Thermochimica Acta, 100 (1986) 255–270
Elsevier Science Publishers B.V., Amsterdam – Printed in The Netherlands

THE HISTORY OF THERMOANALYTICAL AND RELATED METHODS IN THE TERRITORY OF PRESENT-DAY CZECHOSLOVAKIA

J. ŠESTÁK *, I. PROKS, V. ŠATAVA, K. HABERSBERGER, J. BRANDŠTETR,
O. KORÁB, V. PEKÁREK, J. ROSICKÝ, M. VANIŠ and J. VELÍŠEK

Czechoslovak Chemical Society of the Czechoslovak Academy of Sciences, Hradčanské nám. 12, 118 29 Prague 1 (Czechoslovakia) **

(Received 28 January 1986)

ABSTRACT

This article deals with the history, development and present state of thermal analysis and calorimetry in the territory of contemporary Czechoslovakia, starting from the preclassical period up to the present day. The most important contributions of Czechoslovak scientists and the activities of national thermoanalytical groups are both surveyed, including the genesis of scientific meetings and seminars.

THE PRECLASSICAL PERIOD

The scientific application of thermal techniques was preceded in our country by the empirical activities of alchemists. These included mainly melting, distillation, thermal dissociation, condensation and crystallization, i.e. processes based on either heating or cooling of the substances processed. In their laboratories small furnaces, water or sand baths and various types of condensors were therefore in common use. Alchemy flourished in our country in the 15th, 16th and 17th centuries. This discipline was supported not only by the Royal Court (namely under the reign of the Emperor Rudolph the IInd at the turn of the 16th and 17th centuries) but also by numerous nobles. In spite of the fact that the main aim of alchemy was the

---

* Contact address: Dr. J. Šesták, Chemistry Department, Institute of Physics of the Czechoslovak Academy of Sciences, Na slovance 2, 180 40 Prague 8, Czechoslovakia.

** This article is based on the ideas and concepts of I. Proks and suggestions of V. Šatava, and has been edited by J. Šesták with the aid of contributions from the representatives of the individual groups, namely: the Czech Group for Thermal Analysis (K. Habersberger, J. Rosický and J. Šesták), the Slovak Group for Thermal Analysis (O. Koráb, I. Proks and M. Vaniš) and the Group for Chemical Thermodynamics and Calorimetry (J. Brandštetr, V. Pekárek and J. Velíšek).

Dedicated to the 120th Anniversary of the Czechoslovak Chemical Society.

0040-6031/86/$03.50

preparation of either noble metals or medicaments (elixirs), there was in most cases no distinct boundary between the preparation and the analysis of the substances.

The first person to use continuous heating and cooling of a sample for investigation of the properties of substances was Jan Amos Comenius [1]. In his Physicae Synopsis, which he finished in 1629 and published first in Leipzig in 1633, the importance of hot and cold in all natural processes is frequently stressed. Heat (or fire) is considered as the cause of all motions of things. The expansion of substances and the increased space they occupy is caused by their dilution with heat. By the influence of cold, on the contrary, the substance gains in density and shrinks. The condensation of water vapour to liquid water is given as an example. Comenius also determined (although very inaccurately) the volume increase in the gas phase caused by the evaporation of a unit volume of liquid water. In Amsterdam in 1959 he published a treatise investigating the principles of heat and cold: Disquisitiones de Caloris et Frigoris Natura, which was probably inspired by the works of the Italian philosopher Bernardino Telesius. The third chapter of Comenius' book is devoted to the description of the influence of temperature changes on the properties of substances. The aim and principles of thermal analysis are already given in the first paragraph of this chapter:

"In order to observe clearly the effects of heat and cold, we must take a visible object and observe its changes occurring during its heating and subsequent cooling so that the effects of heat and cold become apparent to our senses."

In the following 19 paragraphs of this chapter Comenius gives a systematic description (and also a partially correct interpretation) of the effects of continuous heating and cooling of water and air, and also stresses the reversibility of processes like, for example, evaporation and condensation, etc. Comenius concludes this chapter as follows:

"All shows therefore that both heat and cold are a motion, which had to be proved."

In the following chapter Comenius describes and correctly explains the function of a thermoscope (vitrum caldarium), but introduces his own qualitative scale with three degrees of heat above and three degrees of cold below the ambient temperature.

THE CLASSICAL PERIOD

The development of classical thermal analysis in the territory of present-day Czechoslovakia is linked with the names of Otakar Kallauner (1886–1972) and Josef Matějka (1892–1960). This new physico-chemical technique came into common use in our country during the course of the period when methods of "rational analysis" of ceramic raw materials (playing at those times the role of present X-ray analysis) were suggested and improved. These techniques, at the beginning of the 20th century, were based on the decomposition of clay minerals by digestion with sulphuric acid [2]. The contents of kaolinite in the sample obtained by this method were usually higher than the correct values, since the determined values actually corresponded to the sum of kaolinite and of other components which were also dissolved in sulphuric acid. An attempt to improve these purely chemical techniques of rational analysis was undertaken (however, without great success) in 1913 by J. Burian, Professor at the Technical University of Prague, and J. Juránek [3]. In the same year two new scientists started to work at Burian's Institute, namely O. Kallauner, Privatdocent of ceramics since 1910, and J. Matějka, who had just finished his studies at the University. After having obtained his D.Sc. degree Kallauner went to stay at the Institute of Refractory Materials and Ceramics at the Royal Technical University at Wrocław. The head of this Institute was then Professor K. Friedrich who had published, alone or with his coworkers, a number of thermoanalytical studies about the thermal decomposition of inorganic substances and about the improvement of thermoanalytical instrumentation [4]. B. Wohlin, at the same Institute, thermoanalytically investigated the behaviour of soils, bauxite and similar substances during heating [5]. Kallauner therefore had the chance to get acquainted not only with the top thermoanalytical instruments of those days but also with their application to investigations of the properties of substances subjected to temperature changes. Kallauner and Matějka who were, from the work of Professor Burian, well informed about the contemporary state of the improvement of the methods of rational analysis, used both the experience acquired by Kallauner at Wrocław during his stay and the results of the thermoanalytical investigation of clay minerals published first by H. Le Chatelier and subsequently improved by Mellor, Holdcroft, Rieke, Keppeler, Sokolov, Zemyatchenski and others [6,7] for the elaboration of a further method of rational analysis with a substantially increased reliability compared to previous procedures of this kind. Their method was based on the thermoanalytically established fact that kaolinite decomposes in the temperature range 500–600°C, and that Al_2O_3 from the condensed product of this decomposition is soluble in some dilute acids. From the gravimetrically determined content of Al_2O_3 the content of kaolinite in the sample was then calculated. A later investigation of Sedlec kaolin was also based on these principles [8]. Both authors first tested the function of their apparatus for thermal analysis by comparing their results of the investigation of the thermal dissociation of a number of nitrates, hydroxides, sulphates and carbonates with the results obtained by Friedrich [9]. Their paper was probably the first publication on thermal analysis in the territory of present-day Czechoslovakia. Kallauner and Matějka, who joined the staff of the Technical University in Brno in the same year (Kallauner was appointed Associate Professor in 1914), presented their paper at the Vth Meeting of Czech Natural Scientists and Physicians which took place in Prague in 1914.

At the same meeting other investigations of properties of substances by thermal methods were also presented. Besides the new method of rational analysis already mentioned [10], Kallauner and Preller reported on the thermal analysis of set plaster, as well as of quickly and slowly setting plasters [11]. In the first case the same results as with gypsum were obtained. Their determination of the temperature of quickly setting plaster as a function of time with a conventional thermometer may be considered as an application of the thermal method. Šimek's lecture was interesting, surveying the measurement of high temperatures with Le Chatelier's thermocouple and the thermal analysis of silicate melts using two thermocouples with independent registration [12]. Šimek delivered a critical evaluation of the possibility of applying thermal analysis and rapid quenching of the sample, suggested in the U.S.A. and in Holland, to the determination of phase equilibria in high-temperature silicate systems. Finally the investigation of the thermal dissociation of dolomite by Kallauner was an example of a thermoanalytical method [13]. This paper [13] dealt with the results obtained on measuring the degree of thermal dissociation of $CaMg(CO_3)_2$ after isothermal heating for 15 min at temperatures in the range 500–915°C. Kallauner was able to show the agreement between his own and Friedrich's measurements: the first maximum of the dissociation rate was in the range 710–730°C, the second at 900–915°C.

THE PERIOD BETWEEN THE TWO WORLD WARS

The successful development of thermal analysis in what is now called Czechoslovakia was, however, interrupted by the outbreak of the First World War. After the war the Technical University of Brno was the thermoanalytical centre of the new Czechoslovak republic for about ten years. Here, in 1919, Matějka performed a broad investigation of the chemical transformations of kaolinite during the course of its heating [14]. He found that in the temperature range 500–600°C, water is liberated from this clay mineral on formation of $Al_2O_3 \cdot 2\ SiO_2$, a silicate which may be dissolved in acids. Above 900°C this substance undergoes an exothermic transformation into $Al_8Si_3O_{18}$ (i.e. a substance with the same composition as dumotierite) and SiO_2 is simultaneously split off. Above 1100°C, SiO_2 and a substance similar to sillimanite coexist.

The most important treatise by Matějka, on the thermoanalytical (already partially quantitative) determination of the weight content of kaolinite in soils, appeared four years later [15]. The conditions necessary for a successful quantitative evaluation of the thermoanalytical curves are given there: maintaining both identical sample weight and heating rate throughout a series of experiments (he used 5 g and 30°C min^{-1}); using a reproducible location of the thermocouple junction in the investigated sample; and always applying the same technique for pressing the sample. Matějka determined the time dependence of temperature both in the sample and in the furnace with two independent thermocouples. For the quantitative determination of the content of kaolinite he chose the endothermic plateau at 570–580°C, as he found that the length of this plateau increases with the amount of kaolinite in the soil without being affected by the presence of orthoclase, calcite, mica, quartz and bauxite admixtures. For the quantitative determination of kaolinite in systems containing magnesite, the author recommends its elimination by digestion of the sample in diluted hydrochloric acid.

The development of thermogravimetry in our country between the two World Wars is connected with the name of Professor Stanislav Škramovský. Investigations of the thermal decomposition of complex oxalates of scandium [16] and bismuth(III) [17] led him in 1932 to the construction of an apparatus he named the Stathmograph [18], the name being derived from the Greek "stathmos", i.e. mass (or weight). Škramovský developed the idea of the thermobalance, published by Guichard [19], by substituting the construction of the thermogravimetric curve from a series of discrete points by the automatic registration of the mass of the sample as a function of either temperature or time.

The apparatus of Škramovský (cf. Fig. 1) consists of an electric drying oven with temperature control, the temperature of which can reach 180°C. A weighed amount of substance is placed in the drying oven on a dish suspended on a long filament passing through a hole in the upper wall of the drying oven and the balance case to a hook on the left arm of an analytical balance. A mirror is attached to the middle of the beam reflecting the image of a lighted slit into a rotating drum lined with photosensitive paper. The motion of the drum is transmitted by a gear to the temperature control of the electric drying oven, the temperature of which is thus increased continuously with time. The drum is turned by an electric motor, the time of one revolution being adjustable between 50 min and 6 h. A glass rod immersed in paraffin oil is suspended on the right arm of the balance; as the viscosity of the oil alone was insufficient to dampen the vibration of the beam, a circular brass plate was attached to the glass rod below the oil rod, which reduced the vibration of the beam to a minimum. When the mass of the sample decreases, the deflection of the beam increases steadily, whereby the beam of light reflected by the mirror draws a curve on the photographic paper corresponding to the progress of dehydration with increasing temperature. The temperature is registered automatically during the dehydration process by means of a mercury thermometer provided with platinum contacts distributed along the whole length of the capillary, switching on, at regular temperature intervals, an electric lamp projecting the image of a

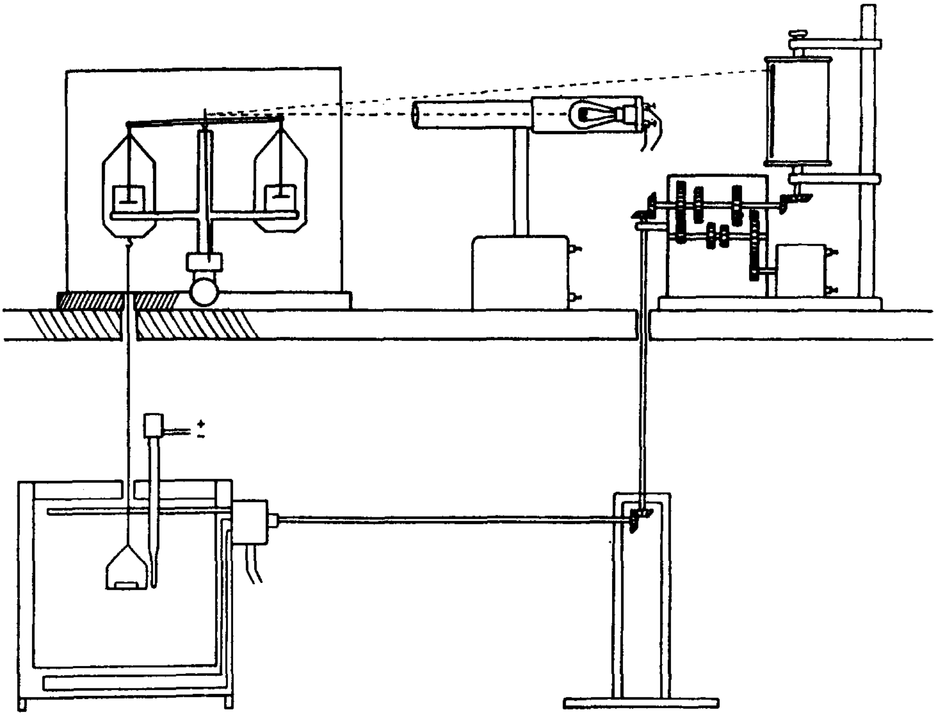

Fig. 1. The original scheme of Škramovský's Stathmograph.

vertical slit into the diagram. The whole apparatus works automatically without supervision and the curves are more characteristic the longer the time of dehydration. The Stathmograph was later improved by substituting the drying oven with a special furnace, whose electric input was continuously increased by a variable voltage autotransformer, the slider of which was driven by a synchronous motor [20,21].

Professor Škramovský successfully applied his apparatus to investigating the dehydration of a number of inorganic salts [22–25] and the influence of the products of this process on its course [26]. Together with R. Forster and C.F. Hüttig he also performed with his apparatus a pioneer investigation of the dehydration of copper sulphate pentahydrate [27]. Other examples of use of this device are refs. 28 and 29. A number of his communications dealt with the investigation of technologically important processes, as, for example, the thermal decomposition of carbonate minerals [30], especially carbonates of importance in metallurgy [31,32], or the reduction of iron ores with carbon [33]. He even applied thermogravimetry in domains where it became of common use only several decades later, as, for example, in pharmacology [34].

Professor Škramovský can be considered rightfully as both a pioneer and an enthusiastic supporter of thermal analysis not only in Czechoslovakia but in many respects over the whole world, since the general spreading and application of this method took place only after the Second World War.

THE DEVELOPMENT OF CONTEMPORARY THERMAL ANALYSIS

Much credit for the development of methods of thermal analysis in Czechoslovakia after World War II must be attributed to the late Professor R. Barta, then head of the Department of Silicate Technology at the Prague Institute of Chemical Technology. On the basis of his experience acquired abroad, he stimulated his coworkers, J. Vašíček and S. Procházka, to construct devices for DTA and thermogravimetry, respectively [35], which he applied, together with others (M. Čáp, J. Kouřimský, V. Šatava), to the phase analysis of silicate materials [35]. Because of the difficulty of obtaining commercial devices, development in this field concentrated on the improvement and innovation of thermoanalytical instruments, sample holders and the registration of the thermoanalytical curves [36–39]. In the domain of application, the optimization of technological processes, for example, the crystallization of melted rocks [40] and the preparation of catalysts [41], were investigated. Of note are also the publication of a survey of the contemporary world literature on thermal analysis by Šatava [42] as well as the attempt to commercially produce the Czechoslovak thermobalance Tegra [38,43].

Some original principles and techniques applied by Czechoslovak scientists should also be mentioned here, namely:

—Periodical thermal analysis by Proks and Zlatkovski [44] giving the possibility of a more precise determination of the equilibrium temperatures of phase transitions taking place in the sample situated at the thermocouple junction.

—Permeability thermal analysis by Komrska [45] which may be used for investigating the dynamics of sintering by measuring the flow rate of a gas passing through a porous sample.

—Dielectric thermal analysis by Bergstein [46] for investigating phase transitions on the basis of the dependence of the dielectric constant on temperature.

—Temperature variation method by Chromý [47] in which the refraction index of transparent microscopic particles suspended in a suitable liquid is determined, and photometric dilatometry investigating the expansion of grains with high-temperature microscopy.

—Accelerated DTA in a controlled atmosphere by Vaniš and Koráb [48].

Other techniques include low- [49] and high-temperature DTA [50], the latter also in controlled atmospheres, as well as the application of various sample holders [51]. Lately, less common techniques, such as emanation thermal analysis promoted by Balek [52], also in simultaneous combination with DTA and evolved gas detection applied by Habersberger [55], hydrothermal thermal analysis suggested by Šatava and Vepřek [53], rapid TA by Chromý and Hložek [54] and DTA calibration by defined electric pulses, realized by Šesták and Svoboda [56] have been used.

Interpretation of the results concentrated first on the problems of phase analysis [57,58] and on the investigation of the thermal dissociation of solids [59–61]. The theoretical basis of thermal analysis was developed in the publications of Proks [62,63] and others [64–68]. Šatava founded a Czechoslovak school of non-isothermal kinetics [69] leading to the establishment of Šatava's method for the evaluation of kinetic data [70–72] and to the publication of the theoretical treatise of Šatava's disciple Šesták [67,72–75], awarded in 1974 with the Mettler Award [76]. A further development of this discipline in the domain of silicate reactions in an oscillating regime was recently performed by Jesenák [77].

The application (also on the commercial scale) of a multistore crucible [73] and of infrared heating [72] in the investigation of the kinetics of reactions of solids, the method of construction of phase diagrams [78] and the technique of dynamic calorimetry [64,66,79], contributions to the problem of a correct calibration [80,81] and finally the formulation of both Czech and Slovak nomenclatures in thermal analysis [82], should also be mentioned.

Besides the papers which have been published both in Czechoslovak and foreign journals (from which we have quoted only a small part, namely those which have appeared in less known journals and periodicals published in Czechoslovakia) more comprehensive monographs should be mentioned, some of which have attained world-wide appreciation. These are the first Czechoslovak books on DTA [83], two monographs published as special issues of Thermochimica Acta [84,85] as well as the books by Blažek [86], Balek and Tölgyessy [87] and Šesták [88] and the textbook for Universities by Rosický [89].

THE PRESENT STATE OF CALORIMETRY

When speaking about thermoanalytical methods, the related technique of calorimetry cannot be overlooked. Without going into detail about the specific development of this discipline, we can say here that in our country it has always been closely linked with the field of chemical thermodynamics. In this review we shall concentrate only on its present state.

A more significant development of the calorimetric experimental technique may be observed at the beginning of the seventies. The necessity to determine basic thermodynamic data gave rise to a number of small calorimetric laboratories working first with devices of their own construction, later with commercial devices from renowned firms (calorimeters of the Calvet type, DSC calorimetry). The directions of experimental techniques and investigations were in most cases motivated by the practical demands of the laboratory. We should notice, however, that the domain of combustion calorimetry and that of the application of biology and life sciences has little tradition in Czechoslovakia as yet.

The most important calorimetric laboratory was founded at the Department of Physical Chemistry at the Institute of Chemical Technology in Prague under the guidance of Professor J. Pick. On the basis of mixing heats, liquid–vapour equilibria in organic systems were determined, along with excess enthalpies of binary and ternary systems and evaporation heats, the systematic measurements delivering data for a data bank. The laboratory is equipped with calorimeters of their own design: an isothermal calorimeter for the temperature range 25–50°C for the determination of mixing heats; a calorimeter for the measurement of evaporation heats in the temperature range 25–100°C and at saturated vapour pressures in the range 1–200 kPa; and a calorimeter for the investigation of thermodynamic properties in the temperature and pressure ranges 20–300°C and up to 3 MPa, respectively.

The development of nuclear power plants in Czechoslovakia also led to the development of the necessary calorimetric techniques, namely the application of calorimetry to nuclear technology (at the Concern Enterprise Škoda in Plzeň) and to radiation dosimetry (at the Institute of Radiation Dosimetry in Prague). The research is aimed at the measurement of neutron fluxes and the determination of energetic fields in the reactor core together with the necessary detection techniques. For the determination of neutron fluxes in the reactor, a quasi-isothermal calorimeter and for the determination of neutron doses in the reactor, graphite and uranium calorimetric detectors were constructed. For the determination of activity, half-life and disintegration energy of nuclides a beam calorimeter was used, for the determination of the energy flux density of X-rays and gamma-radiation a precise twin calorimeter was built. The standardization of electron beams with an energy of 5–40 MeV was performed with a self-built graphite calorimeter.

The important progress achieved in Czechoslovakia in the field of macromolecular chemistry, especially in the field of practical applications in medical techniques, had a positive effect on the foundation of a calorimetric laboratory with a purposeful scientific orientation for many years (Institute of Macromolecular Chemistry in Prague). In this laboratory, which is equipped with high-level commercial calorimetric devices, the work is aimed at investigating the thermodynamic properties of organic polymers, namely in the field of hydrophilic polymers. The mixing heats of systems with more components, including a polar one, as well as the heat capacities and excess enthalpies of a system from the point of view of the fundamental research of new prospective polymer materials are determined, and solvation processes on macromolecules are investigated. The dissolution heats of polymers and the complex formation heats of polymer systems are determined in a similar laboratory in Czechoslovakia (Polymer Institute of the Slovak Academy of Sciences in Bratislava).

Absorption calorimetry is represented by a small laboratory (J. Heyrovský Institute of Physical Chemistry and Electrochemistry in Prague) with a research programme that has already run for several years, which is based on a solid theoretical background. A self-constructed absorption calorimeter is used for investigating the chemisorption of hydrocarbons and organic compounds on metal films, especially on molybdenum, aiming to elucidate the nature of chemisorption in dependence on both the structure of the organic compound and the surface properties of the materials.

Application of the calorimetric technique to the investigation of thermodynamic properties of inorganic materials and systems also has a tradition of long standing in Czechoslovakia. A differential microcalorimeter suitable for measurements of pseudo-differential dissolution heats in the range of concentrated solutions was built at the Institute of Inorganic Chemistry in Prague, which allows precise determination of the crystallization heats of inorganic salts. Similar problems are studied by means of an LKB calorimeter at the Research Institute of Inorganic Chemistry at Ústí nad Labem. Measurements of reaction heats are also performed at the Institute of Inorganic Chemistry of the Slovak Academy of Sciences in Bratislava (with Dr. I. Proks supervising [90]) where the calorimetric laboratory is one of the first in Slovakia. Here the dissolution and cooling heats of complex silicates are determined in solution and the respective phase diagrams are constructed. The calorimetric technique allows data to be obtained at temperatures up to ~ 1600°C. Calorimeters designed at the Institute allow measurements of dissolution heats and may also work as drop calorimeters. The investigation of phase diagrams based on calorimetric data was for many years performed by the late Professor M. Malinovský at the Slovak Institute of Technology in Bratislava.

The determination of heat capacities has been developed in Czechoslovakia both in the high- and low-temperature ranges. A high-temperature calorimeter designed by the late Dr. M. Roubal at the National Research Institute for Materials in Běchovice [91] allowed determinations of heat capacities in the temperature range 900–1900 K. Much attention has been given to standardization of the method using α-Al_2O_3. For heat capacity measurements in the temperature range 4–300 K, a calorimeter with a helium cryostat was built at the Institute for Electrical Engineering at Běchovice. It was used for investigating the temperature dependence of heat capacities and heat conductivities of steels and superconducting materials, especially of $NbTi_{50}$. A device constructed later allowed measurements to be made at temperatures of 2.3–40 K in magnetic fields of up to 4.5 T. The technique of adiabatic demagnetization of paramagnetic substances was used for theoretical investigations in nuclear physics with oriented nuclei in temperature regions nearing absolute zero (Institute of Physics at Řež).

Calorimetry has also found direct industrial applications. Dr. Pekárek and others constructed an isoperibolic calorimeter for the determination of hydrogenation heats, which allows rapid checking of the degree of catalytic hydrogenation of fats. Dr. Tydlitát, at the Research Institute of Building Industries in Prague, designed a calorimeter for investigating the hydration of cement pastes at higher temperatures [92].

At the Institute of Metals in Brno, Dr. Velíšek [93] designed a twin dynamic high-temperature calorimeter for the measurement of small thermal effects by the diathermic or adiabatic method as well as by a method similar to the drop-in technique where a sample previously heated is inserted into the calorimeter and the temperature course and heat flux are observed during its cooling [94].

At the Institute of Physics of the Slovak Academy of Sciences in Bratislava a pulse method [95] for the measurement of the specific heat and of the heat conductivity of small samples, at temperatures of −150 to 1500°C, has been suggested which is based on the analysis of the thermic effect on a rectangular heat pulse. The device also contains an automatic computer-controlled unit [96].

In this review we can omit neither the School of Professor J. Krempaský on pulse calorimetric methods [97] nor the treatise of J. Velíšek on the unification of the classification of high-temperature calorimetric methods [98]; also more general surveys of calorimetric methods have been published [66,99–102].

A special field of calorimetry is represented by enthalpimetry, which is being developed by J. Brandštetr at the Department of Chemistry of the Technical University in Brno [103]. The main attention has been devoted to instrumentation and now a commercially produced device in desk-top size, the Enthalpiograph (presently equipped with a computer) has been developed [104]. Among its most important applications are the deterination of cement content in fresh concrete mixtures, the kinetics of reactions in mixtures of solids and the determination of hydration heats of cement mixtures.

A similar branch of thermochemical analysis is successfully studied at the Institute of Chemical Technology at Pardubice [105]. An important achievement is the construction of an isoperibolic calorimeter with an on-line computer [106].

At present, many laboratories are modernizing their calorimetric devices by introducing direct computer control. Data processing by means of modern techniques is already generally used.

This survey of the main characteristics of the calorimetric laboratories in our country and their equipment is not complete; it may, however, give a general idea of both the present state and trends for future development.

The specialists in the field of calorimetry are organized in the group of chemical thermodynamics and calorimetry (chairman Professor R. Holub, scientific secretary Dr. V. Pekárek), the main activity of which has been dedicated to the organization of various seminars dealing with, besides calorimetry, related topics on temperature control and precise measurements, and on thermodynamics in general. This activity attained its peak in two international conferences:

1st Czechoslovak Conference on Calorimetry, Liblice, 1977 (120 participants from 16 countries), and
2nd Czechoslovak Conference on Calorimetry, Liblice, 1982 (135 participants from 15 countries).

ACTIVITIES OF THE NATIONAL THERMOANALYTICAL GROUPS

The idea of a thermoanalytical association was promoted by the late Professor R. Barta and preliminary principles suggested during the 1946 meeting but unused until the 1972 meeting, both held in Prague. Within this period Professor Barta was the main actor of "The days of thermal analysis" held at the Institute of Chemical Technology in Prague. The important moment in modern thermal analysis was the formation of the Specialized Group on Thermal Analysis in Bratislava in 1972 (Professor M. Vaniš, chairman and Dr. O. Koráb, scientific secretary) as a branch of the Slovak Chemical Society. Having their activity located at the Slovak Technical University in Bratislava the group essentially contributed to the better exchange of information, catalogization of apparatuses, aid in service and consultations. The group also undertook the duty of continuing the Czechoslovak National Conferences, which have taken place as follows [107]:

1966: 4th National Conference on DTA and its Utilization in Silicate Chemistry, Bratislava (38 participants and 19 contributions)
1970: 5th National Conference on DTA and its Utilization in Silicate Chemistry, Smolenice (86 participants, 27 contributions)
1973: TERMANAL '73 (6th National Conference on Thermal Analysis) High Tatras (169 participants with 16 from abroad, 62 contributions)
1976: TERMANAL '76, High Tatras (193 participants with 12 from abroad, 64 contributions, exhibition)
1979: TERMANAL '79, High Tatras (197 participants, with 8 from abroad, 22 plenary lectures and 60 posters, exhibition)
1982: TERMANAL '82, High Tatras (185 participants with 13 from abroad, 13 plenary lectures and 93 posters, exhibition, workshops)
1985: 8th ICTA (including 10th National Conference on Thermal Analysis), Bratislava [108].

The group also organized a series of Summer Schools on Thermal Analysis, which were found to be very useful for young scientists and engineers, held in 1977 (53 participants), 1978 (23 participants) and 1980 (25 participants) in Bratislava.

The Czech group on Thermal Analysis was established in Prague, 1974 (Professor V. Balek chairman and Dr. J. Šesták scientific secretary) and associated with the Czechoslovak Scientific–Technical Society and later joined by the Czechoslovak Chemical Society (1979, chairman Dr. A. Blažek). Major activities of this group have been aimed at the promotion of scientific and technical progress of more specialized branches of thermal analysis including the programme of standardization and nomenclature unification. Among others the group supervised the Czechoslovak nomenclature [82] and the domestic-originated set of temperature standards tested similarly to that for ICTA–NBS commercial standards. The group also organized specialized national seminars as follows:

1975: Measurements of thermophysical properties, Prague. Methods of evolved gas and emanation thermal analysis, Prague.
1976: Actual problems of TA (use of DSC on medicament and explosive testing), Prague. Methods of calibration and standardization in TA [109], Mezná Louka.
1977: Apparatus and standards in thermal analysis [110], Chrudim.
1978: Joint activity of thermoanalysts of Czechoslovakia and G.D.R., Hřensko. Methods of the evaluation of TA curves [111], Dobřichovice.
1979: Thermal analysis and calorimetry of polymers [112], Tábor.
1980: Thermal analysis in the study of oxides and other ceramic materials, Karlovy Vary.
1981: New trends in thermal analysis, Železná Ruda.
1982: Thermodilatometry and thermomechanical analysis, Prague.
1983: Thermal analysis in industrial processing, Český Krumlov.
1984: Thermodilatometry II [113], Prague.
1985: Meeting of ICTA Council, Liblice near Prague.

No less important were the activities of members of our groups in ICTA, namely Professor R. Bárta as Vice-president (1968–1971) and Honorary President (1971–1974), Dr. J. Šesták (1978–1984) and Professor V. Balek (1984–) as Councillors-at-Large, both also being members of nomenclature and awards committees, respectively.

This survey has given an inside account of the work of Czechoslovak thermoanalysts both in the past and present, the latter having been appreciated by the ICTA, who have confirmed the honour of organizing the 8th ICTA in our country (Professor M. Hucl, Chairman), which has been met with interest and appreciation among the scientific public.

ACKNOWLEDGEMENTS

This article has been prepared to celebrate the 120th Anniversary of the Czechoslovak Chemical Society (current Presidents: Professor J. Pick and Professor J. Tomko).

The Authors express their gratitude to Professor V. Balek (Institute of Nuclear Research in Řež), Dr. A. Blažek (Institute fo Chemical Technology in Prague), Professor M. Hucl (vicedean of the Slovak Technical University in Bratislava) and Dr. V. Tomková (Slovak Technical University in Bratislava).

REFERENCES

1 R.C. Mackenzie and I. Proks, Thermochim. Acta, 92 (1985) 3.
2 J. Matějka, Material Testing in Ceramics, Průmyslové nakl., Prague, 1952 (in Czech.).
3 J. Burian and J. Juránek, Chem. Listy, 7 (1913) 1, 68, 97, 148, 210.
4 R.C. Mackenzie, Thermochim. Acta, 73 (1984) 251.
5 B. Wohlin, Sprechsaal, 46 (1913) 719, 733, 749, 767, 781.
6 W.J. Smothers and Y. Chiang, Differential Thermal Analysis, Chemical Publishing Co., Inc. New York, 1958.
7 C. Kallauner and J. Matějka, Sprechsaal, 47 (1914) 423.
8 O. Kallauner, Sprechsaal, 58 (1925) 779.
9 O. Kallauner and J. Matějka, Chem. Listy, 8 (1914) 247.
10 O. Kallauner and J. Matějka, Chem. Listy, 8 (1914) 248.
11 O. Kallauner and J. Preller, Chem. Listy, 8 (1914) 247.
12 A. Šimek, Chem. Listy, 8 (1914) 252.
13 C. Kallauner, Věstník V. sjezdu českých přírodozpytců a lékařů v Praze, 1914, p. 240.
14 J. Matějka, Chem. Listy, 13 (1919) 164, 182.
15 J. Matějka, Chem. Listy, 16 (1922) 8.
16 J. Štěrba-Böhm and S. Škramovsky, Cas. Cesk. Lek., 8 (1928) 211; Collect. Czech. Chem. Commun., 1 (1929) 24.
17 S. Škramovský, Collect. Czech. Chem. Commun., 2 (1929) 292.
18 S. Škramovský, Chem. Listy, 26 (1932) 521.
19 M. Guichard, Bull. Soc. Chim. Fr., 37 (1925) 251, 381; 29 (1926) 1113.
20 S. Škramovský, Silikaty, 3 (1959) 74.
21 S. Škramovský and O. Vondrášek, Cas. Cesk. Lek., 17 (1937) 294; Collect. Czech. Chem. Commun., 10 (1938) 443.
22 S. Škramovský and O. Vondrášek, Cas. Cesk. Lek., 9 (1937) 329.
23 S. Škramovský and J. Štěpán, Cas. Cesk. Lek., 19 (1939) 4.
24 S. Škramovský and A.S. Lukanovič, Cas. Cesk. Lek., 19 (1939) 151, 165.
25 S. Škramovský and J. Štěpán, Chem. Listy, 37 (1943) 19.
26 S. Škramovský, Cas. Cesk. Lek., 14 (1934) 317; Collect. Czech. Chem. Commun., 7 (1935) 69.
27 R. Forster, C.F. Hüttig and S. Škramovský, Z. Phys. Chem., 25 (1934) 1.
28 S. Škramovský, Z. Hauptman and V. Strnad, Sborník pražské university moskevské universitě, KU Prague, 1955.
29 V. Haber, J. Rosický and S. Škramovský, Silikaty, 7 (1963) 95.
30 S. Škramovský, J. Šplíchal and J. Goll, Veda přírodni, 17 (1936) 206.

31 S. Škramovský, J. Šplíchal and J. Goll, Collect. Czech. Chem. Commun., 9 (1937) 302.
32 S. Škramovský, J. Šplíchal and J. Goll, Chem. Obz., 12 (1937) 181.
33 A.E. Dobner and S. Škramovský, Iron Steel Inst., (1936) 578.
34 S. Škramovský, Almanach III, sjezdu slovan, lékárnictva, Bělehrad, 1934, p. 168.
35 Sborníky prací technologie silikátů, VŠChT Praha, I-1954, II-1955, III-1956, vyd. SNTL Prague.
36 Z. Pospíšil and M. Beránek, Silikaty, 1 (1957) 116.
37 V. Sokol, Silikaty, 1 (1957) 177.
38 A. Blažek, Silikaty, 1 (1957) 158.
39 V. Šatava, Silikaty, 1 (1957) 188, 204.
40 J. Voldán, Silikaty, 1 (1957) 125.
41 Č. Hýbl and S. Krais, Silikaty, 1 (1957) 146.
42 V. Šatava, Silikaty, 1 (1957) 188.
43 Z.A. Blažek, Thermobalance Tegra (advertising leaflets).
44 I. Proks and J. Zlatkovský, Chem. Zvesti, 23 (1969) 620.
45 J. Komrska, Silikaty, 11 (1967) 51.
46 A. Bergstein, Collect. Czech. Chem. Commun., 20 (1955) 1058.
47 J. Chromý, Am. Mineral., 54 (1969) 549; Silikaty, 18 (1974) 105.
48 O. Koráb and M. Vaniš, Silikaty, 4 (1960) 266; Chem. Zvesti, 17 (1963) 807.
49 V. Šiške and I. Proks, Silikaty, 5 (1961) 142.
50 J. Šesták, A. Burda, A. Bergstein and P. Holba, Chem. Listy, 63 (1969) 785.
51 J. Rosický, Silikaty, 12 (1968) 295.
52 V. Balek, Silikaty, 13 (1969) 39.
53 V. Šatava and O. Vepřek, Silikaty, 15 (1971) 1; J. Am. Ceram. Soc., 58 (1975) 357.
54 S. Chromý and V. Hložek, Thermochim. Acta, 95 (1985) 433.
55 K. Habersberger and V. Balek, Termanal, 73, SVŠT Bratislava, 1973, p. P-33.
56 J. Šesták and H. Svoboda, Termanal' 73, SVŠT Bratislava, 1973, p. P-16.
57 W. Vaněk and B. Knob, Silikaty, 6 (1962) 63.
58 Č. Hýbl, J. Maďar and M. Matas, Silikaty, 6 (1962) 75.
59 V. Zapletal, J. Jedlička and V. Růžička, Chem. Listy, 50 (1956) 1406.
60 A. Bergstein, Silikaty, 6 (1962) 53.
61 V. Šatava, Collect. Czech. Chem. Commun., 24 (1959) 2172.
62 I. Proks, Silikaty, 5 (1961) 114.
63 I. Proks, Silikaty, 24 (1970) 287.
64 P. Holba, Silikaty, 20 (1976) 45.
65 P. Holba and M. Nevřiva, Silikaty, 21 (1977) 19.
66 J. Šesták, P. Holba and R. Bárta, Silikaty, 20 (1976) 83.
67 J. Šesták, Silikaty, 7 (1963) 125; 11 (1967) 153.
68 J. Šesták and G. Berggren, Chem. Listy, 64 (1970) 561.
69 V. Šatava, Silikaty, 5 (1961) 68.
70 V. Šatava and F. Škvára, J. Am. Ceram. Soc., 52 (1969) 591.
71 V. Šatava, Thermochim. Acta, 2 (1971) 423.
72 V. Šatava and J. Šesták, Anal. Chem., 45 (1973) 154.
73 J. Šesták, Talanta, 13 (1966) 567.
74 J. Šesták and G. Berggren, Thermochim. Acta, 3 (1971) 1.
75 J. Šesták, Phys. Chem. Glasses, 15 (1974) 567.
76 J. Šesták, in I. Buzás (Ed.), Thermal Analysis, Vol. 1, Proc. 4th ICTA, Budapest, 1974, Akademiai Kiado, Budapest, 1975, p. 3.
77 V. Jesenák, Thermochim. Acta, 95 (1985) 13.
78 P. Holba, Silikaty, 23 (1979) 193; 24 (1980) 213.
79 M. Nevřiva, P. Holba and J. Šesták, Silikaty, 20 (1976) 33.
80 M. Nevřiva, Thermochim. Acta, 22 (1978) 187.

81 M. Nevřiva and J. Šesták, Chem. Prum., 28 (1978) 145.

82 J. Šesták, P. Holba and S. Fajnor, Chem. Listy, 77 (1983) 1292.

83 Eliášek M, M. Šťovík and L. Zahradník, Chemické Rozbory Nerostných Surovin: DTA, Academia, Prague, 1957.

84 J. Šesták, V. Šatava and W.W. Wendlandt, Thermochim. Acta, 13 (1973) 333.

85 V. Balek, Thermochim. Acta, 22 (1978) 1.

86 A. Blažek, Termická Analýza, SNTL, Prague, 1972; Thermal Analysis, Van Nostrand Reinhold, London, 1974.

87 V. Balek and T. Tölgyessy, Emanation Thermal Analysis, Akademia Kiádo, Budapest, 1984; Elsevier, Amsterdam, 1984.

88 J. Šesták, Měření Termofysikálních Vlastností Pevných Látek, Academia, Prague, 1982; Thermophysical Properties of Solids, Elsevier, Amsterdam, 1984.

89 J. Rosický, Termická Analyza (Textbooks of Charles University), Pedagogické nakl., Prague, 1986.

90 I. Proks et al., Silikaty, 21 (1977) 253.

91 M. Roubal and V. Landa, Strojirenstvi, 25 (1975) 559.

92 V. Tydlität et al., Czech. J. Phys., B21 (1971) 817.

93 J. Velíšek and V. Slavík, Scripta PF UJEP Chem., 3 (1972) 211; Czech. J. Phys., B17 (1967) 331.

94 J. Velíšek, Chem. Listy, 68 (1974) 1185.

95 L. Kubičár, Czech. J. Phys., A34 (1984) 153.

96 L. Cesnak and J. Bielek, Czech. J. Phys., B25 (1975) 443.

97 J. Krempaský, Measurements of Thermophysical Quantities, VSAV, Bratislava, 1969.

98 J. Velíšek, Scripta PF UJEP Chem., 3 (1972) 189; Czech. J. Phys., A20 (1970) 513.

99 V. Pekárek, Chem. Listy, 69 (1975) 788.

100 L. Kosa, Silikaty, 21 (1977) 367.

101 J. Velíšek, Chem. Listy, 72 (1978) 801.

102 J. Huleja, Chem. Listy, 74 (1980) 897.

103 J. Brandštetr et al., Z. Anal. Chem., 254 (1971) 34; Chem. Listy, 78 (1984) 669.

104 J. Brandštetr et al., Chem. Listy, 66 (1972) 88 63 (1969) 931. Bull. Technol. Univ. Brno, 1-4 (1973) 35; Silikaty, 26 (1982) 734.

105 V. Velich et al., J. Therm. Anal., 24 (1982) 299; 29 (1984) 353.

106 V. Velich et al., Chem. Listy, 79 (1985) 661.

107 Proc. 6th, 7th, 8th and 9th TERMANAL, 1973, 1976, 1979, and 1982, National Conference on Thermal Analysis, edited by M. Vaniš and V. Tomková, Publishing house of SVŠT, Bratislava.

108 A. Blažek (Ed.), Thermal Analysis, Proc. 8th ICTA. Bratislava, Thermochim. Acta, Vol. 92, 1985.

109 P. Holba (Ed.), Proc. of Methods of Calibration and Standardisation in Thermal Analysis, DT ČSVTS, Ústí n/L, 1976.

110 M. Beránek (Ed.), Proc. of Apparatus and Standards in Thermal Analysis, DT ČSVTS, Pardubice, 1977.

111 J. Šesták (Ed.), Proc. of Methods of the Evaluation of Thermoanalytical Curves, DT ČSVTS, Prague, 1978.

112 J. Vaniček (Ed.), Proc. of Thermal Analysis and Calorimetry of Polymers, ČSVTS Silon, Planá n/L, 1979.

113 A. Blažek (Ed.), Proc. of Thermodilatometry II, DT ČSVTS, Prague, 1983.