in comparison with the density of air leads to its accumulation in lowlands, hollows, basements, and collectors. It makes this gas dangerous in terms of floods and leakages.

Butane has weak narcotic action (its maximum permissible concentration is 300 mg/m<sup>3</sup>).

The large scale of *n*-butane production from primary raw materials and its conversion into other chemical products demand knowledge of its thermodynamic properties over a wide range of state parameters. This need led to the organization of experimental investigations of butane thermodynamic properties in different laboratories from approximately 1915 on. Thermodynamic data are important in the realization of such investigations, but the amount of data available for butane is actually not very large.

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The role and significance of general analytical works thus increases, because experimental investigations are limited and fragmentary. However, these works are also not very numerous. The majority of such works contains a decision of particular problems for limited range of parameters. Only the investigation [31], accomplished in National Bureau of Standards (USA), is enough detail.

In this monograph, as in previous monographs, the method of equivalent equations has been utilized for compiling the optimal equation of state and for estimating the precision of tabulated values. The *n*-butane thermodynamic tables were calculated by means of the averaged unified equation of state, both for the single-phase region and for the saturation curve. The properties on the melting curve were calculated by means of the unified equation of state and the equation of the melting curve. These data, in the pressure range from 0.01 MPa up to 100 MPa and in the temperature range from 135 K up to 700 K, are presented in tables on isobars for the user's convenience.

This monograph contains an analysis and generalization of the experimental data on the *n*-butane thermodynamic properties, as published in the world scientific literature in the last 70–80 years, and description of these data by means of the unified equation of state. It continues the monograph series beginning with the monograph concerning the thermodynamic properties of nitrogen published by Standards Publishers (Moscow) in 1977 and by Hemisphere Publishing Corporation (Washington) in 1987, but this monograph is published first in the United States.

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