

## **Curriculum Vita**

**R. WAYNE JOHNSON**  
**Alumni Professor**

**Department of Electrical & Computer Engineering**  
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### **EDUCATION**

Ph.D. in Electrical Engineering from Auburn University, August 1987, Dissertation: "Hybrid Silicon Wafer Scale Packaging Technology". Minor sequence in Materials Engineering. 1985 IEEE Solid State Circuits Council Fellowship, (GPA 4.0/4.0).

Masters of Science in Electrical Engineering from Vanderbilt University, December 1982, Masters Thesis: "Polymer Thick Film Materials for Microwave Applications". Minor sequence in Materials Science, (GPA 4.0/4.0).

Bachelor of Engineering in Electrical Engineering (Summa Cum Laude) from Vanderbilt University, May 1979. Received Dean's Award and Tau Beta Pi Award. Projects included fabrication of microwave circuits, packaging of analog circuits and high temperature hybrids, (GPA 3.0/3.0).

### **WORK EXPERIENCE**

Professor (tenured) – Auburn University, September 15, 2002 – Present, Research interests in electronics manufacturing, advanced packaging, and high temperature electronics.

Director, Information Technology Peak of Excellence – Auburn University, May 16, 2002 – Present. Coordinate research effort between four Samuel Ginn College of Engineering Research Centers and develop other potential research areas within Information Technology.

Alumni Professor (tenured) - Auburn University, September 15, 1997 – September 14, 2002. Research interests in electronics manufacturing, advanced packaging, and high temperature electronics.

Director, Center for Advanced Vehicle Electronics – A NSF Industry/University Cooperative Research Center – Auburn University, July 1, 1999 – May 16, 2002. The focus of the Center is the electronics packaging and manufacturing technologies for harsh environments. The Center has 11 industrial members with annual funding of \$895,000 from memberships and NSF. Additional funding through the Center is approximately \$1,400,000 per year. The Center is interdisciplinary with faculty from Mechanical, Industrial & System, and Electrical & Computer Engineering and Physics participating. The Center has a full time staff of seven professional and administrative employees.

Director – Laboratory for Electronics Assembly & Packaging, September 16, 1987 – Present. Responsible for research, teaching and facilities in the Laboratory for Electronics Assembly & Packaging. This facility includes over \$2,750,000 in state-of-the-art electronics manufacturing equipment.

Professor (tenured) - Auburn University, September 15, 1995 - September 14, 1997. Research interests in multichip modules, electronic materials and processing, power electronics, and high temperature electronics.

Chairman - Consortium for Vehicle Electronics Management Committee, March 1995 - September 30, 1997. Consortium of five companies and Auburn University working to develop low cost packaging technology for automotive and aerospace applications. Funded (\$12,800,000) by the Consortium members and DARPA. Responsible for program management and reporting.

Acting Director - The Center for the Commercial Development of Space Power and Advanced Electronics, September 1, 1995 - May 1, 1996. Responsible for overall Center operation and coordination with NASA and industrial partners. Also responsible for program management for research in power and advanced electronics including silicon carbide, electronics packaging, electronics manufacturing, and power electronics.

Associate Director - The Center for the Commercial Development of Space Power and Advanced Electronics, February 1, 1994 - August 31, 1995. Responsible for research programs in advanced electronics including silicon carbide, electronics packaging and electronics manufacturing. Also responsible for new industrial member recruitment.

Associate Professor (tenured) - Auburn University, September 15, 1991 - September 14, 1995. Research interests in multichip modules, electronic materials and processing, power electronics, and high temperature electronics.

Assistant Professor - Auburn University, September 15, 1987 - September 14, 1991. Research interests in multichip modules, electronic materials and processing, and power electronics. Established teaching and research program in thick and thin film microelectronics including laboratory facilities. Also taught undergraduate circuits and design courses.

Graduate Research Assistant - Auburn University, September 17, 1984 - September 14, 1987. Studied for Ph.D. in Electrical Engineering with research interests in multichip packaging, electronic materials and processing, and power hybrids. Research funded by the Semiconductor Research Corporation.

Graduate Teaching Assistant - Auburn University, September 17, 1984 - August 25, 1985. Taught undergraduate circuits and electronics courses.

Senior Product Engineer - Amperex Electronics Corp., February 15, 1984 - September 14, 1984. Primary responsibility: applications engineering and product management for custom hybrid and discrete semiconductor products.

Hybrid Electronics Engineer - Eaton Corporation, January 3, 1983 - February 15, 1984. Primary responsibility: establish in-house, thick film facility to produce 3-5 million industrial hybrid circuits per year. Tasks included process development, hybrid design, process documentation, production scheduling, cost estimating and supervision of operators.

Instructor - Vanderbilt University, January 1, 1982 - May 15, 1982. Taught hybrid microelectronics course and laboratory.

Product Specialist - DuPont, Electrical Materials Division, July 1, 1979 - December 31, 1980. Primary responsibilities: to assist DuPont customers with the processing of thick film materials with responsibility for all military accounts and several key high-volume commercial accounts. Laboratory facilities were used to produce and evaluate prototype and test parts to verify materials and processes and for military qualification tests. Other responsibilities included failure analysis, evaluation of new materials and processes, customer training seminars and supervision of laboratory personnel.

Project Engineer - Microsystems Technology, Inc., May 1977 - April 1979 (part-time). Major projects: evaluation of materials and processes to produce circuits for use in high temperature (275°C) environments; and design, layout, fabrication, and testing of thick-film multilayer hybrid microcircuits for the F18 Multi-Purpose Display Group.

### **AWARDS**

Best Paper of Symposium Award for, "Reliability of Small BGAs in the Automotive Environment," by Jeffrey C. Suhling, R. Wayne Johnson, John L. Evans, Nokibul Islam, Jing Lui, and Shyam Gale, the 35<sup>th</sup> International Symposium on Microelectronics, Denver, CO, September 4-6, 2002.

Best Paper of Conference Award for "Wafer Applied Underfills for Flip Chip Assembly," by Wayne Johnson, Qing Wang, Fei Ding, Renzhe Zhao, Larry Crane, Mark Konarski, Erin Yaeger, Afranio Torres, Marc Chason, Jan Danvir, Nadia Yala, Jing Qi, and Prasanna Kulkanari, The International Conference on Advanced Packaging and Systems, Reno, NV, March 10-13, 2002.

Best Paper of Conference Award for the paper entitled, "Assembly and Reliability of Flip Chip-on-Laminate with Lead Free Solder," by Zhenwei Hou, Casey Hatcher, R. Wayne Johnson, Erin Yaeger, Mark Konarski and Larry Crane, 2001 HD International Conference, Santa Clara, CA April 18-20, 2001.

Best Paper of Conference Award for the paper entitled, "Comparison of Die Level Stress with Convection and Variable Frequency Microwave Encapsulant Curing for Chip-on-Board," by Yida Zou, R. Wayne Johnson, Jeffrey C. Suhling, Joe Harris, Cheryl Kromis, Iftikhar Ahmad, Denise Tucker, and Zak Fathi, International Conference on High Density Packaging and MCMs, April 6-9, 1999, Denver, CO.

Outstanding Paper of Conference Award for the paper entitled, "Flip Chip on Laminate Manufacturability," by Jing Qi, R. Wayne Johnson, Erin Yaeger, Mark Konarski, and

Larry Crane, International Conference on High Density Packaging and MCMs, April 6-9, 1999, Denver, CO.

1997 Daniel C. Hughes Award from the International Society for Hybrid Microelectronics for “significant technical contributions and continued academia impact on the industry”. This is the top award given by the Society and includes life membership.

1997 Senior Faculty Research Award presented by the Auburn Alumni Engineering Council.

1997 Alumni Professorship presented by the Auburn Alumni Association. This is a five-year appointment.

1994 Fellow of the Society Award from the International Society for Hybrid Microelectronics for “his significant and continuing contributions to ISHM over the course of many years”.

1993 John A. Wagon, Jr. Technical Achievement Award from the International Society for Hybrid Microelectronics for “his contributions in establishing teaching and research programs in multichip modules, electronic materials and processing, power electronics, and high temperature electronics. He was instrumental in the start of the ISHM National Technical Program Committee, Multichip Module Workshops and Conferences, as well as professional development courses”.

### **PROFESSIONAL ORGANIZATIONS**

International Microelectronics and Packaging Society (IMAPS)

Technical Vice President 2000-2004

Vice President for Information Dissemination 1997-1999

Chairman of the Publications Committee 1997-1999

Technical Chair for the Flip Chip Advanced Technology Workshop 1999

Daniel C. Hughes Memorial Award, 1997

Fellow of the Society, 1994

John A. Wagon Jr., Technical Achievement Award, 1993

First Past-President 1992

President 1991

President-Elect 1990

Southeast Regional Director 1987-1989

Chairman Executive Committee 1991

Awards Committee Chair 1992

Chair General for the 8th International Conference on Multichip Modules 1998

Co-Chair General for the 7th International Conference on Multichip Modules 1997

General for the 3rd International Conference on Multichip Modules 1994

Co-Chair General for the 2nd International Conference on Multichip Modules  
1993

Technical Co-Chair for the 1st International Conference on Multichip Modules  
1992

Session Chairman for the International Conference on Multichip Modules 1994,  
1995, 1996

Technical Chairman for the Automotive Advanced Technology Workshop 1996

Session Chair for the MCM Advanced Technology Workshop 1990 and 1991  
Faculty Advisor for Auburn University Student Chapter of ISHM 1987-Present  
Associate Editor for the ISHM International Journal of Microcircuits and Electronic Packaging, 1995, 1996, 1997, 1998  
Editor of the International Journal for Hybrid Microelectronics 1980-1982  
Publication Committee Chairman 1980-1982  
Member of National Technical Committee 1993, 1994, 1995, 1996  
Chairman of the Packaging Subcommittee (NTC) 1994, 1995  
Session Chairman at ISHM Symposiums 1982, 1983, 1984, 1995, and 1996  
President Tennessee Valley Chapter 1983 and 1987  
President-Elect Tennessee Valley Chapter 1982  
Vanderbilt Student Chapter President 1979, 1981

Institute of Electrical and Electronics Engineers (IEEE), Senior Member 1994,  
Components, Hybrids, and Manufacturing Technology Society  
Board of Govenors, 1994-1997

Surface Mount Technology Association, member 1994-present  
Member of the Charles Hutchins Grant Committee

IPC, Auburn representative 1998-present

Interconnection Technology Research Institute, ITRI, Auburn representative 1999-2001

International Electronic Packaging Society (IEPS)  
Board of Directors, 1994-1996  
Vice President for Publications, 1995-1996  
Nominations Committee, 1995

Eta Kappa Nu  
Tau Beta Pi  
Kentucky Colonel

## **PATENTS**

"Automotive Electronics Test System" with Neil Borkowicz, David Muir, and John Evans of Chrysler Corporation, Patent Number 543813, issued August 1, 1995.

## **PUBLICATIONS**

### **Refereed Journal Articles (Published)**

Jeffrey E. Naefe, R. Wayne Johnson, and Richard R. Grzybowski, "High-Temperature Storage and Thermal Cycling Studies of Heraeus-Cermalloy Thick Film and Dale Power Wirewound Resistors," IEEE Transactions on Components and Packaging Technology, Vol. 25, No. 1, March 2002, pp. 45-52.

Zhenwei Hou, Guoyun Tian, Casey Hatcher, R. Wayne Johnson, Erin Yaeger, Mark Konarski and Larry Crane, "Lead Free Solder Flip Chip-on-Laminate Assembly and

Reliability,” *IEEE Transactions on Electronics Packaging Manufacturing*, Vol. 24, No. 4, October 2001, pp. 282-292.

Haiwei Peng, R. Wayne Johnson, George Flowers & Abbey-Gayle Ricketts, Erin Yeager, Mark Konarski, Afranio Torres, and Larry Crane, “Underfilling Fine Pitch BGAs,” *IEEE Transactions on Electronics Packaging Manufacturing*, Vol. 24, No. 4, October 2001, pp. 293-299.

Jing Qi, R. Wayne Johnson, Erin Yaeger, Mark Konarski, Todd Doody, Z. Andrew Szczepaniak, and Larry Crane,” Manufacturability Issues in Flip Chip on Laminate Assembly,” *International Journal of Microcircuits and Electronic Packaging*, Vol. 22, No. 3, 3<sup>rd</sup> Qtr., 1999, pp. 270--279.

Lawrence Crane, Afranio Torres-Filho, Chris Ober, and Wayne Johnson, “Development of Reworkable Underfills, Materials, Reliability and Processing,” *IEEE Transactions on Advanced Packaging*, Vol. 22, No. 2, 1999.

Y. Zou, Jeffery Suhling, R. Wayne Johnson, R. C. Jaeger, and A. K. M. Mian, “In-Situ Stress State Measurements During Chip-on-Board Assembly,” *IEEE Transactions on Electronics Packaging Manufacturing*, Vol. 22, No. 1, 1999, pp. 38-52.

R. Wayne Johnson, Michael Palmer, Michael Bozack and Tamara Issac-Smith, “Thermosonic Gold Wire Bonding to Laminate Substrates with Palladium Finishes,” *IEEE Transactions on Electronics Packaging Manufacturing*, Vol. 22, No. 1, 1999, pp. 7-15.

R. Wayne Johnson, David Price, Dan Maslyk, Michael Palmer, Stuart Wentworth, Charles Ellis, John Czarnowski and Justin Bolger, “Patterned Adhesive Flip Chip Technology for Assembly on Polyimide Flex Substrates,” *International Journal of Microcircuits and Electronic Packaging*, Vol 20, No. 3, 3<sup>rd</sup> Qtr., 1997, pp. 309-316.

Chris Dunn, R. Wayne Johnson, Mike Bozack, Cheryl Kromas, Joe Harris, and Marnie Knadler, “Thermosonic Gold Ball Bonding to Immersion Gold/Electroless Nickel Plating Finishes on Laminate MCM Substrates,” *International Journal of Microcircuits and Electronic Packaging*, Vol 20, No. 3, 3<sup>rd</sup> Qtr., 1997, pp. 317-324.

Marcus Lankford, Kyle Davis, R. Wayne Johnson, M. E. Baginski, and Hayden Hontgas, “Electromagnetic Compatibility Design and Performance of Multichip Modules,” *International Journal of Microcircuits and Electronic Packaging*, Vol 20, No. 3, 3<sup>rd</sup> Qtr., 1997, pp. 333-338.

Robert Newberry, R. Wayne Johnson, Larry Bosley, and John Evans, “Analysis of an MCM Implementation for an Automotive Controller,” *International Journal of Microcircuits and Electronic Packaging*, Vol 20, No. 3, 3<sup>rd</sup> Qtr., 1997, pp. 325-332.

R. M. Nelms and R. Wayne Johnson, “200°C Operation of a 500-W DC-DC Converter Utilizing Power MOSFET’s,” *The IEEE Transactions on Industrial Applications*, Vol. 33, No. 5, 1997, pp. 1267-1272.

Stuart M. Wentworth, Brian L. Dillaman, Jon R. Chadwick, Charles D. Ellis, and R. Wayne Johnson, “Attenuation in Silver-filled Conductive Epoxy Interconnects,” *The IEEE*

*Transactions on Components, Packaging and Manufacturing Technology - Part A*, Vol. 20, No. 1, 1997, pp. 52-59.

J. B. Casady and R. W. Johnson, "Status of Silicon Carbide (SiC) as a Wide-Bandgap Semiconductor for High Temperature Applications: A Review," *Solid -State Electronics*, Vol. 39, No. 10, 1996, pp. 1409-1422.

J. B. Casady, W. C. Dillard, R. W. Johnson, and U. Rao, "A Hybrid, 6H-SiC Temperature Sensor Operational from 25°C to 500°C," *The IEEE Transactions on Components, Packaging and Manufacturing Technology - Part A*, Vol.19, No. 3, September 1996, pp. 416-422.

J. B. Casady, J. D. Cressler, W. C. Dillard, R. W. Johnson, A. K. Agarwal, and R. R. Siergiej, "DC Characterization of Depletion-Mode 6H-SiC MOSFET's from 294K to 723K," *Solid-State Electronics*, Vol. 39, No. 6, June 1996, pp. 777-784.

J. B. Casady, E. D. Luckowski, M. Bozack, D. Sheridan, R. W. Johnson, and J. R. Williams, "Etching of 6H-SiC and 4H-SiC Using NF<sub>3</sub> in a Reactive Ion Etching System," *Journal of the Electrochemical Society*, Vol. 143, No. 5, May 1996, pp. 1750-1753.

J. B. Casady, W. Dillard, R. W. Johnson, A. K. Agarwal, R. R. Siergiej, and W. E. Wagner, "Low Frequency Noise in 6H-SiC MOSFETs," *IEEE Electron Device Letters*., Vol. 16, No. 6, June 1995, pp. 274-276.

John L. Evans, Larry Bosley, and R. Wayne Johnson, "MCM-L Technology: System Cost Comparisons for High Volume Automotive Electronics," *IEEE Transactions on Components, Hybrids and Manufacturing Technology Part B: Advanced Packaging*, Vol. 18, No. 1, February 1995, pp. 28-32.

Jon Aday, R. Wayne Johnson, John L. Evans, and Chris Romanczuk, "Wire Bonded Thick Film Silver Multilayers for Under-the-Hood Automotive Applications," *The International Journal of Microcircuits and Electronic Packaging*, Vol. 15, No. 3, 1994, pp. 302-311.

Richard C. Jaeger, Jeffrey C. Suhling, Martin T. Carey, and R. Wayne Johnson, "Off-Axis Sensor Rosettes for Measurement of the Piezoresistive Coefficients of Silicon," *IEEE Transactions on Transactions on Components, Hybrids, and Manufacturing Technology*, Vol. 16, No. 8, December 1993, pp. 925-931.

R. Wayne Johnson, G. Bennett Weir, and James R. Bromstead, "200°C Operation of Semiconductor Power Devices," *IEEE Transactions on Transactions on Components, Hybrids, and Manufacturing Technology*, Vol. 16, No. 7, November 1993, pp. 759-764.

Miro Tomana, R. Wayne Johnson, Richard C. Jaeger, and William C. Dillard, "A Hybrid, Silicon Carbide Differential Amplifier for 350°C Operation," *IEEE Transactions on Transactions on Components, Hybrids, and Manufacturing Technology*, Vol. 16, No. 5, August 1993, pp. 536-542.

R. E. Beaty, R. C. Jaeger, J. C. Suhling, R. W. Johnson, and R. D. Butler, "Evaluation of Piezoresistive Coefficient Variation in Silicon Stress Sensors Using a Four Point Bending

Test Fixture", *IEEE Transactions on Components, Hybrids and Manufacturing Technology*, Vol. 15, No. 5, October 1992, pp. 904-914.

Kevin D. Robb and R. Wayne Johnson, "Analysis of Slot-Fed Microwave Feed Structures Using the Transmission Line Matrix (TLM) Method", *The International Journal of Microcircuits and Electronic Packaging*, Vol. 15, No. 2, Second Quarter 1992, pp. 103-112.

R. Ramesham, T. Roppel, R. W. Johnson, and J. M. Chang, "Characterization of Polycrystalline Diamond Thin Films Grown on Various Substrates", *Thin Solid Films*, Vol. 212, Nos. 1-2, May 1992, pp. 96-103.

R. W. Johnson, E. L. Thomas, R. Duren, D. W. Curington, and A. C. Lippincott, "Insulated Metal Substrates for the Fabrication of a Half-Bridge Power Hybrid", *IEEE Transactions on Components, Hybrids and Manufacturing Technology*, Vol. 14, No. 4, December 1991, pp. 886-893.

D. A. Bittle, J. C. Suhling, R. E. Beaty, R. C. Jaeger, and R. W. Johnson, "Piezoresistive Stress Sensors for Structural Analysis of Electronic Packages", *Journal of Electronic Packaging*, Vol. 113, No. 3, September 1991, pp. 203-214.

Kevin D. Robb, Fred J. German, Stuart M. Wentworth, and R. Wayne Johnson, "Analysis of Microstrip Resistors Using the Transmission Line Matrix (TLM) Method", *International Journal for Hybrid Microelectronics*, Vol. 14, No. 2, June 1991, pp. 62-69.

C. L. Chen, R. Wayne Johnson, R. C. Jaeger, M. B. Cornelius and W. A. Foster, "Packaging Technology for a Low Temperature Astrometric Sensor Array," *IEEE Transactions on Components, Hybrids and Manufacturing Technology*, Vol. 13, No. 4, December 1990, pp. 1083-1089.

F. German and R. Wayne Johnson, "Full Wave Three-Dimensional Simulation of Maxwell's Equations for the Electrical Characterization of High-Speed Interconnects," *IEEE Transactions on Components, Hybrids and Manufacturing Technology*, Vol. 13, No. 2, June 1990, pp. 341-346.

R. Wayne Johnson, T. L. Phillips, K. Weidner, S. F. Hahn, D. C. Burdeaux and P. Townsend, "Benzocyclobutene Interlayer Dielectrics for Thin Film Multichip Modules," *IEEE Transactions on Components, Hybrids and Manufacturing Technology*, Vol. 13, No. 2, June 1990, pp. 347-352.

T. A. Baginski and R. Wayne Johnson, "A Novel RF Insensitive EED Utilizing a Balanced Reactive Bridge," *IEEE Transactions on Electromagnetic Compatibility*, Vol. 32, No. 1, February 1990, pp. 69-73.

R. Wayne Johnson, R. Weeks, D. Hopkins, J. Muir, and J. Williams, "Plated Copper on Ceramic Substrates for Power Hybrid Circuits," *IEEE Transactions on Components, Hybrids and Manufacturing Technology*, Vol. 12, No. 4, December 1989, pp. 530-536.

R. Wayne Johnson, T. L. Phillips, R. C. Jaeger, S. F. Hahn and D. C. Burdeaux, "Multichip Thin Film Technology on Silicon," *IEEE Transactions on Components, Hybrids, and Manufacturing Technology*, Vol. 12, No. 2, June 1989, pp. 185-194.

R. Wayne Johnson, Michael Cornelius, Jimmy L. Davidson and Richard C. Jaeger, "Planar Hybrid Interconnection Technology," *International Journal for Hybrid Microelectronics*, Vol. 10, No. 1, 1st Quarter, 1987.

R. Wayne Johnson, Jim Davidson, Richard Jaeger and David Kerns, "Silicon Hybrid Wafer Scale Package Technology," *IEEE Journal of Solid State Circuits*, October 1986, pp. 845-851.

R. Wayne Johnson, P. W. Rich, D. D. Rich and L. K. Wilson, "Advances in Thick Film Conductors for Microwave Integrated Circuits," *Electro Component Science and Technology*, Vol. 6, Nos. 3 and 4, 1980.

R. Wayne Johnson, Larry Wilson and Donald Kinser, "Characterization of Thermal Compression Wire Bonds to Thick Film Conductors on Porcelain Substrates," *IEEE Transactions on Components, Hybrids and Manufacturing Technology*, Vol. 2, No. 3, September 1979, pp. 288-293.

#### **Refereed Journal Articles (Accepted for publication)**

S. V. Sattiraju, B. Dang, R. W. Johnson, Y. Li, J. S. Smith and M. J. Bozack, "Wetting Characteristics of some Pb-free Solder alloys and PWB Finishes," accepted by the *IEEE Transactions on Electronics Packaging Manufacturing*.

Yun Zhang, Renzhe Zhao, Daniel K. Harris, and R. Wayne Johnson, "A Computational Study On Solder Bump Geometry, Normal, Restoring, And Fillet Forces During Solder Reflow In The Presence Of Liquefied Underfill," accepted by the *IEEE Transactions on Electronics Packaging Manufacturing*.

Yida Zou, R. Wayne Johnson, Jeffery C. Suhling, Joe Harris, Cheryl Kromis, Iftikhar Ahmad, Denise Tucker, Zak Fathi, "Die Level Stress with Convection and Variable Frequency Microwave Encapsulant Curing for Chip-on-Board Assembly," accepted by the *International Journal of Microcircuits and Electronic Packaging*.

Ahsan Mian, Jeffrey C. Suhling, R. Wayne Johnson and Richard C. Jaeger, "Measurement of Backside Flip Chip Die Stresses Using Piezoresistive Test Die," accepted by the *International Journal of Microcircuits and Electronic Packaging*.

#### **Refereed Journal Articles (Submitted for publication)**

Jing Liu & R. Wayne Johnson, Erin Yaeger, Mark Konarski and Larry Crane, "Processing and Reliability of CSPs with Underfill," submitted to the *IEEE Transactions on Electronics Packaging Manufacturing*.

Renzhe Zhao, R. Wayne Johnson, Greg Jones, Erin Yaeger, Mark Konarski, Paul Krug and Larry Crane, "Processing of Fluxing Underfills for Flip Chip-on-Laminate Assembly," submitted to the *IEEE Transactions on Electronics Packaging Manufacturing*.

## Invited Lectures

"High Temperature Electronics Packaging", National Research Council Committee on Materials for High-Temperature Semiconductor Devices, Washington D.C., February 10, 1994.

"Silicon Multichip Modules", Multichip Module Seminar - IEEE Society for Components, Hybrids, and Manufacturing Technology, April 13, 1991, San Diego, CA.

"A Review of High Temperature Electronics Packaging," High Temperature Electronics Workshop, June 1989.

"Thin Film Silicon Hybrids," VLSI and GaAs Packaging Workshop, September 1988.

## Books and Book Chapters

Chapter 19: "Flip Chip Assembly and Underfilling" in the *Handbook of Area Array Packaging* published to McGraw Hill, 2001.

"Hybrid Assembly and Packaging", R. Wayne Johnson, Chapter 8 in *High Temperature Electronics*, edited by Randall Kirschman, IEEE Press, 1998.

"Automotive Multichip Modules", R. Wayne Johnson and John L. Evans, Chapter 15, *Advanced Electronic Packaging*, edited by William D. Brown, IEEE Press, 1998.

"Assembly", R. Wayne Johnson, Chapter 8 in *Multichip Module Technology Handbook*, edited by Iwona Turlik and Philip Garrou, McGraw-Hill, New York, NY 1997.

"Introduction to Hybrid Microelectronics", R. Wayne Johnson, Chapter 1 in the *Handbook of Hybrid Microelectronics, 2nd Edition*, edited by Jerry Sargent and Charles Harper, McGraw-Hill, Inc., New York, NY, 1994

"Silicon Multichip Modules", R. Wayne Johnson, Chapter 16 in *Multichip Module Technologies and Alternatives - The Basics*, edited by D. A. Doane and Paul Franzon, Van Nostrand Reinhold, New York, NY, 1992.

*Multichip Modules: Systems Advantages, Major Constructions, and Materials Technologies*, edited by R. Wayne Johnson, Robert Teng, and John Balde, IEEE Press, New York, NY, 1991.

*Modular Series in Hybrid Microelectronics*, edited by R. Wayne Johnson, The International Society for Hybrid Microelectronics, Reston, VA, 1991.

"Introduction to Hybrid Microelectronics", R. Wayne Johnson, Chapter 1 in *Modular Series in Hybrid Microelectronics*, edited by R. Wayne Johnson, The International Society for Hybrid Microelectronics, Reston, VA, 1991.

"Wafer-Scale Multichip Packaging Technology", R. Wayne Johnson, Richard C. Jaeger,

and Travis N. Blalock, Chapter 10 in *Wafer Scale Integration*, edited by Earl E. Swarzlander, Jr., Kluwer Academic Press, Boston, 1989.

### **Advisory Board**

*Advanced Packaging*, Lake Publishing Corporation, Libertyville, Illinois.

### **Editorial Board**

Associate Editor - *The International Journal of Microcircuits and Electronic Packaging*

Associate Editor - *IEEE Transactions on Electronics Packaging Manufacturing*

### **Papers at Professional Meetings**

Jeffrey C. Suhling, R. Wayne Johnson, John L. Evans, Nokibul Islam, Jing Lui, and Shyam Gale, "Reliability of Small BGAs in the Automotive Environment," Proceedings of the 35<sup>th</sup> International Symposium on Microelectronics, Denver, CO, September 4-6, 2002, pp. 524 – 532. Winner of the "Best Paper of Symposium Award".

Tan Zhang and R. Wayne Johnson, "Assembly on Liquid Crystal Polymer (LCP) Substrates for Advanced Packaging," accepted for the 35<sup>th</sup> International Symposium on Microelectronics, Denver, CO, September 4-6, 2002, pp. 1-9.

Robert Dean, R. Wayne Johnson, Holly Garison, Nicole Schutz, Mike Kranz, Ron Legowik, Bill Bowers, and Bill Payne, "Strategies for Successfully Integrating MEMS Die onto Laminate," Proceedings of the 35<sup>th</sup> International Symposium on Microelectronics, Denver, CO, September 4-6, 2002, pp. 109-114.

R. Wayne Johnson, John L. Evans, Peter Jacobsen, and Rick Thompson, "High Temperature Automotive Electronics," Proceedings of the International Conference on Advanced Packaging and Systems, Reno, NV, March 10-13, 2002, pp. 77-87.

Wayne Johnson, Qing Wang, Fei Ding, Renzhe Zhao, Larry Crane, Mark Konarski, Erin Yaeger, Afranio Torres, Marc Chason, Jan Danvir, Nadia Yala, Jing Qi, and Prasanna Kulkanari, "Wafer Applied Underfills for Flip Chip Assembly," Proceedings of the International Conference on Advanced Packaging and Systems, Reno, NV, March 10-13, 2002, pp. 195-205. Winner of the "Best Paper of Conference Award".

Jing Qi, Prasanna Kulkarni, Nadia Yala, Jan Danvir, Marc Chason, R. Wayne Johnson, Renzhe Zhao, Larry Crane, Mark Konarski, Erin Yaeger, Afranio Torres, Rebecca Tishkoff, and Paul Krug "Assembly of Flip Chips Utilizing Wafer Applied Underfill," Proceedings of the 2002 APEX Technical Program, January 19-24, 2002, San Diego, CA, pp. S18-3-1 to S18-3-7.

Jing Liu, R. Wayne Johnson, Erin Yaeger, Mark Konarski and Larry Crane, "CSP Underfill, Processing and Reliability," Proceedings of the 2002 APEX Technical Program, January 19-24, 2002, San Diego, CA, pp. S16-1-1 to S16-1-7.

Larry Crane, Mark Konarski, Erin Yaeger, Afranio Torres, Rebecca Tishkoff, Paul Krug, Steve Bauman, Wayne Johnson, Prasanna Kulkanari, Renzha Zhao, Marc Chason, Jan Danvir, Nadia Yala, and Jing Qi, "Development of Wafer Scale Applied Reworkable Fluxing Underfill for Direct Chip Attach, Part II," Proceedings of the 2002 APEX Technical Program, January 19-24, 2002, San Diego, CA, pp. S36-2-1 to S36-2-6.

Renzhe Zhao, R. Wayne Johnson, Greg Jones, Erin Yaeger, Mark Konarski, Paul Krug and Larry Crane, "Processing of Fluxing Underfills for Flip Chip-on-Laminate Assembly," Proceedings of the 2002 APEX Technical Program, January 19-24, 2002, San Diego, CA, pp. S18-1-1 to S18-1-7.

Erin Yaeger, Z. Andrew Szczepaniak, Mark Konarski, Larry Crane, Zhenwei Hou, Guoyun Tian, and R. Wayne Johnson, "Underfill Materials, Processing and Reliability for Fine Pitch Flip Chip on Laminate Assembly," Proceedings of the 2002 APEX Technical Program, January 19-24, 2002, San Diego, CA, pp. S17-3-1 to S17-3-6.

S. V. Sattiraju, B. Dang, R. W. Johnson, Y. Li, J. S. Smith and M. J. Bozack, "Wetting Characteristics of Pb-free Solder Pastes and Pb-free PWB Finishes," *Proceedings of the 51<sup>st</sup> IEEE Electronic Components and Technology Conference*, Lake Buena Vista, FL. May 29 - June 1 2001, S37p12

Renzhe Zhao, Yun Zhang, R. Wayne Johnson, Daniel K. Harris, "A Study of Normal, Restoring, and Fillet Forces and Solder Bump Geometry during Reflow in Concurrent Underfill/Reflow Flip Chip Assembly," *51<sup>st</sup> IEEE Electronic Components and Technology Conference*, Lake Buena Vista, FL. May 29 - June 1 2001,

Zhenwei Hou, Casey Hatcher, R. Wayne Johnson, Erin Yaeger, Mark Konarski and Larry Crane, "Assembly and Reliability of Flip Chip-on-Laminate with Lead Free Solder," *Proceedings of the 2001 HD International Conference*, Santa Clara, CA April 18-20, 2001, pp. 323-330. Received 'Best Paper of Conference' Award.

Nael Hannan, Puligandla Viswanadham, Larry Crane, Erin Yaeger, Afranio Torres, and R. Wayne Johnson, "Reworkable Underfill Materials For Improved Manufacturability And Reliability Of Csp Assemblies," *Proceedings of the 2001 APEX Conference*, San Diego, CA, January 14-18, 2001, pp. AT8-3-1 – AT8-3-10.

Wayne Johnson, Roger Lugo, Seshu V. Sattiraju, and Greg Jones, "Improved Thermal Process Control for Lead-free Assembly," *Proceedings of the 2001 APEX Conference*, San Diego, CA, January 14-18, 2001, pp. LF1-2-1 – LF1-2-10.

Larry Crane, Mark Konarski, Erin Yaeger, Paul Neathway, Ken Tojima, Marc Chason, Jan Danvir, Nadia Yala, Jing Qi, Wayne Johnson, and Prasanna Kulkarni, "Development of Wafer Scale Applied Reworkable Fluxing Underfill for Direct Chip Attach," *Proceedings of the 2001 APEX Conference*, San Diego, CA, January 14-18, 2001, pp. AT6-1-1 – AT6-1-5.

S.V.Sattiraju, R.W.Johnson, D.Z.Genc and M.J.Bozack, "Wetting Performance of Several Lead-free Board Finishes and Solder Alloys", *IPCWorks 2000 Proceedings*, Sept 9-14, 2000, Miami pp. S-01-2-1 to S-01-2-12.

S. Sattiraju, R. W. Johnson, D. Genc, and M. J. Bozack, "Wetting Performance vs Flux and Board Finish for Several No-Pb Solder Alloys," *Proceedings of the 25th International Electronics Manufacturing Technology (IEMT) Symposium*, Santa Clara, CA, Oct 2-3, 2000, pp. 253-262.

R. Wayne Johnson, Shannon Pan, Mike Palmer and Robert Dean, "Conductive Adhesives for Under-the-Hood Automotive Applications," *Proceedings of the 5<sup>th</sup> International High Temperature Electronics Conference*, June 12-15, 2000, Albuquerque, NM.

Zhenwei Hou, R. Wayne Johnson, Erin Yaeger, Mark Konarski, and Larry Crane, "Compatibility of Current Flipchip Process with Lead Free Solder Bumps," *Proceedings of the 37<sup>th</sup> IMAPS Nordic Annual Conference*, Helsingør, Denmark, September 10 – 13, 2000, pp. 123-127.

Larry Crane, Afranio Torres, Erin Yaeger and R. Wayne Johnson, "Reworkable Underfill Development, Processing and Reliability," *Proceedings of the 3<sup>rd</sup> Annual HDI Expo*, Phoenix, AZ, September 25-27, 2000, pp. 65-70.

R. Wayne Johnson, Shannon Pan, Mike Palmer and Robert Dean, "Conductive Adhesives for Under-the-Hood Automotive Applications," *Proceedings of the 5<sup>th</sup> International High Temperature Electronics Conference*, June 12-15, 2000, Albuquerque, NM.

Haiwei Peng, R. Wayne Johnson, George Flowers, Erin Yeager, Mark Konarski, Afranio Torres, and Larry Crane, "Underfilling Micro-BGAs," *Proceedings of the International Conference on High-Density Interconnect and Systems Packaging*, Denver CO, April 25-28, 2000, pp. 134-140.

Prasanna Kulkarni, R. Wayne Johnson, Erin Yaeger, Mark Konarski, Afranio Torres, Paul Krug and Larry Crane, "Manufacturing of Flip Chip-on-Laminate," *Proceedings of the APEX Technical Program*, Long Beach, CA, March 12-16, 2000, pp. P-AP3/2/1 – 5.

Ahsan Mian, Jeffrey C. Suhling, R. Wayne Johnson and Richard C. Jaeger, "Measurement of Backside Flip Chip Die Stresses Using Piezoresistive Test Die," *Proceedings of the 1999 International Microelectronics Symposium*, October 26-28, 1999, Chicago, IL.

Yida Zou, R. Wayne Johnson, Jeffery C. Suhling, Joe Harris, Cheryl Kromis, Iftikhar Ahmad, Denise Tucker, Zak Fathi, "Comparison of Die Level Stress with Convection and Variable Frequency Microwave Encapsulant Curing for Chip-on-Board," *Proceedings of the 1999 International High Density Packaging and MCM Conference*, Denver, CO, April 6-9, 1999, pp. 77-16. Winner of "Best Paper of Conference Award"

Jing Qi, R. Wayne Johnson, Erin Yaeger, Mark Konarski, Todd Doody, Z. Andrew Szczepaniak and Larry Crane, "Flip Chip on Laminate Manufacturability," *Proceedings of the 1999 International High Density Packaging and MCM Conference*, Denver, CO, April 6-9, 1999, pp. 345-352. Winner of "Best Paper of Outstanding Paper of Conference Award"

R. Wayne Johnson, Vicky Wang, and Michael Palmer, "Thermal Cycle Reliability of Solder Joints to Alternate Plating Finishes," *Proceedings of the 1998 Surface Mount International Conference*, San Jose, CA, August 25-27, 1998.

C. S. White, R. M. Nelms, R. W. Johnson, and R. R. Grzybowski, "High Temperature Electronic Systems Using Silicon Semiconductors," *Conference Record of the 1998 Industry Applications Society Thirty-Third IAS Annual Meeting*, Vol. 2, October 1998, pp. 967-976.

Jeffrey E. Naefe, R. Wayne Johnson, and Richard R. Grzybowski, "High-Temperature Storage and Thermal Shock Studies of Passive Component Attach Materials," *Proceedings of the 4<sup>th</sup> International High Temperature Electronics Conference*, Albuquerque, NM, June 16-19, 1998, pp. 68-78.

Jeffrey E. Naefe, R. Wayne Johnson, and Richard R. Grzybowski, "High-Temperature Storage and Thermal Cycling Studies of Heraeus-Cermalloy Thick Film and Dale Power Wirewound Resistors," *Proceedings of the 4<sup>th</sup> International High Temperature Electronics Conference*, Albuquerque, NM, June 16-19, 1998, pp. 191-206.

Jay S. Salmon, R. Wayne Johnson, and Mike Palmer, "Thick Film Hybrid Packaging Techniques for 500°C Operation," *Proceedings of the 4<sup>th</sup> International High Temperature Electronics Conference*, Albuquerque, NM, June 16-19, 1998, pp. 103-108.

R. Wayne Johnson, M. Albert Capote, Sherry Zhu, Ligui Zhou, and Bing Gao, "Reflow-Curable Polymer Fluxes for Flip Chip Encapsulation," *Proceedings of the International Conference and Exhibition on Multichip Modules and High Density Packaging*, Denver, CO, April 15-17, 1998, pp. 41-46.

R. Wayne Johnson, Michael Palmer, Michael Bozack and Tamara Issac-Smith, "Thermosonic Gold Wire Bonding to Palladium Finishes on Laminate Substrates," *Proceedings of the International Conference and Exhibition on Multichip Modules and High Density Packaging*, Denver, CO, April 15-17, 1998, pp. 291-299.

Y. Zou, Jeffery Suhling, R. Wayne Johnson, and R. C. Jaeger, "Complete Stress State Measurements in Chip on Board Packages," *Proceedings of the International Conference and Exhibition on Multichip Modules and High Density Packaging*, Denver, CO, April 15-17, 1998, pp. 405-415.

R. Wayne Johnson, M. Albert Capote, Z. Ming Zhou, Sheery Chu, and Ligui Zhou, "Reflow-Curable Polymer Fluxes for Flip Chip Assembly," *Proceedings of Surface Mount International Technical Program*, San Jose, CA September 7-11, 1997, pp. 267-272.

S. T. Lin, J. C. Suhling, R. W. Johnson, B. Han, and J. L. Evans, "Finite Element and Moire Interferometry Study of Chip Capacitor Reliability," *Proceedings of InterPACK '97*, Hawaii, June 15-19, 1997.

John L. Evans, Robert Newberry, Larry Bosley, Steven G. McNeal, Andrew Mawer, R. Wayne Johnson, and Jeff Suhling, "PBGA Reliability for Under-the-Hood Automotive Applications," *Proceedings of InterPACK '97*, Hawaii, June 15-19, 1997.

R. Wayne Johnson, "The Student Factory at Auburn University," *Proceedings of the 47th Electronic Components and Technology Conference*, San Jose, CA, May 19-21, 1997, pp. 589-592.

J. Naefe, M. Palmer, M. Lankford, and W. Johnson, "High Temperature Characterization of Heraeus-Cermalloy Thick Film and Dale Power Wirewound Resistors," *Proceedings of the 17th Capacitor and Resistor Technology Symposium*, Jupiter Beach, FL, March 24-27, 1997, pp 244-250.

R. Wayne Johnson, David Price, Dan Maslyk, Michael Palmer, Stuart Wentworth, Charles Ellis, John Czarnowski and Justin Bolger, "Adhesive Based Flip Chip Technologies for Assembly on Polyimide Flex Substrates," *Proceedings of the 1997 International Conference on Multichip Modules*, Denver, CO, April 2-4, 1997, pp. 81-86, Best Paper of Session Award.

Chris Dunn, R. Wayne Johnson, Mike Bozack, Cheryl Kromas, Joe Harris, and Marnie Knadler, "Thermosonic Gold Ball Bonding to Alternate Plating Finishes on Laminate MCM Substrates," *Proceedings of the 1997 International Conference on Multichip Modules*, Denver, CO, April 2-4, 1997, pp. 170-176, Best Paper of Session Award.

Marcus Lankford, Kyle Davis, R. Wayne Johnson, M. E. Baginski, and Hayden Hontgas, "Investigation of Design and Performance of Multichip Modules Including Electromagnetic Compatibility," *Proceedings of the 1997 International Conference on Multichip Modules*, Denver, CO, April 2-4, 1997, pp. 187-192.

Robert Newberry, Larry Bosley and R. Wayne Johnson, "A Comparative Analysis of a MCM Implementation for an Automotive Controller," *Proceedings of the 1997 International Conference on Multichip Modules*, Denver, CO, April 2-4, 1997, pp. 323-328.

Brian L. Dillaman, Stuart M. Wentworth, and R. Wayne Johnson, "Attenuation and Reliability of Conductive Adhesive Interconnects," *Proceedings of the 1996 Electronics Packaging Conference*, Austin, TX, Sept. 29-Oct. 1, 1996, pp. 130-139.

John M. Czarnowski, Mark E. S. Reynolds, Justin C. Bolger, Matthew T. Hayes, Charles D. Ellis, R. Wayne Johnson, and Michael J. Palmer, "Evaluation of Area Bonding Conductive Adhesives for Flip Chip Attach of Area Bonded Die," *Proceedings of the 1996 International Electronics Manufacturing Technology Symposium*, Austin, TX, Oct. 14-16, 1996, pp. 476-481.

W. C. Dillard, J. B. Casady, R. C. Jaeger, D. C. Sheridan, and R. W. Johnson, "High-Temperature (623°K), 4H-SiC, Thick-Film, Hybrid Operational Amplifier: Design, Fabrication, and Performance," *Proceedings of the 3rd International High Temperature Electronics Conference*, Albuquerque, NM, June 9-14, 1996, pp. VIII-15 - 20.

J. B. Casady, R. W. Johnson, Charles D. Ellis, Rongxiang Hu, Chin-Che Tin, Tamara Isaacs-Smith, W. C. Neely, and T. Kwasigro, "High Temperature Performance of Dielectrics on Silicon Carbide for Use in Device Passivation and Gate Dielectric," *Proceedings of the 3rd International High Temperature Electronics Conference*, Albuquerque, NM, June 9-14, 1996, pp. IX-27 - 32.

David C. Sheridan, Charles D. Ellis, William C. Dillard, and R. Wayne Johnson, "Evaluation of Si<sub>3</sub>N<sub>4</sub>/SiO<sub>2</sub> Stack, and Commercially Available MOS Capacitors for High Temperature Electronics", *Proceedings of the 3rd International High Temperature Electronics Conference*, Albuquerque, NM, June 9-14, 1996, pp. VI-27 - 32.

William Dillard, Jeffery Naefe, Michael Palmer, and R. Wayne Johnson, "A Test Fixture for High Temperature, Low Noise Testing of Electronic Components," *Proceedings of the 3rd International High Temperature Electronics Conference*, Albuquerque, NM, June 9-14, 1996, pp. XIV-9 - 14.

Eric D. Luckowski, John R. Williams, Chin-Che Tin, Rongxing Hu, J. B. Casady, R. W. Johnson, "High Temperature Performance of 4H and 6H-SiC MESFETs for Small Signal Analog Applications," *Proceedings of the 3rd International High Temperature Electronics Conference*, Albuquerque, NM, June 9-14, 1996, pp. P-101 - 106.

Jeffery E. Naefe, M. J. Palmer, R. Wayne Johnson, and R. R. Grzybowski, "High Temperature Performance of Thick Film and Wire Wound Resistors", *Proceedings of the 3rd International High Temperature Electronics Conference*, Albuquerque, NM, June 9-14, 1996, pp. P-107 - 112.

J. B. Casady, D. C. Sheridan, W. C. Dillard, and R. W. Johnson, "Characterization of 4H-SiC JFETs for Use in Analog Amplifiers Capable of 723°C Operation," *Proceedings of the 1996 Spring Meeting of the Materials Research Society*, San Francisco, CA April 8-12, 1996.

R. Wayne Johnson, Roy W. Knight, and Jeffrey C. Suhling, "Thermo-Mechanical Analysis of Metal Backed Circuit Boards," *Proceedings of the 1st Conference on Commercial Development of Space*, Albuquerque, NM, Jan 7-11, 1996, pp. 245-250.

E. D. Luckowski, J. B. Casady, J. R. Williams, and R. W. Johnson, "Electrical Characterization and Charge Transport in 6H-SiC Misfit's," *Proceedings of the 1st Conference on Commercial Development of Space*, Albuquerque, NM, Jan 7-11, 1996, pp. 251-256.

J. B. Casady, W. C. Dillard, R. W. Johnson, A. K. Agarwal, and R. R. Siergiej, "DC and Low Frequency Noise Characterization of 6H-SiC MOSFET's from 25°C to 350°C," *Proceedings of the 6th International Conference on SiC and Related Materials*, Kyoto, Japan, Sept. 18-21, 1995.

J. B. Casady, E. D. Luckowski, M. Bozack, D. Sheridan, R. W. Johnson, and J. R. Williams, "Fabrication Procedures and Characterization of 6H-SiC Misfit's for Use in High Temperature Electronics," *Proceedings of the 6th International Conference on SiC and Related Materials*, Kyoto, Japan, Sept. 18-21, 1995.

J. B. Casady, R. W. Johnson, and W. C. Dillard, "Characterization of 6H-SiC JFETs for Use in a Temperature Monitor Operating from 25°C to 350°C," *Proceedings of the 45th Electronic Components and Technology Conference*, Las Vegas, NV, May 21-24, 1995.

J. B. Casady, E. D. Luckowski, R. W. Johnson, J. Crofton, and J. R. Williams, "Fabrication Procedures and Characterization of 6H-SiC MESFETs for Use in High Temperature Electronics, *Proceedings of the 45th Electronic Components and Technology Conference*, Las Vegas, NV, May 21-24, 1995.

R. Wayne Johnson, Marnie Knadler, George Petrovic, Chauvet Parker, Jay Desai, Larry Bosley, Mike Witty and Kevin Prodromides, "Consortium for Automotive Electronics: An Approach to MCM Technology Development," *Proceedings of the 4th International Conference on Multichip Modules*, Denver, CO, April 19-21, 1995.

John L. Evans, Larry E. Bosley, Chris Romanczuk, and R. Wayne Johnson, "MCM Packaging Alternatives for Automotive Electronics: Comparing Fine Pitch, Ball Grid Array, and Polyimide Chip Carriers," *Proceedings of the 4th International Conference on Multichip Modules*, Denver, CO, April 19-21, 1995.

J. D. White, J. C. Suhling, R. W. Johnson, R. W. Knight, and C. S. Romanczuk, "Reliability of Plastic Quad Flat Pack Solder Joints in Potted Automotive Engine Controllers," *Proceedings of the 1994 International Symposium on Microelectronics*, Boston, MA, Nov. 1994.

R. Mark Nelms, David W. Campbell, and R. Wayne Johnson, "200°C Operation of a 500W DC-DC Converter Utilizing Power MOSFET's," *Proceedings of the 1994 IEEE IAS Annual Meeting*, Denver, CO.

R. Mark Nelms, David W. Campbell, and R. Wayne Johnson, "Design of a DC-DC Converter for Operation at 200°C", *Proceedings of the Second International High Temperature Electronics Conference*, Charlotte, NC, June 5-10, 1994.

John L. Evans, Chris Romanczuk, Larry Bosley, and R. Wayne Johnson, "High Temperature Requirements for Automotive Electronic Controllers," *Proceedings of the Second International High Temperature Electronics Conference*, Charlotte, NC, June 5-10, 1994.

Kang, Y. L., Suhling, J. C., Johnson, R. W. and Jaeger, R. C., "Silicon and Silicon Carbide Stress Sensors for Application to Electronic Packaging," *Proceedings of the 1994 SEM Spring Conference on Experimental Mechanics*, pp. 311-320, Baltimore, MD, June 6-8, 1994.

Jeff C. Suhling, R. Wayne Johnson, Jeff D. White, Kevin W. Matthai, Chris S. Romanczuk, John L. Evans, and Steve W. Burcham, "Solder Joint Reliability of Surface Mount Chip Resistors/Capacitors on Insulated Metal Substrates," *Proceedings of the 44th Electronic Components and Technology Conference*, Washington D.C. May 2-4, 1994.

John L. Evans, Larry Bosley, and R. Wayne Johnson, "MCM-L Technology: System Cost Comparisons for High Volume Automotive Electronics," *Proceedings of the International Conference on Multichip Modules*, Denver, CO, April 13-15, 1994.

R. Wayne Johnson, Jon Aday, John L. Evans, and Chris S. Romanczuk, "Using MCM-L Technology for Under-the-Hood Automotive Environmental Conditions," *Proceedings of*

*the 1993 International Symposium on Microelectronics*, Dallas, TX, November 9-11, 1993, pp. 584-588.

Roy W. Knight, R. Wayne Johnson, Chris S. Romanczuk, Stephen W. Burcham, and John L. Evans, "Finite Element Analysis of the Thermal Characteristics of an Automotive Powertrain Controller," *Proceedings of the 1993 International Symposium on Microelectronics*, Dallas, TX, November 9-11, 1993, pp. 650-655.

Jon Aday, R. Wayne Johnson, John L. Evans, and Chris S. Romanczuk, "Thick Film Silver Multilayers for Under-the-Hood Automotive Applications," *Proceedings of the 1993 International Symposium on Microelectronics*, Dallas, TX, November 9-11, 1993, pp. 126-131.

Richard C. Jaeger, Jeffrey C. Suhling, Martin T. Carey, and R. Wayne Johnson, "A Piezoresistive Sensor Chip for Measurements of Stress in Electronic Packaging", *Proceedings of the 43th Electronic Components and Technology Conference*, Lake Buena Vista, FL, June 2-4, 1993.

David S. Meir, Neil Borkowicz, John L. Evans, and R. Wayne Johnson, "Using MCM Technology to Enhance the Development of Electronic Control Modules", *Proceedings of the International Conference on Multichip Modules*, Denver, CO, April 14-16, 1993.

James R. Bromstead, G. Bennett Weir, and R. Wayne Johnson, "200°C Operation of Semiconductor Power Devices", *Proceedings of the Tenth Symposium on Space Nuclear Power and Propulsion*, Albuquerque, NM, January 10-14, 1993, pp. 617-623.

Miro Tomara, R. Wayne Johnson, Richard C. Jaeger, and John Palmour, "A SiC, Hybrid Operational Amplifier for 350°C Operation", *Proceedings of the 42th Electronic Components and Technology Conference*, San Diego, CA, May 18-20, 1992, pp. 157-161.

Richard C. Jaeger, Jeff C. Suhling, and R. Wayne Johnson, "Errors Associated with the Design, Calibration, and Application of Silicon Piezoresistance Stress Sensors", *Proceedings of the First Joint Conference on Electronic Packaging*, Milpitas, CA, April 8-12, 1992.

James Bromstead, G. Bennett Weir, R. Wayne Johnson, Richard C. Jaeger, and Eric Baumann, "Performance of Power Silicon Devices at High Temperature", *Proceedings of the First International High Temperature Electronics Conference*, June 16-20, 1991.

Martin Carey, Jeff C. Suhling, and R. Wayne Johnson, "Piezoresistive Stress Sensors for High Temperature Microelectronics", *Proceedings of the First International High Temperature Electronics Conference*, June 16-20, 1991.

Jeff C. Suhling, Robert E. Beaty, Richard C. Jaeger, and R. Wayne Johnson, "Piezoresistive Sensors for Measurement of Thermally-Induced Stresses in Microelectronics", *Proceedings of the 1991 SEM Spring Conference on Experimental Mechanics*, June 1991.

E. Thomas, M. Weil, A. Lippincott, and R. W. Johnson, "Insulated Metal Substrates for Power Hybrids", *Proceedings of the 1990 International Symposium in Microelectronics*, October 15-17, 1990, pp. 329-337.

K. D. Robb, F. J. German, and R. W. Johnson, "Modeling Thick Film Resistor Configurations at Microwave Frequencies Using the Transmission Line Matrix (TLM) Method", *Proceedings of the 1990 International Symposium in Microelectronics*, October 15-17, 1990, pp. 513-517.

C. Chen, R. W. Johnson, R. C. Jaeger, M. B. Cornelius, and W. A. Foster, "Multichip Thin-Film Technology for Low Temperature Packaging", *Proceedings of the 40th Electronic Components and Technology Conference*, Las Vegas, NV, May 20-23, 1990, pp. 571-579.

R. E. Beaty, J. C. Suhling, C. A. Moody, D. A. Bittle, R. W. Johnson, R. D. Butler, R. C. Jaeger, "Calibration Considerations for Piezoresistive-Based Stress Sensors", *Proceedings of the 40th Electronic Components and Technology Conference*, Las Vegas, NV, May 20-23, 1990, pp. 797-806.

P. H. Townsend, P. C. Burdeaux, S. F. Hahn, M. Thomsen, J. N. Carr, R. Wayne Johnson and K. Weidner, "Multilayer Interconnection Structure Using Second Generation Polymers Derived from Bis-Benzocyclobutene," *Proceedings of the 1989 International Symposium in Microelectronics*, October 24-26, 1989, pp. 447-453.

F. German, J. Jackson, and R. Wayne Johnson, "Three-Dimensional Full Wave Electromagnetic Analysis of Hybrid Interconnections Using the Transmission Line Matrix (TLM) Method, *Proceedings of the 1989 International Symposium on Microelectronics*, October 24-26, 1989, pp. 601-606.

R. Wayne Johnson, Douglas Hopkins and Richard Jaeger, "The Microelectronics Program at Auburn University", *Proceedings of the 1989 International Symposium on Microelectronics*, October 24-26, 1989, Best paper of Session Award, pp. 367-375.

Richard Weeks, R. Wayne Johnson, Douglas Hopkins, James Muir and Janette Williams, "Plated Copper on Ceramic for Power Hybrid Applications," *Proceedings of the 39th Electronic Components Conference*, Houston, Texas, May 22-24, 1989, pp. 544-550.

R. Wayne Johnson, "Thin Film Multichip Hybrids: An Overview," *Proceedings of the Technical Program of the National Electronic Packaging and Production Conference*, Anaheim, California, March 7-9, 1989.

R. Wayne Johnson, Timothy L. Phillips, Stephen F. Hahn, David C. Burdeaux, and Paul Townsend, "Multilayer Thin Film Hybrids on Silicon," *Proceedings of the 1988 International Symposium on Microelectronics*, October 1988, Best Paper of Session Award, pp. 365-373.

F. German, B. Dillard, L. Riggs and R. Wayne Johnson, "Transmission Line Matrix Method for Modeling Electrical Performance of Interconnections," *Proceedings of the 1988 International Symposium on Microelectronics*, October 1988, Best Paper of Session Award, pp. 492-495.

R. Wayne Johnson, T. L. Phillips, R. C. Jaeger, S. F. Hahn, and D. C. Burdeaux, "Thin Film Silicon Multichip Technology," *Proceedings of the 38th Electronic Components Conference*, May 1988, pp. 267-275.

R. Wayne Johnson and R. C. Jaeger, "Thin Film Hybrids on Silicon," Abstracts of the Engineering Foundation Conference on Advanced Materials and Processes for High Density Packaging, March 1988, (Abstract Only)

R. Wayne Johnson, R. C. Jaeger and J. L. Davidson, "Hybrid Wafer Scale Integration Utilizing Planar Interconnection Technology," VLSI and GaAs Packaging Workshop, September 1987, (Abstract Only)

R. Ramanathan, C. R. Ellis, R. C. Jaeger and R. Wayne Johnson, "Optical Fiber Interfaces to Diode Detectors for Wafer Scale Packaging," VLSI and GaAs Packaging Workshop, September 1987, (Abstract Only)

R. Wayne Johnson, Michael Cornelius, Jimmy L. Davidson and Richard C. Jaeger, "Planar Hybrid Interconnection Technology," *Proceedings of the 1986 International Symposium on Microelectronics*, October 1986, Best Paper of Session Award, pp. 758-765.

Richard C. Jaeger, Jimmy L. Davidson and R. Wayne Johnson, "Silicon-Based Hybrid Wafer Scale Packaging," IFIP Workshop on Wafer Scale Integration, Paper K1, March 1986.

Jimmy L. Davidson, Richard C. Jaeger, David V. Kerns and R. Wayne Johnson, "Hybrid Wafer Scale Integration Packaging Technology," *IEEE Southcon Proceedings*, Paper 19/3, March 1986.

R. Wayne Johnson, Jim Davidson, Richard Jaeger and David Kerns, "Hybrid Silicon Wafer-Scale Packaging Technology," *IEEE International Solid-State Circuits Conference Digest*, February, 1986, pp. 166-167.

R. Wayne Johnson, Jim Davidson and Richard Jaeger, "Microelectronics at Auburn University," *Proceedings of the Fifth Annual International Electronics Packaging Conference*, October 1985, pp. 353-360.

R. Wayne Johnson, "Polymers in Microwave Applications," *Proceedings of the 1982 International Electronics Packaging Society Conference*, November 1982, pp. 615-622.

R. Wayne Johnson, "A Status Report on Polymer Thick Film Technology," *Proceedings of the 1982 International Microelectronics Symposium*, November 1982.

Bob Allen and R. Wayne Johnson, "Membrane Tough Switches: Review of Technology, Trends and Applications," *Proceedings of the 1982 International Microelectronics Conference*, May 1982.

Vernon A. Pitt, Christopher R. S. Needes and R. Wayne Johnson, "Ultrasonic Aluminum Wire Bonding to Thick Film Copper Conductors," *Proceedings of the 1981 Electronics Components Conference*, May 1981, pp. 18-23.

R. Wayne Johnson and Rene Cote, "Thermosonic Gold Wire Bonding to Silver Bearing Conductors," *Proceedings of the 1980 International Microelectronics Symposium*, October 1980, pp. 313-321.

James Pierce, R. Wayne Johnson, Helen Schmidt and John Larry, "New Thick Film Resistors for Potentiometer Applications," *Proceedings of the 1980 International Microelectronics Symposium*, October 1980, pp. 214-228.

R. Wayne Johnson, Phil Rich, Debra Rich and Larry Wilson, "Advances in Thick Film Conductors for Microwave Integrated Circuits," *Proceedings of European Hybrid Microelectronics Conference 1979*, May 1979.

R. Wayne Johnson and Donald Kinser, "Examination of the Relationship Between Structure, Adhesion, and Conductivity in Copper Thick Film Systems," *Proceedings of the 1978 International Microelectronics Symposium*, September 1978, pp. 73-78.

### **SHORT COURSES**

**Hybrid Microelectronics:** This five day course provides a hands-on discussion of thick film, thin film and cofired ceramic substrate technologies, bare semiconductor assembly and packaging methods and surface mount technology. The students fabricated a pulse generator using thick film, chip-and-wire technology as part of the course.

**Semiconductor Fabrication:** This five-day course covers the basic semiconductor fabrication processes and materials. In the laboratory, the students fabricate N-MOS transistor designs.

**Multichip Module Fundamentals:** This one-day course discusses the materials and processes for fabrication and assembly of multichip modules along with a discussion of design issues.

**Area Array Assembly: Flip Chip, Chip Scale Package and Ball Grid Array:** This one-day course describes the various area array packaging options and the assembly materials and processes for their use.

**Flip Chip Technology:** This one-half day course describes bumping of wafers, substrate design, assembly and reliability.

**Chip Scale Package Assembly:** This one-half day course describes different chip scale packages, assembly issues and reliability.

**Packaging for High Temperature:** This one-half day course explores the issues associated with packaging electronics for operating temperatures ranging from 200°C to 500°C.

### **UNITED NATIONS DEVELOPMENT PROGRAM**

Served as Expert in MultiChip Module Technology during two visits (4 weeks in 1993 and 2 weeks in 1995) to Telebras CPqD in Campinas, Brazil. Worked in research laboratories and taught short course during visits.

