Eduard-Job-Foundation for Thermo- and Matterdynamics

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The new approach

This new approach to thermodynamics is based on a direct metrication of the pre-scientific concept of heat, leading directly to the conclusion that entropy possesses all properties of this form of heat. Prof. F. Herrman (University of Karlsruhe, Germany) has shown in a series of field experiments that it is then possible to teach thermodynamics even at secondary school level.

It is also possible to quantify the chemical potential, enabling chemical thermodynamics to lose its abstract character and become intuitively understandable. The subject of chemical thermodynamics can then blend smoothly into other physical chemistry topics and a holistic teaching of physical chemistry becomes possible.

In addition to other works the Job-Foundation preferably supports projects based on this approach to thermodynamics, as described in the books by H. Fuchs [1] and G. Job [2].

Characteristics of the new approach:

- allows its user a unified description of mechanical, electrical, thermal and chemical systems.
- can be applied both to micro- and macroscopic, reversible and irreversible, static and kinetic systems.
- a shorter and more efficient thermodynamical calculus.
- All quantities used within the new approach have a real physical counterpart.
- Teaching can be easily adapted to all levels of education ranging from school to post graduate studies.
- The simplicity of the new approach allows the teacher to spend more time on subjects other than thermodynamics.

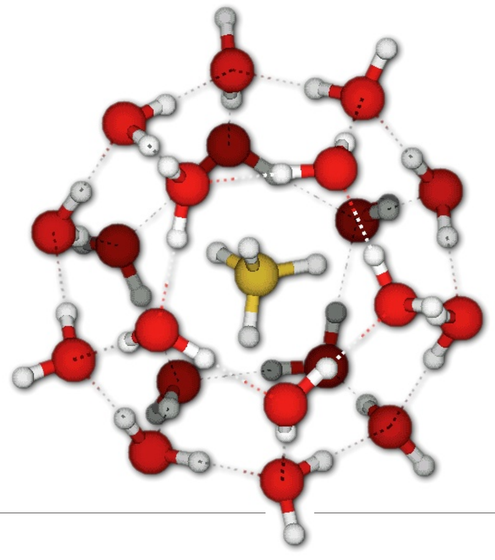


figure 1

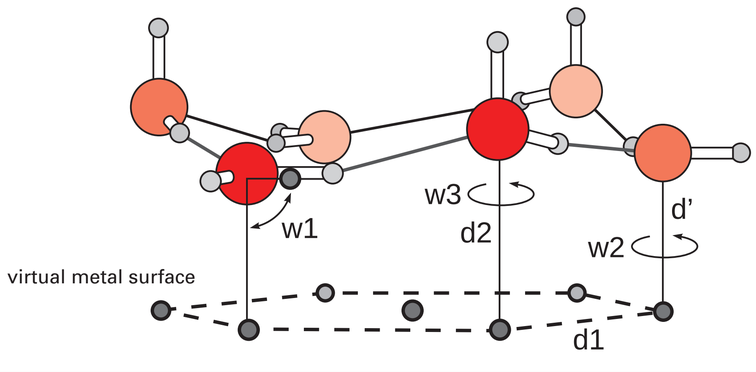


figure 2

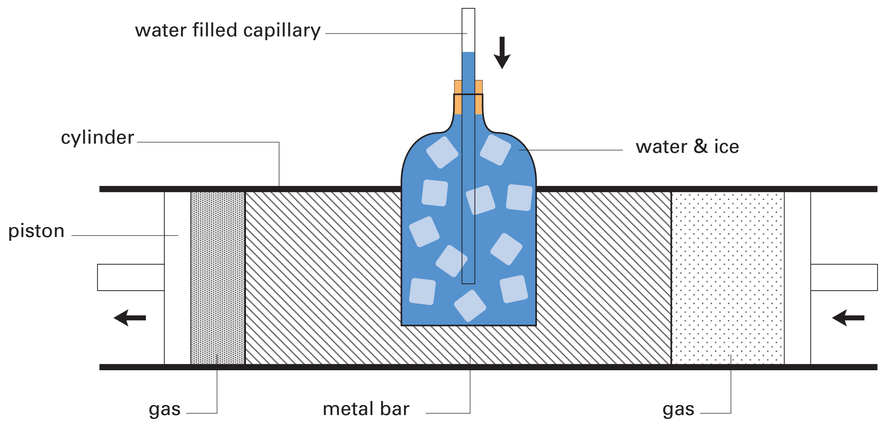
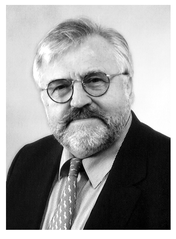


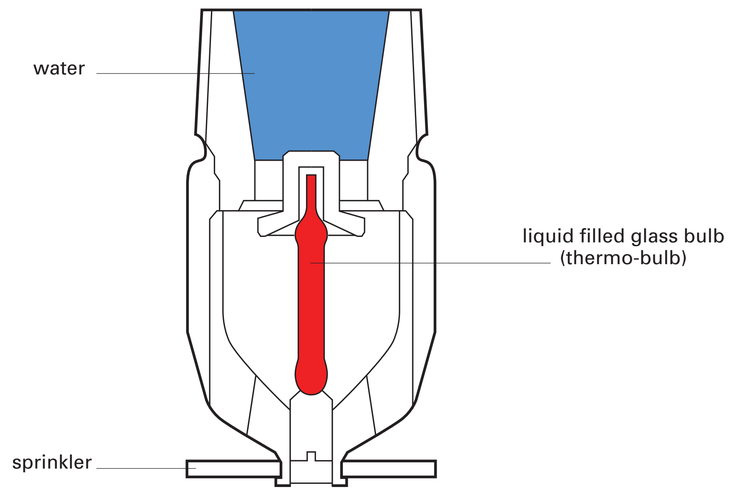
figure 3



The benefactor

The benefactor and president of the foundation is Dipl. Ing. **E. Job**. In 1971 he formed the Job-GmbH in Ahrensburg (Germany, near Hamburg) and this is now the leading producer of heat-responsive glass bulbs (thermo-bulbs) for the sprinkler industry. As a result of this special importance of thermodynamics for his business and a strong personal interest in the subject, he started the Job-Foundation in January 2002.

Functionality of a thermo-bulb



As the thermo-bulb becomes hot, the red liquid expands until it finally breaks the glass bulb to release the water. Next, the steel plate at the bottom of the sprinkler smashes the water flow into a gentle rain to extinguish the fire below the sprinkler

Current projects

■ Quantumchemical and thermodynamical analysis of gas hydrate formation

The smallest element of the gas hydrate structure is the $(H_2O)_{20}$-cage (figure 1), which encloses a single methane molecule. The Job-Foundation focuses specially on two questions:

a.) Is it possible to deduce the properties of gas hydrates from the interactions among the $(H_2O)_{20}$ and/or $CH_4@(H_2O)_{20}$ clusters?

b.) How strong is the influence of geometrical constraints within the hydrogen bonded network of the $(H_2O)_{20}$ cluster on the properties of the gashydrate?

■ Theoretical analysis of the growth of water layers on transition metal surfaces

On several transition metal surfaces water adsorbs molecularly to form a water bilayer. The properties of this bilayer seem to be controled by stress within the hydrogen bonded network.
Figure 2 shows a $(H_2O)_6$ cluster on virtual surface [3, 4, 5] as a model of the bilayer structure, which is used to analyse the stress related phenonema in the hydrogen bonded framework independently of the precise electronic structure of the metal underneath. Despite its simplicity this model already reproduces correctly most properties of the water bilayer.

■ Writing text books, hand outs, descriptions of physical and computational experiments ... as a teaching aid for all topics in physical chemistry

One example for this procedure is shown in figure 3. The entropy production caused by the flow of entropy can be visualized by the following thought experiment: Heat is released on the right side of the metal bar by compressing the gas in the cylinder. At the same time the piston on the left side is used to expand the gas in the cylinder and the heat released at the right side should be completely absorbed by the gas on left side. Although all the heat produced on the right side is absorbed by the gas on the left side, the lowered water level of the ice calorimeter indicates the production of extra heat.
The Job-Foundation works on a java-based computersimulation to demonstrate this peculiar effect to students as part of a lecture or dry lab course.

■ Assistance with thermodynamical calculations as part of general chemistry

The Job-Foundation was asked to calculate under which conditions the following reaction is reversible:

$$Al_2(CH_3)_{6\,(dissolved)} \rightleftharpoons Al_2(CH_2)_{3\,(solid)} + 3\,CH_4$$

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[1] H. U. Fuchs "Dynamics of Heat", Springer, New York 1996, [2] G. Job "Neudarstellung der Wärmelehre", Akademische Verlagsgesellschaft, Frankfurt a. M. 1972,
[3] T. Lankau, I. L. Cooper, J. Phsy. Chem. A 105 (2001) 4084-4095, [4] T. Lankau J. Phsy. Chem. A 106 (2002) 6154-6160, [5] O. Konrad, T. Lankau, Chem. Phys. Lett. 359 (2002) 35-40