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# *Preface*

This Special Issue of the Journal of Thermal Analysis attempts to outline the main opportunities and major messages of the methods of thermal analysis applied in the field of polymers. Although it was not possible to cover all domains of thermal analysis used for polymer characterization it is nevertheless assumed that the interested reader will gain an insight into the utility and versatility of the various methods of thermal analysis.

Thermoanalytical data may be used both for the characterization of the thermal properties of polymeric systems, and for the estimation of thermodynamic functions of polymers. Additionally kinetic studies of phase transitions and thermal degradation of polymers are possible.

From the thermodynamic point of view, besides the recognition and characterization of the different phase transitions together with the accompanying energetic effects, the knowledge of the temperature dependence of the heat capacity is essential, because all important thermodynamic functions are accessible via this property. But taking into account that determination of heat capacities at very low temperatures near 0 K is experimentally not practicable, one of the keystones for the evaluation of absolute values of thermodynamic functions is related to the estimation of the heat capacities of solids near 0 K using vibrational spectra as well as special fitting procedures. Consequently, the first paper of Zhang and Wunderlich of the Special Issue is dedicated to this question.

Another important aspect concerning the utility of TA methods is connected with the ability of evidencing the different possible phase transitions of polymers and of estimating the related energetic effects. Both first order phase transitions (melting/crystallization as well as mesophase transitions and isotropization of LC-polymers) and glass and sub-glass transitions are accompanied by specific and well defined thermal and mechanical effects. Respective TA data can additionally be used for kinetic evaluation.

The different aspects of crystallization and crystallization kinetics are presented in the subsequent three papers, whereas thermal characteristics of mesophases are discussed in the paper of Yoon *et al.* The contribution of Utschick *et al.*, demonstrates the utility of DSC-studies to evidence comparatively the thermal characteristics of unsaturated and saturated ter-co-polymers.

The aspects of the thermal analysis of polymers at high pressures by PVT and high pressure DTA are presented in an overwiew-paper by Zoller *et al.*, who designed and constructed the first PVT-apparatus.

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The possibilities of the recently introduced 'modulated' DSC analysis for characterizing glass transitions in polymers and of the kinetics of the glass transition are discussed by Wunderlich *et al.*, whereas Dobbertin *et al.* are using dielectric spectroscopy combined with calorimetry for analysing the characteristics observed in the glass transition range of semicrystalline PET.

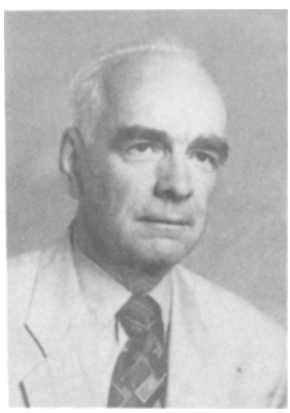
The next two theoretical papers of Anderson *et al.*, are concerned with the possibilities and limits of a real kinetic analysis by thermoanalytical methods (thermogravimetry – TG – and DSC) of such complex processes as radical polymerization and depolymerization, the main result being that for convincing and theoretically justifiable kinetic parameters, at least two independently measured concentrations changes of the reaction participants are needed.

The contribution of Gupta and Viswanath deals with the kinetic compensation effect observed in thermal degradation of polymers, whereas the paper of Katsikas *et al.*, demonstrates the utility of thermogravimetry for characterizing the thermal degradation of different poly(itaconates).

Thermogravimetry can also be used for estimation of thermal stability, life time and endurance of polymeric materials, the volatility of the products being, however, the main prerequisite. Correlated with this aspect is the historical review on TA kinetics and thermal endurance of electrical insulating materials presented by Ozawa *et al.*

The possibilities of dynamic mechanical analysis for polymer characterization are exemplified in the last two papers. George *et al.*, use DMA combined with thermogravimetry to study polyethylene composites reinforced with pineapple fibres, whereas Vilics *et al.*, evidence the utility of DMA for the analysis of sub-$T_g$ transitions in plasticized PVC blends.

Finally, Shlensky and Aksenov present in a short laboratory note a new contact thermal heater for the study of short-time thermal destruction of polymers.



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