Foreword

THIS Special Section includes the selected papers from the presentations of conferences organized under the auspices of IEEE CPMT. These conferences include International Conference on Simulation and Experiments in Microelectronics and Microsystems (EuroSimE), Electronic Components Technology Conference (ECTC), and Electronic Packaging Technology Conference (EPTC). The selected papers in this special section cover a broad technical scope to address the cracking and delamination problems in electronic packaging.

Delamination and cracking are most dominant failure mechanisms in electronic devices during assembly, packaging and reliability testing conditions. Mechanical related failures in microelectronics and microsystems, including backend processes, assembly and packaging processes, and reliability qualification tests, account for more than 65% of the total reliability failures, and become the bottleneck for both current and future product and technology developments. Microelectronic devices often have complex architectures, hybrid materials, and small features. The mechanical behaviors of such integrated structures often affect their fabrication and reliability. By the very nature of integrated structures, the field is multi-scale in both geometric and time domains, cross-disciplinary, involving many materials (metals, ceramics, polymers, semiconductors, etc.), and many modes of response (fracture, deformation, instability, and mass transport), strongly nonlinear and also stochastic.

In recent years we have seen a tremendous progress in the application of the advanced mechanics including micromechanics, damage mechanics and multiscale modeling analysis to the problems in microelectronic devices. The first paper by Wei *et al.*, an effective method is developed to precisely evaluate the stress singularities in the vicinity of internal corners within the packages. The paper by Fan *et al.* uses the multiscale micromechanics analysis to analyze the vapor pressure evolution during soldering reflow and determines the most important parameter that governs the delamination behavior of underfill during moisture sensitivity test. The paper by van Driel focuses on thermo-hygro-mechanical reliability issues, particularly related to delamination. The paper by Zhou *et al.* examines the effect of non-uniform moisture distributions on characterizing hygroscopic swelling of polymer materials, and investigates the impact of hydroscopic stresses on flip chip package reliability. In the paper by Chew *et al.* the damage mechanics approach is applied to study the influence of non-uniform initial porosity distribution on adhesive failure in electronic packages. Ghaffarian *et al.* conducted extensive testing to investigate the thermal cycle reliability and failure mechanisms of ceramic column grid array (CCGA) and plastic ball grid array (PBGA) assemblies with and without corner staking. In the paper by Wong, molecular dynamics simulation is used to study the interfacial adhesion for SAM induced covalent bonded copper-EMC interface.

We hope that this special delamination and cracking section can be helpful for your work. We also would like to hear from you your feedback and suggestions for improving our work. We will continue to publish special issues on this topic on a regular basis. All the other papers presented at the above-mentioned conferences can be found in the IEEEXPLORE online database.

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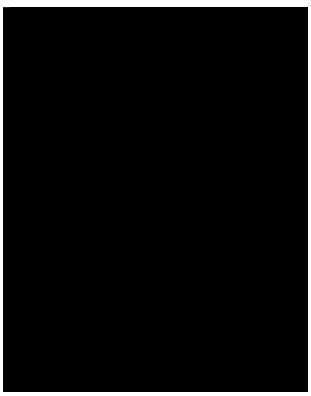
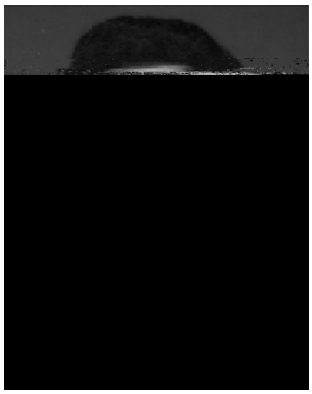


Abhijit Chandra received the B.Tech. degree in mechanical engineering from the Indian Institute of Technology, Kharagpur, the M.S. degree from the University of New Brunswick, Fredericton, NB, Canada, and the Ph.D. degree from Cornell University, Ithaca, NY.

He worked at the General Motors Research Lab, from 1983 to 1985. Since 1985, he has served on the faculty at the University of Arizona, Michigan Technological University, and Iowa State University, Ames. He is currently Professor of Mechanical Engineering at Iowa State University. He is also the Chief Technology Officer and a member of Board of Directors of Actus Potentia, Inc. Over the last 20 years, he has served as Project Director and Principal Investigator on more than 20 research and educational projects funded by the U.S. Government and private industries. His educational interests include development of dynamic and interactive concept mapping principles, and its application to imrovement of learning abilities in K-12 and undergraduate students. His involvement in Actus Potentia, Inc. primarily serves the mission of developing educational software for science and technology education in K-12. He is the author of a book, and has published about 100 technical articles in international archival journals, and has given more than 200 presentations in various conferences. He also holds one U.S. patent. Five other patent applications are in the process. He regularly serves as a Reviewer for various international journals and as a panel reviewer for various funding agencies. He also serves as a consultant to several Fortune 500 companies

in areas of product and process designs. His research interests include investigations of fundamental mechanics of manufacturing processes and in utilizatiing those insights for designing effective and efficient manufacturing processes with unique capabilities.

Dr. Chandra received the Preseidential Young Investigator Award from the National Science Foudation in 1987, and an Outstanding Paper Award from SME in 1999. He currently serves as an Associate Editor of the IEEE TRANSACTIONS ON COMPONENTS AND PACKAGING TECHNOLOGIES and the IEEE TRANSACTIONS ON ADVANCED PACKAGING.



Xuejun Fan received the B.S. and M.S. degrees from Tianjin University, Tianjin, China in 1984 and 1986, respectively, and the Ph.D. degree in engineering mechanics from Tsinghua University, Beijing, China, in 1989.

He is currently an Associate Professor in the Department of Mechanical Engineering, Lamar University, Beaumont, TX. From 1997 to 2000, he was with the Institute of Microelectronics (IME), Singapore, heading a group of modeling and simulation in advanced packaging development. He moved to Philips Research Lab, Briarcliff Manor, NY, as a Senior Member Research Staff in 2000, and then to Intel Cooperation, Chandler, AZ, as Senior Staff Engineer in 2004. He held a faculty position at Taiyuan University of Technology, Shanxi, China, from 1989 to 1997. He received the Young Scientist Fellowship from Japan Society of Promotion of Science to work at the University of Tokyo in 1993. He was a Visiting Professor at the University of British Columbia, Vancouver, BC, Canada, from 1996 to 1997. He was promoted to a Full Professor at Taiyuan University of Technology, Taiyuan, Shanxi in 1991, and became one of the youngest professors in China that year when he was 27. He is a well-known industry expert in moisture induced failures in electronic packages. He has published more than 80 scientific papers and filed 14 U.S. patents. His interests and expertise lie in the areas of reliability, material characterization and thermal and mechanical modeling for microelectronic packaging.

Dr. Fan was one of the 30 Nominees for the title of “1991 Ten Outstanding Youth of China,” and was one of five recipients for the second-best prize of Young Faculty Award for the Excellence in Teaching and Research in 1994 by Fok Ying-Tung Education Foundation.