Special Section on Components and Packaging Technologies With Contributions From ITherm 2002 Thermal Management Track

ITHERM 2002, the 8th Intersociety Conference on Thermal, Mechanical and Thermomechanical Phenomena in Electronic Systems, hosted approximately 500 international experts in the areas of thermal management, thermomechanical and mechanics issues, and emerging technologies in electronic packaging and systems in San Diego, CA, May 30–June 1, 2002. The Technical Program included nearly 150 peer-reviewed papers presented in 35 sessions arranged into three Tracks: Thermal Management, Applied Mechanics, and Emerging Technologies. Twenty-five of these sessions were in the area of Thermal Management. This represented an increase in the number of presented papers and attendance compared with ITherm 2000, in spite of an economic downturn in the intervening period. Three special issues of the CPMT IEEE TRANSACTIONS ON COMPONENTS AND PACKAGING TECHNOLOGIES have been planned, one for each Track. The papers appearing in this Special Issue are in the area of thermal management and have been nominated by session chairs for consideration for the ITherm 2002 Best Paper in the Thermal Management Track. In addition, three of the six Keynote Speeches have also been included in this Special Issue. These papers reflect a broad range of current interest topics covered in the area of thermal management at ITherm 2002. Of the sixteen papers selected for this Special Issue, eleven have been accepted for publication after peer review. The following paragraphs summarize these papers.

Three keynote papers have been included in this Special Issue. Bergles has presented a comprehensive and thorough historical development of cooling of electrical and electronic equipment over the past four decades, from the cooling of electrical motors to the cooling of electronic systems using boiling heat transfer. Bar-Cohen and Iyengar have reviewed entropy minimization techniques for optimization of heat sinks used in electronic cooling. Price has presented an overview of the future of thermal management in military electronics with an emphasis on phased array radar systems encompassing the role of heat sinks and heat exchange devices such as cold plates, electronic chassis cold walls, compact heat exchangers, air and vapor-cycle refrigeration systems, phase change materials, thermoelectric devices, spray-cooling, heat pipes, and capillary pump loops.

Five papers discuss modeling, design and material issues associated with heat sinks used in the cooling of electronic packages. These papers deal with wide ranging issues from the development and characterization of novel heat sinks to the optimization of micro-channel heat sinks. Wirtz *et al.*, have presented a novel 3-D aluminum wire filament bonded mesh deployed as a heat exchange surface and a model for effective thermal conductivity. Milanez *et al.*, have studied thermal contact conductance at light contact loads, which result in surface asperity height distributions that are not perfectly Gaussian. Wei and Joshi have reported results of an optimization study of a stacked micro-channel heat sink using a resistance network model. Iyengar and Bar-Cohen have conducted an analysis of plate fin heat sinks in forced convection using coefficient of performance (COPT) as a metric to provide a viable technique for combining least-material optimization with the entropy minimization methodology. Saini and Webb have examined heat rejection limits of air-cooled plane fin heat sinks with duct and impingement flows using analytical models to predict the optimum geometries minimizing thermal resistances.

Burzo *et al.*, have employed a transient thermo-reflectance system to measure the thermal characteristics of thin-film SiO_2 layers in the range of 100–1000 Å. They have concluded that the effective thermal resistance of SiO_2 thin-films with interface effects is up to one order of magnitude smaller than the values reported for bulk SiO_2.

Schmidt and Shaukatullah have presented an extensive and thorough review of the literature in the newly emerging area of thermal issues in data centers.

Mukherjee and Mudawar have studied two-phase cooling of a square simulated electronic device carried out with a pumpless loop incorporating a self-enhancing and self-sustaining mechanism. The predictions of a pressure drop model illustrate the pumpless loop's self-sustaining and self-enhancing attributes, and relate critical heat flux trends to those of the two-phase mixture acceleration along the boiling surface. Jones, Liu, and Gao have presented new methods for thermal management that integrate micro heat pipes directly within the LTCC substrate, achieving effective thermal conductivity enhancement for spreading heat in both radial and axial directions. They have described new materials and processes developed to fabricate the components required to thermal loads in excess of 300 W/cm^2. Alawadhi and Amon present a computational and experimental study of a phase change material (PCM) based thermal control unit for wearable computer applications. A paraffin material is investigated within an aluminum matrix.

Using a combination of interferometric images and particle image velocimetry, Kehoe and Davies attempted to delineate the mixed convection regime in heated horizontal ribs which are two-dimensional approximations of a super ball grid array package mounted on a printed circuit board in cross-flow at a low Reynolds number and a high Grashof number.

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Dr. Amon received the SWE Distinguished Engineering Educator award in 1999 and Professor of the Year award for 2000, the Gustus L. Larson Memorial Award for outstanding achievements in Mechanical Engineering from the American Society of Mechanical Engineers (ASME), and several awards from the American Society for Engineering Education (ASEE), including the George Westinghouse Award in 1997 and the Ralph Coats Roe Award in 2002. The ASME Pittsburgh Chapter named her "Engineer of the Year," in 1999. She is a Fellow of ASME and AAAS. Active in professional societies, she currently serves as Chair of the ASME HTD K-16 Committee on Electronics Cooling, chair of the ASME HTD K-3 Honors and Awards Committee, and executive member of the ASME Electronic and Photonic Packaging Division. Her editorship roles include associate editor for the *ASME Journal of Heat Transfer*, the *IEEE Transactions on Components and Packaging Technologies*, Associate Editor for *Electronic Packaging G&B Book Series*, and co-editor of the *Journal of Heat and Mass Transfer* and *ASME* publications. She was elected General Chair of the ITherm 2002 Intersociety Conference on Thermal and Thermomechanical Phenomena in Electronic Systems.

Koneru Ramakrishna (M'98) received the B.E. degree from Andhra University, Waltair, India, the M.Tech degree from the Indian Institute of Technology, Madras, the M.S.M.E. degree from Kansas State University of Agriculture and Applied Science, Manhattan, and the Ph.D. degree in mechanical engineering from the University of Pennsylvania, Philadelphia. His Ph.D. work was in the areas of breakdown of electrical discharge and heat transfer.

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Dr. Ramakrishna is a member of ASME. He was the Program Co-Chair for ITherm 2000, Program Chair for ITherm 2002, and elected General Chair of the ITherm 2004. He has also organized several sessions on thermal and thermo-mechanical aspects of electronic packages at ITherm'98, Interpack'95 and '97 and its predecessors, and at ASME IMECE.

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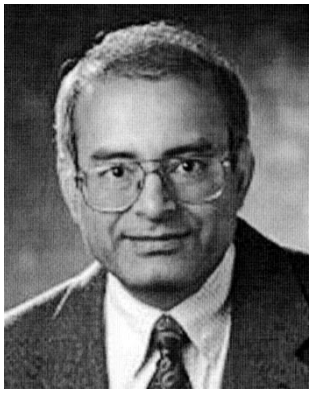

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