Preface

This special issue of Journal of Thermal Analysis and Calorimetry is dedicated to one of the newest thermal analysis techniques, called temperature-modulated differential scanning calorimetry (TMDSC). This technique has in its short lifetime generated much attention and controversy. Even its name can bring up a lively discussion. We are not sure that TMDSC is an optimum choice for naming this thermal analysis technique. In principal, there would be now need to use the word temperature since temperature is the only logical parameter to be modulated in a DSC experiment. The use of the word temperature implies the existence of the modulation of some other parameter for another DSC technique. The technique was originally known as modulated differential scanning calorimetry (MDSC), but this name was discontinued, since it conflicted with the registered trade-mark of TA Instruments version of this technique. Likewise, the suggested use of dynamic differential scanning calorimetry (DDSC) to describe the family of temperature-modulated differential scanning calorimetry techniques also could be confused with Perkin-Elmer's offering. As it stands now, two names are frequently used to describe this family of modulation techniques, the one described above (with and without hyphen) and 'modulated temperature differential scanning calorimetry' (MTDSC). A possible objection to the latter has been its acronym implying an 'empty DSC'.

Many companies are known for a version of TMDSC as noted below:

Company	Instrument	Abbreviation
TA Instrument	Modulated differential scanning calorimetry	MDSC
Perkin-Elmer	Dynamic differential scanning calorimetry	DDSC
Mettler-Toledo	Alternating differential scanning calorimetry	ADSC
Seiko Instruments	Oscillating differential scanning calorimetry	ODSC

However, some of the above techniques may not be available in certain countries due to patent protection.

The first TMDSC technique developed was MDSC, and introduced as a commercial product in 1993. The original idea can be credited to M. Reading (see 'A Personal Perspective on the Rise of MTDSC' by M. Reading, this issue). The technique was further developed by TA Instruments using the suggestion of Brian Hahn of using a discrete Fourier transformation method for the deconvolution. In MDSC a specimen is exposed to a linear ramp of temperature, which has a superimposed sinusoidal oscillation. This results in a cyclic heat flow. In this manner not only can the total heat flow be determined, but its reversing and non-reversing components can be separated. The total heat flow is then the sum of both reversing and non-reversing heat flows and is equivalent to the heat flow signal of a conventional DSC. The reversing heat flow is the heat capacity component of the heat flow and its importance, for example, can be seen in the analysis of the glass transition in difficult analyses. The non-reversing heat flow results when the heat flow does not follow the temperature modulation. Such events are cold crystallization, evaporation,

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chemical reactions such as thermoset cure, and decomposition. Use of the phase correction to account for thermal lags during modulation can result in further signals which include the complex, reversing, and kinetic heat capacities in addition to the now phase corrected reversing and non-reversing heat flows. Other manufacturers may have different terminology. For example, Perkin-Elmer's DDSC separates the complex heat capacity into a storage and loss heat capacity. However, no heat capacity is actually lost, but the terminology and mathematics applied is based on linear response analysis, which is used in dynamic mechanical analysis and dielectric analysis and extended to DSC by Schawe.

The number of published TMDSC related papers has increased rapidly, from less than 20 articles in 1993 to over 100 written in 1997. More than 300 papers (including lectures and seminars) have been published so far with the use of this new technique (see Menczel and Judovits: Literature Status on Temperature-Modulated Differential Scanning Calorimetry in this issue).

The articles in this special issue were placed in six general categories:

Introduction, which contains a special paper from M. Reading describing the 'birth' of TMDSC, and a paper from the guest editors of this issue organizing most publications on TMDSC; TMDSC theory; instrumental response analysis; applications of TMDSC to polymeric systems; food and pharmacology; and other techniques.

We are very pleased to present this collection of outstanding articles which demonstrates the diversity of use and interest of this new technique.

Joseph D. Menczel and Lawrence Judovits

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