Chemical Potential in Focus – Flow of Substances and its Consequences

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The benefit of chemical thermodynamics is beyond question but the field is reputed to be difficult to learn. One of its most important fundamental quantities, the *chemical potential* μ, commonly defined as the partial derivative of a quantity which involves energy and entropy, seems especially hard to grasp. As a simpler and faster way to an understanding of this quantity we propose to introduce it as a basic concept in analogy to quantities such as length, mass etc [1,2]. After characterizing μ by a set of typical and easily observable properties, this phenomenological description may be supported by a direct measuring procedure. The proposed approach is elementary, does not require any special previous knowledge, and leads immediately to results that can be utilized practically.

After a detailed introduction into the topic, the focus of the presentation will lie on the description of the flow of substances and its consequences such as osmosis, vapor-pressure lowering and freezing-point depression, as one example for the use of the chemical potential μ. These types of transformations are found everywhere, in households and the environment as well as in nature and in engineering. For example, it is known from everyday life that juice is drawn out of sugared strawberries or that cherries swell up and burst after a long rain. Additionally, illustrative but nevertheless easily and safely realisable experiments can be carried out such as demonstrating osmotic pressure by constructing an „osmometer“ by use of a carrot. This improves the understanding of such processes and forges links between textbook knowledge and everyday experiences. Selected experiments will be shown live during the oral presentation.

References

[1] G. Job, R. Rüffler, Physical Chemistry – an Introduction with New Concept and Numerous Experiments, Vieweg+Teubner, Wiesbaden, 2010 (in German; English edition in preparation).

[2] G. Job, Proc. Taormina Conf. on Thermodynamics, Classe I di Scienze Fis. Mat. e Nat. Vol. LXX – Suppl. N. 1, 1992, 385-409.