Vapor Pressure by TGA

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Abstract

The knowledge of the vapor pressure of a chemical compound is fundamental in area such as process design and control, material storage and stability, for establishing environmental regulations and required for Material Safety Data Sheets (MSDS).

Thermogravimetric analysis (TGA) techniques are based on continuous recording of mass changes of sample of material, as a function of a combination of temperature with time: this technique is well suited for investigating processes such as evaporation or sublimation [1,2].

Differently than vacuum based Knudsen cell approaches, the experimental setup can be parameterized at ambient conditions via an auxiliary reference substance resorting to a generalization of Langmuir equation for free evaporation [3]. We show that vapor pressure data can be assessed in a fast, reliable and sensitive manner. The compounds considered in this work span a pressure range from 10 Pa for low volatile substances and several decades upwards for more volatile ones. Furthermore, relying on Clausius-Clapeyron equation, accurate values for sublimation or vaporization enthalpy of the samples are calculated [4,5]. This makes TGA class of methods an easy way to estimate both thermodynamical quantities.

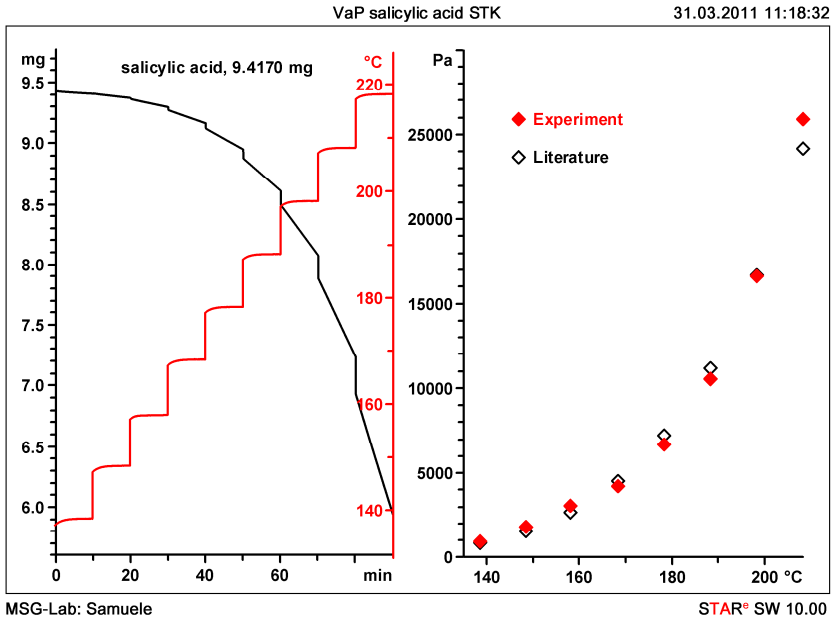

Figure 1: Typical temperature program and its corresponding mass loss profile (respectively red and black curve in the left part), together with the experimental calculated and literature values for vapor pressure of salicylic acid (right part).

References

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[2] K. Chatterjee, D. Dollimore, K.S. Alexander, *Thermochim. Acta* (2002), 107-117
[3] S. Neuenfeld, J. Zerweck, Rückblick GEFTA Jahrestagung (1999): http://www.gefta.org
[4] ASTM E2071 (2005)
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