

*Education Workshop*

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**WORLDWIDE STATUS AND FUTURE OF THERMAL ANALYSIS EDUCATION**

*E. Turi, P. Haines, G. Hakvoort, T. Hatakeyama, V. Mathot and G. Pokol*

It has become a tradition for the ICTA Education Committee to organize a workshop as part of the quadrennial ICTA Conference. The material published here was contributed by the authors listed above.

**WORLDWIDE STATUS AND FUTURE OF THERMAL ANALYSIS EDUCATION**

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The aim of this workshop was to discuss how best to promote on a worldwide basis:

- the education of thermal analysts and,
- the application of thermal analysis.

The dual objectives cannot be separated; increased application creates a need for more skilled thermal analysts. In this report, I review the highlights of the previous Education Committee Workshop, address topics of particular importance in our program, and present the lists of our associates on the committee.

**Keywords:** thermal analysis education

**Second Thermal Analysis Education Workshop – Jerusalem, 1988**

The first part of the agenda was a report evaluating the work of the ICTA Education Committee between the 8th and 9th ICTA (1985 to 1988). Specific recommendations that were made in 1985 ("Bratislava Recommendations") continue to serve as guidelines for our activities [1].

- Include thermal analysis education in the early stages of student curricula

- Organize 'short courses' for those who did not receive formal education in thermal analysis while in school
- Produce basic textbooks
- Train educators in thermal analysis

Although in 1985 we concluded that "in most countries thermal analysis education was inadequate", by 1988 we were able to report significant progress in our short-term projects. University training of professionals continued to lag. We had made progress in promoting the education of thermal analysts, and more in extending the application of thermal analysis, particularly in the area of polymers. Nevertheless, Professor Wunderlich pointed out in Jerusalem the discrepancy between the growing need for skilled thermal analysts, and the limited availability. He suggested the introduction of thermal analysis in basic education, and the development of a professional curriculum [2]. As part of my closing lecture of the 9th ICTA, the following "Jerusalem Recommendations" were formulated [3]:

#### *Short-term projects*

1. Update and upgrade the education of professional, already using thermal methods
2. Create additional societies and thermal analysis discussion groups

#### *Long-term projects*

1. Train specialists (up to Ph.D. level) in materials characterization
2. Support national and international scientific meetings on thermal analysis
3. Establish 'Materials Characterization Institutes' (independent, or part of another institution for higher education)

### **The Education of thermal analysts**

The Education Committee's main goals are:

- to improve the education of thermal analysts on the job
- to increase the number of professional thermal analysts trained in colleges and universities
- to promote the application of thermal analysis

To improve the level of education, top priority must be to educate the educators. I believe that one possible solution would be to establish 'summer schools' for educators already trained in thermodynamics, physical chemistry, and other related subjects. To be prepared for proposing long-term solutions, the Education Committee decided to survey the training of thermal analysts in the USA and Canada. Professor Wunderlich was kind enough to send out 481 ques-

tionnaires to university Chemistry, Chemical Engineering, Materials Engineering, and Polymer Sciences Departments. A little better than 50% (247) replied. The following are excerpts from Professor Wunderlich's report [4]:

Discussions of the Education Committee at the recent ICTA Meetings have always led to the conclusion: too little is done in teaching thermal analysis. This survey shows the first quantitative analysis.

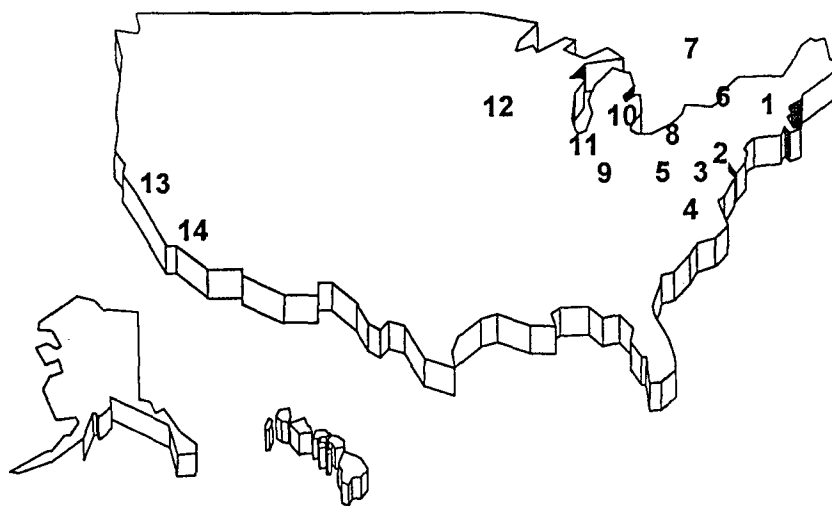
- \* Only 3.6% of all departments have a course of 1–3 credit hours in thermal analysis.
- \* Only 0.6% of the 10000 students in the survey have taken a course in thermal analysis, and only 21% hear about thermal analysis in related courses.
- \* Only 30% of the departments offer laboratory experiments related to thermal measurements. 75% of the students in these departments have not done a single experiment related to thermal measurement!
- \* On the positive side, 51% of all departments own one or more pieces of thermal analysis equipment, and more than 1000 students and faculty are involved in thermal analysis in their research.

The availability of quantitative data, thanks to Professor Wunderlich, puts us in a better position to convince educational institutions, government, and industry to include systematic thermal analysis education as a priority. Dr. Wunderlich has suggested that we prepare sample curricula for undergraduate and graduate courses. He has also distributed a questionnaire to our colleagues outside the USA and Canada so that we would be able to evaluate the worldwide status of thermal analysis teaching.

### Local Thermal Analysis Groups

Professional thermal analysis groups are organized on international, national, regional, and local levels. "Grass roots" organizations now serve very important purposes, particularly in these difficult economic times. First, local groups bring lectures, discussions and demonstrations to members who may not be able to travel and second, they offer a forum for experienced colleagues to share the wealth of their knowledge with their local scientific community. To show how local thermal analysis groups in the United States and Canada have spread, I have included a map showing NATAS affiliated organizations in North America (Fig. 1). I had the privilege of starting the first group in New Jersey in 1977, followed by Dr. Jen Chiu who began the group in Delaware in 1978.

A glance at this map shows that most of these groups are located in the same areas as industries that most frequently use thermal analysis. The survey was completed by Martha Steiner and published in the ICTA News [5]. I believe that other ICTA member societies may benefit from setting up similar networks in their countries.



1. New England Thermal Forum
2. New Jersey TA Group
3. TA Forum of Delaware Valley
4. Chesapeake and Potomac TA Society
5. Western Pennsylvania TA Society
6. Niagara Frontier TA Society
7. Canadian TA Society
8. North Coast TA Society
9. Ohio Valley TA Society
10. Great Lakes TA Society
11. Chicago Area TA Society
12. Midwest TA Group
13. Golden Gate Polymer Forum
14. Southern California TA Group

Fig 1 Regional and local Thermal Analysis Societies (Groups) affiliated to NATAS

## Courses on thermal analysis

### *Short courses*

There are both an increasing number of short courses being offered around the world, as well as more training programs sponsored by the instrument companies. Despite deepening economic difficulties, we held three short courses in a two-month period (March and April 1992, sponsored by the ACS and by Polytechnic University), with attendance from 32 states and Japan, and over 130 participants. Attendance at these courses continues to be a testimonial to the importance of

these courses to participants as well to their sponsors from industry, academia, and governmental institutions.

In addition, there is encouraging news about short courses from many countries. An excellent example is Dr. Ninan's success in India, where he recently instructed 60 chemistry teachers in two groups. These teachers in turn will carry the message about thermal analysis to other students throughout India.

### *Graduate courses*

Despite the growing use of thermal analysis in academic research and industrial practice, there are very few graduate courses available to students in the United States. One of these is offered by Professor Wunderlich at the University of Tennessee. Professor S. Cheng at the University of Akron in Ohio gives a biannual credit course for graduate students entitled "Thermal Analysis in Polymeric Materials". Both courses are now using Professor Wunderlich's "Thermal Analysis", Academic Press, 1990.

### **Progress in selected countries**

Remarkable progress has been made in the last four years in a number of countries; I would like to highlight developments in China, Russia, Ukraine, and Singapore.

#### *China*

I had the opportunity to meet Mme Qi Mingbi in Beijing in 1988. At that time six out of eight members of their thermal analysis group were specialists in organic and polymeric materials, a ratio close to that obtained by instrument companies in a review of programs, which demonstrated that 80% of thermal analysis instrument capacity is used for organics and polymers. Mme Qi published a report in 1991 on the past and present status of thermal analysis in China [6].

Professor X. Liu, Regional Chairman (Kunming, Yunnan), recently sent us a report about their program "Higher education system for thermal analysis", held in Kunming in April 1992. It was attended by 58 participants from around China. Dr. Liu used our latest report on the work of the ICTA Education Committee and also distributed copies of the ICTA questionnaire. They concluded that their situation in China was similar to that in North America with regard to thermal analysis education. (I would like to take the liberty of expressing great satisfaction that the work of this Committee was the subject of discussion.) Professor Z. Liu, who is a member of the Education Committee, has sent us the plans for thermal analysis meetings scheduled for 1992 in China. It includes six events and a summer school on thermal analysis, the latter co-sponsored by the thermal analysis societies of four provinces.

### *Russia and Ukraine*

It is obvious that the enormous political changes that have taken place in the former USSR have affected every walk of life, including technical and scientific organizations. This has included the liberalization of travel to international meetings; it was my pleasure to meet Professor Yuli Godovsky at the ACS National Meeting in San Francisco this year. Both Russia and Ukraine are represented in our committee. In a short period, they introduced new training and application programs and compiled more than 20 papers for a special issue of the Journal of Thermal Analysis devoted to articles from the former USSR.

A more detailed report on thermal analysis in Russia and Ukraine appears in the ICTA News. Professor Godovsky reported on a meeting of more than 200 scientists in Kazan on "Polymer Blends". In addition, there were seminars on "Thermal Analysis of Polymers" in Kiev and Leningrad, organized by Drs. Privalko and Bershtein, respectively. Professor Privalko wrote to us about their Kiev conference this June, with 40 participants from Ukraine and Russia. About half of the meeting was devoted to presentations related to thermal analysis of polymers.

### *Singapore*

Mr. C. Tay, our regional chairman in Singapore, represents a particularly rapidly developing country, where Western and Japanese companies and institutions are investing heavily in research and development. I first met Mr. Tay in Kuala Lumpur in 1987 where he was attending our thermal analysis course sponsored by the University of Malaya. In his first report to the Education Committee, Mr. Tay pointed out that in Singapore almost 90% of thermal analysis instruments are utilized for polymer characterization. In March of this year, Mr. Tay held his 3rd short course on "Polymer Characterization by Thermal Analysis" at the Singapore Polytechnic. Many of the participants decided to join their newly established Thermal Analysis Group. Mr. Tay hopes that this group will also be joined by our colleagues in Thailand and Malaysia as he is in the process of establishing contacts with scientists in those countries.

### **Books**

Without question, books on the theory and practice of thermal analysis are among the most important aids in educating not only thermal analysts, but others interested in this technique of vital importance. The following is not a comprehensive list of relevant publications; it is a selection of books written or edited by our associates in the Education Committee, and published recently (or whose publication is expected soon.) It was an important part of our activities during the past several years.

- M. Brown, *Introduction to Thermal Analysis, Techniques, and Applications*. Chapman and Hall, 1988, p. 205.
- V. Bernshtein and V. Egorov, *Differential Scanning Calorimetry of Polymers*. Ellis Horwood Ltd. In Press 1992 Appx. 320 p. (Russian language edition published 1990).
- Y. Godovsky, *Thermophysical Properties of Polymers*. Springer Verlag, New York, 1992 p. 296.
- Z. Liu and T. Hatakeyama, *Thermal Analysis Handbook*. Chemical Industry Publisher Co., Beijing. In preparation, expected 1992.
- X. Liu, *Technical Basis of Thermal Analysis*. (Chinese) p. 354.
- Z. Liu et al., *Introduction to Thermal Analysis*, Chemical Industry Publisher, Beijing, 1991. (Chinese).
- E. Turi (Ed.), *Thermal Characterization of Polymeric Materials*. 2nd Edition. Academic Press, New York, In preparation, expected 1994. Appx. p. 1300.
- B. Wunderlich, *Thermal Analysis*. Academic Press, New York, 1990, p. 464.

### Future plans

I wish to conclude my report with a look into the future. I have pointed out the nearly universal applicability of thermal methods to almost all areas of research and industry. These horizons are still expanding. I would like to mention briefly the new trends and challenges we will face in the coming years and emphasize some "hot" topics.

- Better quality control
- Aging
- Service life under various conditions
- Performance prediction
- Characterization of medical devices

A word about medical devices: this is the most rapidly growing area in the health care industry. These devices, or parts of them, are almost invariably made of polymers. They are manufactured by about 16,000 device makers with a total of approximately 30 billion dollars business volume. In addition to their economic and technical importance, we are very much aware that poor quality may be life threatening. Consider that these devices include heart valves, pacemakers, even artificial hearts!

In the future we plan the following:

1. Extend the activities of the Education Committee to additional countries
2. Increase the number of short courses, seminars, and tutorials on thermal analysis
3. Disseminate information on important scientific and technical books, newsletters, and other reference material
4. Develop recommendations for course curricula for undergraduate and graduate courses
5. Generate worldwide statistical data and evaluate the status of thermal analysis education in 10–20 more countries
6. Promote further application of thermal analysis to polymers

## Conclusions

There has been significant progress worldwide in the last four years in the education of thermal analysts; much more needs to be done. Although there are logistic difficulties for a committee of 23 scientists from around the world, we have spent considerable time and effort working together. I have included a list of my colleagues on the committee as Appendix I.

I believe that thermal analysis has a bright future. I am proud of the role that our Committee and our Society have had in realizing the gains already made and we will continue to make every effort to promote thermal analysis around the world.

## Appendix I

### *Committee Members*

M. Brown, South Africa  
Y. Godovsky, Russia (Moscow)  
T. Hatakeyama, Japan  
Z. Liu, China (Changchun, Jilin)  
V. Mathot, BeNeLux Countries  
L. Niinisto, Scandinavian Countries  
G. Pokol, Hungary  
M. Richardson, United Kingdom  
E. Turi, USA (Chair)  
B. Wunderlich, USA

### *Regional Chairmen*

V. Bernshtein, Russia (St. Petersburg)  
I. Giolito, Brazil  
P. Haines, United Kingdom  
X. Liu, China (Kunming, Yunnan)  
K. Ninan, India (Trivandrum)  
V. Papkov, Russia (Moscow)  
V. Privalko, Ukraine (Kiev)  
Qi. Mingbi, China (Beijing)  
A. Siegmann, Israel  
R. Shanks, Australia  
M. Steiner, USA  
C. Tay, Singapore, Malaysia, Thailand  
I. Varma, India (Delhi)



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- 1 W. Ludwig and S. St. J. Warne, *Thermochim. Acta*, 110 (1987) 23.
- 2 E. Turi, B. Wunderlich, M. Brown and T. Ozawa, *Thermochim. Acta*, 148 (1989) 13.
- 3 E. Turi, *Thermochim. Acta* 135 (1988) 11.
- 4 *ICTA News* 24 (1991) 5.
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**Zusammenfassung** — Ziel dieses Seminars war die Diskussion, wie auf weltweiter Basis am besten

- die Ausbildung von Thermoanalytikern und
- die Anwendung der Thermoanalyse
- gefördert werden kann.

Beides kann nicht voneinander getrennt werden; intensivere Anwendung schafft und benötigt auch mehr geschulte Thermoanalytiker. Vorliegend wird ein Überblick über die Höhepunkte des letzten Education Committee Workshop gegeben, es werden Themen von besonderer Bedeutung in unserem Programm angesprochen und eine Liste der Mitarbeiter des Ausschusses angeführt.

## ‘PROBLEMS, PROPOSALS AND PROJECTS’:

**A review of the activities of the thermal methods group (UK) in thermal analysis and education**

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Meetings and discussions held by the Thermal Methods Group to keep its members fully aware of the most recent developments in thermal analysis, and the efforts made to increase the number of graduates and researchers who know the potential and range of thermal methods, are discussed. Difficulties which may occur, and steps being taken to overcome them, are considered.

## Historical

Since its foundation in 1964 [1], the Thermal Methods Group and its members have been active in promoting the cause of thermal analysis, calorimetry and the many other techniques which thermal analysts may use. Regular meetings have been held either ‘topic’ based – on polymers, pharmaceuticals or reactions, or ‘technique’ based – on DSC, TG, EGA. There are usually about three meetings per year, and we try to choose a venue which is accessible to most people. In 1986, we celebrated 21 years [2] and, before 11th ICTA, we shall have been in existence for more than 30 years! An active and hard working committee changes yearly, but constant and ever-helpful have been the Honorary Secretary throughout all this time Dr. Cyril Keattch, and our stalwart co-opted member, Dr.

Robert Mackenzie. To keep all members in touch with personnel and instrumental changes, the Group publishes the 'TMG News' annually.

### **Problems: educational activities**

The most 'educational' of the Group's activities have been the 'Thermal Analysis Schools' held every couple of years, usually at a University where a great deal of Thermal Analysis teaching and research is being done: Salford, Manchester, Hertfordshire and Kingston. These schools have been made possible by the unstinting co-operation of the manufacturers, who came and demonstrated equipment and allowed hands-on experiments to the participants. This format, together with lectures from experts such as Dr. Robert Mackenzie, Dr. David Dollimore and specialists from the manufacturers gave invaluable and practical training to about thirty people at each of the nine Schools.

The recession in business has caused problems, so that our last two attempts to hold the schools have attracted very few people. Firms cannot employ nearly so many new graduates. They are shifting 'experts' from one area to another, and making many really skilled analysts redundant! They cannot spend nearly as much money to send people on courses as they used to and, indeed, a recent Survey [3] showed that many firms mostly encourage 'On the Job' training. We have not yet taken our 'Thermal Analysis Schools' out to firms, but certainly some firms organise their own 'Thermal Analysis Forum'.

### **Proposals**

First, we thought that we should try to establish who, what and where! Who was teaching Thermal Methods? To whom were they teaching, and how many students or graduates were involved? What were considered the most important techniques, what was stressed, what methods were used and what practicals were done? We also hoped to establish a 'database' of people involved in Thermal Analysis Education in the UK and so find out where it was taught, and, as importantly, where it was NOT!. This was carried out by a meeting in April 1992 at Leeds, where about 40 dedicated thermal analysts met to exchange ideas. It was probably a get-together of people already convinced of the need for Thermal Methods and its teaching, but many useful proposals came from the talks and discussions and are reported briefly in 'TMG News' [4]. A questionnaire based on one devised by Dr. B. Wunderlich [5] was circulated and the results are being analysed. The Thermal Methods Group hope to publish full reports of the talks and the other information made available at this Education Meeting shortly.

Secondly, we thought that more encouragement might be given to Young Researchers. The TMG already supports the 'TMG Award' which was first awarded in 1981 to Dr. E. Paterson at ESTA 2, and was given at 10th ICTA this year to Dr. A. J. Ryan for his essay on X-ray methods [6]. Since the number of entries for the

Award is often small, we propose to start a series of Young Researchers Meetings, at appropriate venues around the UK, at which young research workers could give short papers about their work with thermal analysis or associated techniques. These might be supported by one 'plenary' lecture by an eminent Thermal Analyst. This proposal would, we hope, encourage and promote appreciation of the nature and uses of thermal analysis and might be sponsored by certain local firms and manufacturers.

Thirdly, with the development of newer methods and apparatus, we decided that we needed a new approach and considered how the new breed of thermal analyst could best be instructed in the most efficient way of using his equipment. The actual techniques would be demonstrated by the manufacturer when the equipment was supplied. Any problems of operation would be apparatus specific, and the chief need was for guidance with the interpretation and the software facilities available. We are therefore organising for the future one day-workshops. The first will be next September on 'Thermal Analysis Software, Practice and Pit-falls'. We hope that this will be the first of a new type of practical workshop and most useful to our members.

## Projects

The TMG holds about three national meetings each year. Recent meetings have dealt with biological and pharmaceutical applications, polymers, minerals and evolved gases. We have also held joint meetings with other analytical groups and European societies.

A meeting will be held on 'Kinetic Aspects of Thermal Analysis' in November 1992 and a two-day meeting on 'Thermal Analysis of Advanced Materials' at Oxford in April, 1993. Also planned are meetings on 'Calibration and Standardisation' and on 'Environmental Aspects'. Clearly, these will all play an important part in keeping the thermal analysts up-to-date with the most recent work in the area [7].

Besides these, thermal analysis meetings are organised by Prof. Edward Charsley for the Thermal Analysis Consultancy Service at Leeds [8], including meetings on 'Industrial and Research Applications', 'Quantitative Aspects of DSC' and on 'TG-MS'. London University has a thermal analysis service which undertakes research and instruction in thermal methods [9].

Many Universities and colleges in the United Kingdom are teaching thermal methods to undergraduates and postgraduates in science and technology courses and using them in their researches and projects. Other societies, such as the Institute of Petroleum and the Institute of Physics have panels which also consider thermal methods, and the TMG keeps in contact with them.

## Future plans

One other proposal which has been suggested is to prepare a book of graded thermal analysis problems, involving one technique, or simultaneous techniques, or necessary additional analytical methods such as X-ray diffraction. This is already done most successfully with molecular spectroscopy [10], and would complement existing texts [11, 12] and enable the 'students' to work at their own pace and realise the power and range of applications of Thermal Analysis.

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**Zusammenfassung** Es werden Treffen und Diskussionen der Thermal Methods Group besprochen, die dazu dienen, ihre Mitglieder über die jüngsten Entwicklungen in der Thermoanalyse auf dem laufenden zu halten, weiterhin werden die unternommenen Bemühungen diskutiert, um die Anzahl von Hochschulabsolventen und Forschern zu erhöhen, welche die Möglichkeiten und die Reichweite thermischer Methoden kennen. Dabei werden mögliche Probleme und deren Überwindung berücksichtigt.

## THERMAL ANALYSIS EDUCATION IN THE BENELUX COUNTRIES

### Past, present and future

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Activities in the fields of thermal analysis and calorimetry taking place in the BeNeLux countries (Belgium, the Netherlands and Luxembourg) are described.

### Belgium and Luxembourg

To an outsider, the situation in Belgium is confusing. The country is divided into two: a Flemish (Dutch-speaking) part and a Walloon (French-speaking) part. This linguistic division is reflected in all aspects of Belgian social life.

In the Dutch-speaking part, structured activities at district level are of recent date (1985). Of course, before that time there were already research groups in several places which worked specifically in the field of thermal analysis, and moreover many Flemish thermal analysts were (and still are) members of the Dutch Thermal Analysis Society, TAWN. Nevertheless, recently a more structured approach was opted for. An informal organization was set up with the members taking turns at organizing annual meetings. It is characteristic of my Flemish colleagues (from a Dutch point of view) that this 'loose' structure works well. I asked Prof. J. Mullens to give a few details about the recent history of this organization. I am enclosing his contribution as an appendix.

In the field of education and training I should mention the Free University of Brussels course on 'Thermal Analysis for Polymer Material Research' in 1990, directed by Prof. B. van Mele.

There are no organizations in the field of thermal analysis and calorimetry in the French-speaking part of Belgium and in Luxembourg. A number of research groups are working in the field, but there are no contacts between these groups and the Flemish and Dutch organizations.

### The Netherlands

The Dutch Thermal Analysis Society (TAWN) - current membership 264 - is the umbrella organization for a broad range of thermal analysis and calorimetry activities. It organizes annual Theme Days and Thermal Analysis Days, which attract about 80 and 100 participants, respectively.

The society's history dates back to the first ICTA congress in Aberdeen in 1965, where Dr. Mackenzie invited some Dutch participants to discuss the need

for a Dutch thermal analysis society. Prof. L. van der Plas, who was among the very first TAWN members, reviewed TAWN's history at the recent celebration of its 25th anniversary. (This will be published in ICTA News.) In my opinion it is a highly representative account of the developments that have taken place in the field of thermal analysis, and its interest is therefore not limited to people in the Netherlands.

TAWN's education and training activities include special Theme Days, which in 1987 (lectures by Prof. B. Wunderlich) and 1990 (lectures by Dr. M. Richardson) each attracted 90 members and guests. Other recent examples of training activities by TAWN members are:

- Annual TA courses, directed by Dr. G. Hakvoort;
- Transnational Training Project in Polymer Science and Technology courses, including the course on 'Calorimetry and Thermal Analysis on Polymers' in 1989, directed by V. B. F. Mathot.

As mentioned, TAWN recently (1-2 October 1991) celebrated its foundation by organizing a highly successful two-day congress, 'TAWN 25'.

Dr. Hakvoort's report of this event is included in ICTA NEWS 24(2) of December 1991. The programme included lectures on important fields of application and topical aspects (Catalysis and Inorganic Chemistry; Polymers; Methods and Techniques; Pharmacy and Biochemistry; Miscellaneous; Thermo Troubles) as well as poster presentations and an instrument exhibition. The number of participants was 150.

At the last general meeting a decision was taken to introduce a 'TA Award for Young Scientists', which includes a prize of NLG 2000, (currently provided by the ATAS company) for young scientists in the Netherlands and Dutch-speaking Belgium who have made an outstanding contribution towards the achievement of the society's objective, which is 'to generate and spread knowledge and know-how in the field of thermal analysis and calorimetry'. Nominees need not be TAWN members. The Netherlands and Flanders are equally represented on the judging committee, which will nominate candidates to the TAWN Board. This is another example of the good relations between Dutch and Flemish thermal analysts.

## Appendix

### **The Flemish Thermal Analysis Society (J. Mullens, Limburg University, Diepenbeek, Belgium)**

The Flemish Thermal Analysis Society in Belgium was founded in 1985. The foundation of a society in Belgium was in fact suggested by Mr. A. J. Aartsen, a Dutchman who is a well-appreciated expert on and salesman of thermal analysis equipment.

The foundation took place at the Laboratory of Inorganic Chemistry of Antwerp on the initiative of Prof. H. Desseyn (University of Antwerp), J. Janssens (University of Antwerp) and Prof. J. Mullens (Limburg University of Diepenbeek). A delegation of the Dutch Thermal Analysis Society TAWN (Dr.G. Hakvoort, V. Mathot, M. Pijpers and Prof. A. Schuijff) was present to encourage their Flemish neighbours. To celebrate the foundation, A. J. Aartsen surprised the 40 participants of this first meeting in Antwerp with the famous 'Bossche bollen' (a delicious pastry from his home town)! Beside the foundation ceremony the programme included several scientific lectures.

Since that day annual meetings have been organized, where members presented lectures about their scientific work. The number of participants from universities and industries has constantly increased and is currently about 100.

The last meeting in May 1991 was organized by Prof. J. Mullens at the Laboratory of Inorganic and Physical Chemistry of the Limburg University in Diepenbeek: eight lectures and 11 posters were presented, dealing with applications on polymers as well as inorganic materials; instruments demonstrations were also given, thanks to the collaboration of eight instrument makers. The 1992 meeting on May 7 will be organized by Prof. B. van Mele at the University of Brussels (Department of Physical Chemistry and Polymers) and the 1993 meeting by Prof. S. Hoste at the University of Ghent (Laboratory of General and Inorganic Chemistry).

As Dr. G. Hakvoort mentioned in ICTA News of June 1991 there are indeed very good contacts between the Flemish and the Dutch Societies: several members of the Flemish group attend the TAWN meetings and vice versa.

**Zusammenfassung** — Die Aktivitäten auf dem Gebiete der Thermoanalyse und der Kalorimetrie in den Benelux-Staaten werden beschrieben.

## THERMAL ANALYSIS EDUCATION IN JAPANESE UNIVERSITIES AND ACADEMIC SOCIETIES

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This report introduces the present situation of TA education in Japanese Universities. The main activities of the Society of Thermal Analysis and Calorimetry in Japan, including conferences, publications, workshops and education seminars are expanded upon.

The population of Japan is 125 millions and these people live in an area of 30% of the total area of the main four islands (ca.  $3.7 \times 10^5 \text{ Km}^2$ ). More than 50% of 18 year-olds enter universities of college. These facts suggest that Japanese society is well organized and that scientific informations spreads quickly.

There are several hundred universities and colleges and it is difficult to investigate thoroughly the exact situation of thermal analysis in higher education in Japan. The following data are a representative result. A questionnaire was made using the same format as that of Professor B. Wunderlich. Figure 1 shows the universities to which the questionnaire was sent. No university teaches Thermal Analysis (TA) as a separate course. However thermodynamics is taught as a separate course in more than 70% universities (Fig. 2a). TA is taught as a part of lectures in thermodynamics, physical chemistry, analytical chemistry, thermochemistry, mineralogy and physicopharmaceutics (Fig. 2b). TA is taught to both undergraduate students (65%) and graduate students (35%). Almost every university has two to three TA instruments (Fig. 3) and DSC/DTA is the most common. DSC/DTA, TG and TMA are used by 200 professors and students in 16 universities. It seems that TA education is quite advanced in some universities, while in others it is not stressed. It seems to be necessary to change the curriculum in various scientific and engineering fields in order to promote TA education.

The Society of Thermal Analysis and Calorimetry, Japan, was established in 1969 and the number of members was ca.900 in 1991. Professors teaching TA in the universities are active members of the Society. Figure 4 shows the variation in number of members with time. The society is small if it is compared with many other academic societies; for example, the number of members of the Chemical Society, Japan, is 38,000 and that of the Society of Polymer Science and Technology, Japan, is 12,000.

An annual conference, workshops, publications including a quarterly Society journal and TA books edited by the Society, and seminars for newcomers are the main activities of the Society. At the annual meeting, 100 to 120 papers are normally presented. The 28th annual meeting will be held at Tokyo, October 1992.

A TA seminar is an unique activity of the Society. From 1976 to 1985, the seminar was held once a year, and from 1986 to 1992 twice a year. On each oc-



casation, 100 participants attended two days of lectures and a training exercise under the title 'Thermal Analysis for Beginners'. TA instrument makers also display their new machines. Participants discuss with lectures personally and undertaken training practice. From 1976 to the present, about 2400 people have taken part in the seminar. At the same time, the TA book titled 'Thermal Analysis, Fundamentals and Applications' edited by the Society has sold more than 3,000 volumes.

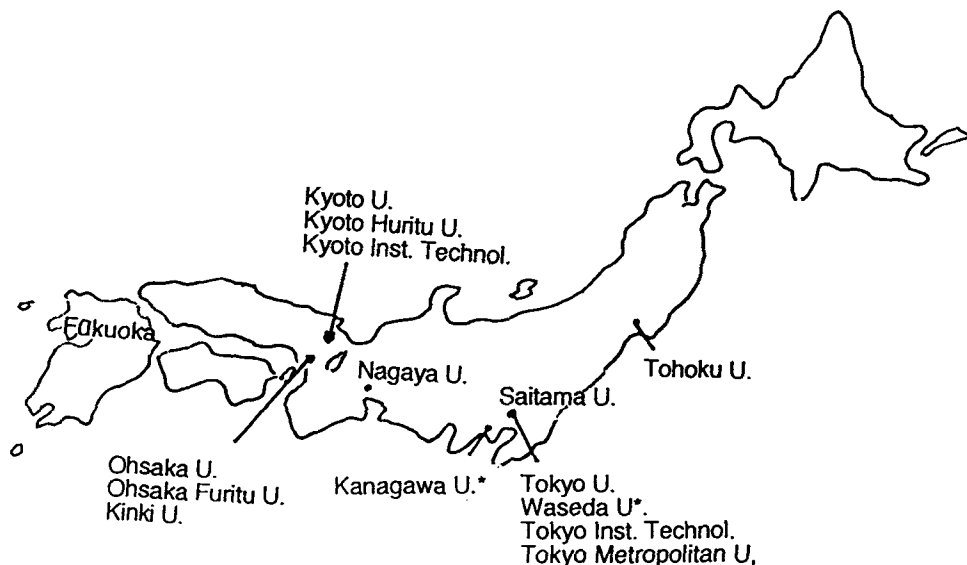


Fig. 1 Location of universities where questionnaire was sent

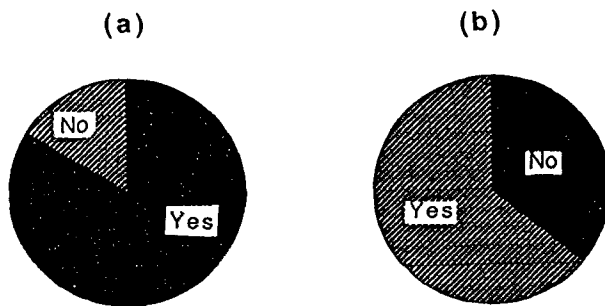


Fig. 2 Ratio of (a) the thermodynamics as taught as a separate course and (b) TA as taught as part of another course topic

Society members are free to organize workshops, if the organizer shows a brief plan and schedule to the Society board. Title of the workshops have been as

follows: 1985 – Application of calorimetry on biological system; 1986 – Research development of polymeric materials by TA, Theory and application of DTA and DSC; 1987 – Purity and Cp measurements by TA; 1988 – TA for development of new materials; 1989 – Computer software of TA, Phase control of functional materials by TA; 1990 – Non-equilibrium state of polymers, Application of DSC on protein engineering, ITS-90 and TA; 1991 – Water-polymer interaction.

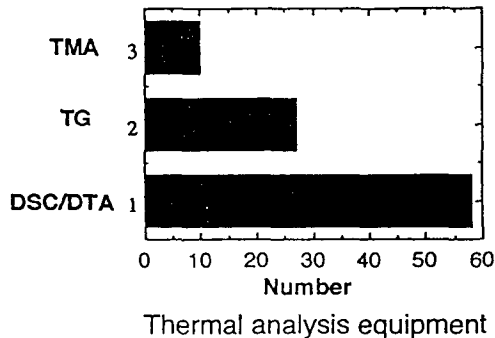


Fig. 3 Number of TA instruments in 16 universities

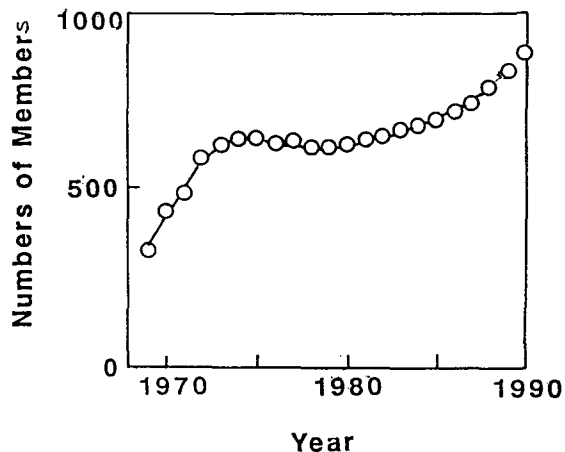


Fig. 4 Numbers of members of the Society of Thermal Analysis and Calorimetry in Japan

The Society plays a catalytic role among TA scientists in Japan and at present there is no need for local committees such as found in China and USA.

**Zusammenfassung** — Vorliegender Bericht vermittelt einen Überblick über die gegenwärtige Situation bei der Lehre der Thermoanalyse an japanischen Universitäten. Die Hauptaktivitäten der Japanischen Gesellschaft für Thermoanalyse und Kalorimetrie, einschließlich von Konferenzen, Veröffentlichungen, Workshops und Schulungsseminaren, werden weiter erweitert.

## THERMAL ANALYSIS EDUCATION IN HUNGARY

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This report outlines thermal analysis (TA) education at Hungarian universities and mentions relevant activities of the bodies of the Hungarian Academy of Sciences and the Hungarian Chemical Society.

TA education in Hungary has a long and rich history. Thermal methods and their applications have been taught at engineering and science schools since the fifties, and (as a rule) by leading experts. Some of the university institutes teaching TA have continuously been centers for developing new methods and instrumentation, theory and applications of these techniques.

Discussion of the present situation may start with the normal university courses, i.e. the subjects offered to students working for their university diploma. (This degree in Hungary usually requires five years of university studies and is approximately equivalent to M. Sc.)

The fundamentals of TA are included in analytical chemistry courses for students in chemistry, chemical engineering and pharmacy. These courses consist of a theoretical part and laboratory practice and are mandatory for each student. In addition, the curricula at chemical engineering and science faculties contain special laboratory practices in instrumental analysis with individual problems, where thermoanalytical topics can be selected by students. There are special elective TA courses, and subjects other than analytical chemistry also present some information on the application of TA (polymer chemistry and physics, solid state chemistry, etc.). Each year several thesis projects are based on TA.

Reference to TA is included in the programs of students in geology and civil engineering, too.

For experts holding a university degree in chemistry, chemical engineering and pharmacy, special two-year part-time courses are organized in instrumental analysis, containing TA as an individual subject. This provides an opportunity for those having jobs in a related field to obtain detailed and new information. Special short TA courses are also offered. Research work done for the doctoral (Ph. D.) degree is relatively often connected to TA.

The information of experts on the new results and possibilities in TA are facilitated by the activity of the Hungarian Academy of Sciences (HAS) and the Hungarian Chemical Society (HCS).

In the framework of HAS, the Subcommittee on TA has 20 elected members and about 15 experts invited regularly. The Subcommittee (Chairman: G. Liptay, Secretary: G. Várhegyi) organizes three to four meetings a year. These one- or two-day events include lectures, visits to research facilities, information on conferences, etc.

A Working Group on TA is maintained by HCS. The group (headed by J. Simon and B. Androsits) consists of about 120 members; several group meetings are organized each year, often with lecturers from abroad.

As for the possibilities of further development, it is important that TA keep its strong position in Ph. D. programs. Also, a very useful initiative of the TA Subcommittee of HAS was to organize joint meetings with other subcommittees of local groups (joint meeting of subcommittees of drug analysis and TA). So, it can be hoped that TA will increase its useful role in the investigations of materials.

**Zusammenfassung** — Vorliegender Artikel hebt die Lehre der Thermoanalyse (TA) an den ungarischen Universitäten hervor und berichtet über relevante Aktivitäten seitens der Ungarischen Akademie der Wissenschaften und der Gesellschaft Ungarischer Chemiker.