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Vaporization enthalpies of a series of the fluoro- and chloro-substituted methylbenzenes

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ABSTRACT

Vapor pressures of fluorobenzene, chlorobenzene, 2-chloro-, 3-chloro-, and 4-chloro-methylbenzen 2-chloro-1,3-dimethylbenzene, 2,6-dichloro-1-methylbenzene were measured by the transpirat method. Molar standard enthalpies of vaporization at the reference temperature were calculated fr temperature dependences of vapor pressures. Available literature data on halogenobenzenes w collected and evaluated by using correlation gas-chromatographic method. Simple group-additiv procedure was developed for estimation vaporization enthalpies of mono- and di-halogen-substitu benzenes.

1. Introduction

Halogen substituted benzenes belong to the long-lived pollutants frequently found in industrial effluents. Reliable thermodynamic data for these compounds are of an environmental interest [1]. Careful search for primary experimental data on halogenobenzenes available in literature has been performed in this work. It has turned out that the good quality primary vapor pressures and vaporization enthalpies exist only for fluorobenzene and chlorobenzene (see Table 1). Collection of experimental data available for fluoro- and chloro-substituted methylbenzenes suffered from ambiguity. Indeed, the comprehensive compilations by Stull [2] and by Stephenson and Malanowski [3] contain vapor pressure data for numerous halogen substituted benzenes over a wide range of temperature. The origin of the data presented there is not clear, methods of measurements are unknown, as well as errors of measurements and purities of compounds. In this context, additional measurements on halogen substituted methylbenzenes are desired. As a part of our systematic research on thermochemical properties of halogen organic compounds [4–6] this paper presents new vapor pressure data for seven halogen substitut benzenes and methylbenzenes: fluorobenzene, chlorobenze 2-chloro-, 3-chloro-, and 4-chloro-methylbenzenes, 2-chloro-1 dimethylbenzene, 2,6-dichloro-1-methylbenzene. Molar standa enthalpies of vaporization, $\Delta_l^g H_m$, for these compounds were c culated from temperature dependences of vapor pressures. We a collected vapor pressures of halo-methylbenzenes available in t literature and treated these data uniformly in order to derive a evaluate their enthalpies of vaporization. The evaluated values $\Delta_l^g H_m$ (298.15 K) were used to develop a group-additivity proc dure for mono- and di-halogen-substituted benzenes.

2. Experimental

2.1. Materials

The samples used for the transpiration experiments were commercial origin. Origin of samples and initial purity are giv in Table 1. Prior to experiments the samples were purified repeated vacuum fractional distillation with the Teflon spinnin band column under reduced pressure. The final degree of samp purity was determined by using a Hewlett Packard gas chroma graph 5890 Series II equipped with a flame ionization detec and a Hewlett Packard 3390A integrator. The carrier gas (nitroge

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