B U R H A N O Z M A T

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(SC86326)

ACHIEVEMENT HIGHLIGHTS

- Received Ph.D. from M.I.T as a U.S. Department of Energy (DOE) and NATO Science Fellow.
- Technical leadership and Management experience in large, medium and small size companies: IBM, GE, Texas Instruments, Harris Semiconductors, and OZER Advanced Technologies.
- More than 15 years of R&D experience in thermal and structural (CFD, FEA) analyses of broad class of mechanical structures including Microelectronics, Power and RF packages.
- Familiar with SolidWorks, FloWorks, Cosmos/m, Abaqus and Patran FEA, CFD codes.
- Strong background in mechanical behavior of materials under thermal and structural fatigue and static loads, fluid mechanics, heat transfer, thermodynamics, solid mechanics, materials and statistical reliability analyses, failure analyses.
- Designed, analyzed, and tested the thermal capacitors of the ExoMars space module to be launched in 2016. Featured for this work on the front page of the Times Union, NY Capital Region's leading newspaper (June 11, 2014).
- Wrote and contributed many winning proposals. Recognized for numerous inventions and publications.

EXPERIENCE

OZER Advanced Technologies (Sole Proprietorship, est. 2000) **Voorheesville, NY**
Principal and R&D Engineer

- Designed, analyzed, prototyped, tested and delivered advanced high performance and energy efficient metal foam Heat Exchangers (HX) which resulted in shorter time to market, reduced life cost and increased market share.
- Customers include Boeing, NASA, European Space agency, Northrop Grumman, NAVY, Air Force, Advanced Materials, and Dell Computers, with a wide variety of military and commercial applications.
- Designed and performed structural and thermal analyses of the passive Al metal foam based heat exchangers of the Entry, Descent and Landing Demonstrator Module (EDM) of the European Space Agency (ESA) and the Russian Space Agency's ExoMars program.
    - Tested the thermal characteristics of passive heat exchangers. The simulations and the test results were within the accuracy of thermocouples.
    - Featured for this work on the front page of the Times Union, NY Capital Region's leading newspaper (June 11, 2014).
- Developed and reduced to practice an investment casting based Metallic Foam manufacturing technology with a NYSERDA grant.
- Designed and performed Finite Element Analysis (FE) and Computational Fluid Dynamics (CFD) analysis; built and tested prototype metallic foam based HX units.
- Contributed to the projects of Northrop Grumman Lockheed Martin Advanced Radar and Ram Air to liquid HX programs.
    - Successfully performed feasibility analysis, including numerical modeling, designing, prototyping, and testing of electronics cold plates, as well as Ram Air to liquid HXs.
    - Verified results up to (4X) performance, weight and size improvements of the foam metal HX and cold plates compared to state of the art current technology.

GE Corporate R&D Center **Niskayuna, NY**

Senior Technical Staff, Power Electronics Packaging and Reliability Laboratory

- Principal inventor and the key developer of the Advanced, Inverter Converter Controller Power Module package for space, medical, and industrial/transportation drive applications. The packaging density, thermal and the electrical performance improved (4X) due to:
  - A double sided, integral, HX design
  - A wireless, Chip on Flex substrate based interconnects structure

- Principal inventor and the key developer of the advanced hermetic, multi-device Battery Power Converter (BPC) Power Module package for military and commercial space applications. The module employs a high reliability design, which separates I/O and sealing functions.
- Recognized as the technical leader in the transfer of the Chip on Flex Power Module technology to the Center for Power Electronic Systems (CPES), the multimillion-dollar, multi-year power electronics consortium supported by NSF, Industry and Universities.
- Identified failure mechanisms in refrigerator control units and electrolytic capacitors, as current crowding and electromigration. Recommended material, design and process changes that solved the reliability problems.

Harris Power R&D Center **Latham, NY**

Senior Scientist, Technical Manager and the Leader of Advanced Packaging Group

- Leader of the Power Electronics packaging teams for Navy's national, multi-year, multi-million dollar Power Electronic Building Blocks program. Developed key enabling technologies required to meet the program deliverables and milestones.
- Developed Al/Ni/Au solderable metallization approach for Alumina and AlN based through hole ceramic lids, an enabling technology for packaging and wirelessly connecting power devices.
- Invented high performance compact and integral exchangers using either liquids or air as the coolant, and offering extremely low thermal resistance approaching 0.03 C/W-in^2.
- Designed and built thermal test system and modules utilizing Integrated Gate Bipolar Transistor Hermetic Thin Packages as variable power resistors. Characterized and significantly improved (up to 4X) the thermal performance of Power Modules using various thermal management approaches.

Texas Instruments, Defense Systems and Electronic Group **Dallas, TX**

Member of Technical Staff, Technical Manager, Research & Development Engineer

- Directed and performed research and development of advanced microelectronics packaging materials and technologies.
- Made major contributions to Advanced Packaging Technology and Material Development proposals resulting in Texas Instruments winning grants worth several million dollars.
- Directed material and process development efforts for substrates, die attach, chip interconnect and Ball Grid Array attachment of packages to surface mount Printed Wire Boards. Assessed the structural and thermal performance and reliability of packages by performing linear and nonlinear Finite Element Analyses. Fully populated prototype ATF power controller board which passed all reliability tests in the first round, resulting in reduced costs and ahead of schedule completion.
- Modeled and evaluated the thermal performance of various Interconnect Techniques for Multi Chip Module Applications. Made significant contributions to Interconnect Technology selection decisions and DARPA-GE proposals through Finite Element Modeling of thermal performance for the Flipped Chip, Flipped Tab, and Chip First High Density interconnect designs.
- Lead and managed the development of a parametrically driven Finite Element Analysis input code that predicts the effect of the low cycle fatigue thermal reliability of plated through holes and won the IPC Best Technical Paper Award for this work.

IBM East Fishkill, Advanced Packaging Laboratory **Hopewell Jct., NY**

Staff Research & Development Engineer

- Directed the research and development of low resistance thermal interface materials. Coordinated University Research Projects on high performance thermal management of electronics packages. Directed the selection, metallurgical and rheological characterization and implementation of thermal interface materials for high end main frame computers. Developed thermal assembly techniques for high-end Multi-Chip Modules for

mainframe computers that resulted in the improvement of assembly yields and reliability by 20%. Co-inventor of advanced cooling technologies.

- Joined by invitation the Advanced Packaging Technology Ceramics Group task force for strengthening, and toughening of electronic ceramics. Directed analysis and understanding of property microstructure relations. Co-Inventor of the surface preparation process that improved the strength of electronic ceramics. Selected as a member of the composition evaluation team for enhanced electronic ceramics.

EDUCATION

Massachusetts Institute of Technology, Cambridge, MA

Ph.D. Mechanical Engineering

Specialty: Physics and micro-mechanical modeling of deformation and failure of engineering materials

NATO Science Scholarship

U.S. Department of Energy Graduate Fellow

Elected full member Sigma Xi

Istanbul Technical University, **Istanbul, Turkey**

MS Mechanical Engineering

Thesis: "Precision Control of Velocity in a Hydraulic Transmission System"

NATO Science Scholarship

Graduated first in class, G.P.A. 5.0/5.0

Istanbul Technical University, Istanbul, Turkey

BS Mechanical Engineering

Thesis: "Injection head and closed cavity mold design for polymer manufacturing systems"

Graduated 3rd in class

PUBLICATIONS

- M. Gottero , V. Perotto and R. Martino, B. Leyda and B. Ozmat, "Phase-change thermal capacitors for ExoMars 2016 mission" 44th International Conference on Environmental Systems, July 2014, Tucson, Arizona
- B. Ozmat, "Reticulated Metal Foams Build Better Heatsinks" Power Electronics Technology, pp.30-35, Nov. 2007
- B. Ozmat et al., "Thermal Applications of Open Cell Metal Foams" Materials and Manufacturing Processes, Special Edition, Vol.19, No. 5, pp. 839-862, 2004
- B. Ozmat et al., "An Advanced Approach to Power Module Packaging" IWIPP, 2000
- B. Ozmat et al., "A New Power Module Packaging for Enhanced Thermal management" Itherm 2000 proceedings
- B. Ozmat. et al., Harris ThinPak, "A Metalized Ceramic Interposer for High Performance Power Devices" PCIM proceedings
- B. Ozmat, et al., "An Advanced Packaging Technology for High Performance Power Devices" AICE Proceedings of the 32nd Intersociety Energy Conversion Engineering Conference, pp. 694-699, 1997
- B. Ozmat. "Reticulated Metal Foam based Integral Heat Exchangers for Advanced Power Modules" in preparation
- B. Ozmat, W. Johannes "Plated Interconnections and the Reliability of MCM-L" The Best Paper Award, IPC Proceedings
- B. Ozmat "Engineering Properties of Light Weight Thermal Core Materials" 1994 ISHM Journal
- B. Ozmat, R. Peterson, T. Baughn "Thermo Mechanical Stresses in Al_2O_3 Based Microwave Substrates" accepted for publication in ASME WAM

- B. Ozmat "Interconnect Technologies and the Thermal Performance of Multi Chip Modules" Thermal Phenomena in Electronic Systems, pp. 226-245, I-THERM Proceedings, 1992
- T. Baughn, L. Braiser, B. Ozmat "The Effect of Edge Preparation on the Failure of Thin Film Network Alumina Components" International Symposium for Testing and Failure Analysis, November
- B. Ozmat, N. Reheis "A New Composite Core Material for Surface Mount Technology Applications" Proceedings of SMTA pp. 569-592, San Jose
- B. Ozmat, A. S. Argon, et al. "Growth Modes of Cracks in Creeping Type 304 Stainless Steel" Mechanics of Materials, 1991
- B. Ozmat, S. Walker, M. Elkins "A Nonlinear Thermal Stress Analysis of the Plated Through Holes of Printed Wiring Boards" Proceedings of IEPS, Marlborough
- B. Ozmat, "A Nonlinear Thermal Stress Analysis of Surface Mount Solder Joints" Proceedings IEEE, ECTC Nevada, 1990
- B. Ozmat, B. Copeland "A Reliability Analysis of Surface Mount Solder Joints Under Vibration Stress Conditions" SMART VI Conference, Florida
- B. Ozmat, M. Guy, R. Hastings, "A High Reliability Surface Mount Technology Module for Avionics Applications" Proceedings of IEPS, San Diego, September 1989
- K. Andy, B. Ozmat, "Package Sealing and Encapsulation" Microelectronics Packaging Handbook, Editors R.R. Tummala, E.J. Rymaszewski, 1997
- Argon, C.W. Lau, B. Ozmat, D. M. Parks, "Creep Crack Growth in Ductile Alloys" Fundamentals of Deformation and Fracture, Cambridge University Press, Cambridge, England, 1984

PATENTS AND DISCLOSURES

- An Advanced Wireless Power Module Technology (GE-CRD Filed application)
- A Method of Metalizing for Ceramic Members of Semiconductor Power Packages (SE-1079-PD, Filed Application)
- Semiconductor Power Pack (SE-1156-PD, Filed Application)
- A High Performance Integral Heat Exchanger for Power Electronic Modules (SE-1190-PD, Filed Application)
- Subtractive Patterning and Electroless Ni and Au Plating of IVD Blanket metallization on Electronic Ceramics (SE-1327-PD, Filed Application)
- A Method of Fabricating Copper-Ceramic Lids for Hermetic Packages for Power Devices
- Integrated Circuit Packaging Method and the Package (TI-18121, Filed)
- Ceramic Based Substrate for Electronic Circuit System Modules (TI-13304, Filed)
- Novel Constraining Core for Surface Mount Technology (TI-13679, Filed)
- Constraining Core for Surface Mount Technology Applications (TI- 14179, Filed)
- Module For Packaging Semiconductor Integrated Circuit Chips On A Semi-Conductor Base Substrate (IBM, Filed in US and Europe)
- Wafer Scale Integration Emulation Package (IBM, Filed in US and Europe)
- Method Of Partitioning Testing And Diagnosing A VLSI Multi-Chip Package And Associated Structure (IBM, Filed in US and Europe)
- A Novel Heat Transfer Module for Ultra High Density and Silicon on Silicon Packaging Applications (TI-14604, Filed)
- Molybdenum Leads for Fine Pitch Ceramic Chip Carriers in High Performance Military and Commercial Surface Mount Applications, TI
- An Advanced Substrate Technology for Microelectronics packaging Applications, TI
- An Advanced Packaging Approach for Microwave and Digital MCM Applications (TI-17471, Filed)
- An Advanced Reactor for Fabricating Microwave Multilayer Interconnect Structures, TI