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Foreword

This special issue of The Journal of Thermal Analysis contains 14 papers from a Conference on Thermal Analysis of Advanced Materials held at the Oxford Centre for Advanced Materials and Composites (OCAMAC) in Oxford, 1–2 April 1993. The conference was sponsored jointly by the Thermal Methods Group of The Royal Society of Chemistry and OCAMAC. The conference organisers were Brian Cantor and Keyna O'Reilly for OCAMAC and Jenny Hider and Cyril Keattch for the Thermal Methods Group. The primary aim of the conference was to discuss the application of thermal analysis methods such as differential scanning calorimetry (DSC) and thermomechanical analysis (TMA) etc. to the characterisation of structural and electrical ceramics, polymers, metals and composites, in order to develop advanced materials processing techniques and improved materials structures and properties. 30 oral presentations were made at the conference which was attended by over 50 participants.

While not all the speakers submitted written forms of their presentations, the papers in this issue give an indication of the materials and methods under consideration at the conference. These have been subjected to the usual strict peer review process of the Journal. The papers presented here cover a wide selection of thermal analysis techniques, including DSC, differential thermal analysis (DTA), TMA, Smith thermal analysis, thermogravimetry (TG) and simultaneous thermal analysis (STA), and a wide range of materials, including structural, electrical and electronic ceramics, polymers, glasses, metals and composites. Two of the papers are from invited reviews, by Sale and by Cantor. Sale, and later Gholina and Sale, discuss the role of a range of thermal analysis techniques in understanding the phase development in magnetic, electronic and superconducting ceramics processed using chemical techniques such as gel processing. He shows how thermal analysis may be used to demonstrate the existence of precipitates during gel processing and also to indicate the critical temperatures of processing during the decomposition of gel precursors for the production of complex oxides. Cantor describes some examples of the use of DSC in providing information for advanced solidification processing of metals and alloys, including spray forming, squeeze casting, grain refinement and crystallisation of amorphous alloys. He shows that DSC measurements are valuable for testing kinetic theories of nucleation and growth and validating solidification process models.

Other papers include discussion of new thermal analysis techniques, the advantages of not-so-new techniques, and the application of thermal analysis to a range of different materials. Richardson and Flemings describe a TG technique in which the use of interactive heating rates, controlled by rate of sample weight loss, can allow better resolution of overlapping processes without excessive run times, and describe how, in many cases, it is possible to convert older thermobalances to this interactive mode. Hayes and Chao show that the Smith method of thermal analysis, in which the

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temperature difference between the sample and the furnace is controlled, has a number of advantages over conventional thermal analysis techniques when applied to the determination of multicomponent alloy phase diagrams. Billon *et al.* observe that, in crystallisation studies of polymers by DSC, transcrystallinity effects caused by parasitic nucleation at the polymer surface can alter the peak shape. They explain these effects using crystallisation theories and computer simulation. Jordan and Jha use DSC analysis to determine the thermal stability of fluoride glasses for fibre optic applications, with laboratory prepared specimens without costly fabrication of optical fibres, and Chang *et al.* use DSC to study the crystallisation of amorphous alloys to produce in situ particulate composites.

Overall, the Conference on Thermal Analysis of Advanced Materials was successful in bringing together a variety of different scientists, involved with a range of different thermal analysis methods and materials processing and applications problems. The conference delegates found considerable value in interacting across the broad spectrum. This special issue of the Journal of Thermal Analysis captures some of the same eclectic flavour, and should be of similar interest to many practising scientists and technologists in these fields.

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