

Brian L. Rowden

164 Cumberland View Dr,
Oak Ridge, TN 37830
Cell: 518-478-4479

<https://www.linkedin.com/in/brian-rowden-166640103/>
brian.rowden@ieee.org

EXPERIENCE

Oak Ridge National Laboratory

Senior Research Staff – High Voltage Power Electronics

Oak Ridge, TN

2019 – Present

Research and development of high voltage power electronics and electronics packaging coupled with hardware system integration and thermal management solutions for grid interfaces, dc fast charging, and transportation.

- Project lead for medium voltage (3.3-15kV) power packaging design and development for high frequency power conversion. Integration of system level packaging to include sensors, drivers, controls, and magnetics for high isolation building blocks
- Project lead for extreme fast charging hardware design from grid tie to load converter to support medium and heavy-duty vehicles with 1MW+ charging infrastructure for multiport charging station.
- Development of Advanced Component Laboratory space for design, manufacturing, and testing of advanced electronic packaging with supporting cleanroom infrastructure and equipment.
- Design and development of integrated power systems and test cells for ac/dc and dc/dc converters in power ranges from 10kW to 1mW.
- Development of industrial partnerships for power packaging co-designs and converter development to support technology deployment for grid integration.
- Power packaging materials development and high frequency, high power density design for lightweight transportation integration.
- Roadmap development for medium voltage subsystem manufacturing and test facilities.

Danfoss Silicon Power – US

Senior Application Engineer – Americas

Utica, NY

2018 – 2019

Custom power module packaging and thermal management design, development, and manufacturing for silicon and wide-bandgap semiconductors for OEM and Tier 1 customers in automotive, industrial and renewable markets.

- Lead customer interaction for device selection, package performance, and system level integration for application specific projects.
- Research new electronic packaging, thermal management, and materials to maximize wide bandgap semiconductor device performance in the application environment.
- Interface with research institutions and laboratories for next generation integration of power devices, packaging and systems.

GE Global Research – Electronics Lab

Senior Engineer, SiC Power Packaging Lab

Niskayuna, NY

2013 – 2017

Research and development of electronic packaging, thermal management, materials, and manufacturing for wide band gap semiconductors, power electronics, harsh environment electronics, sensors, and system level integration.

- Lead wide band gap power module design, modeling, and development efforts including system level design interactions for industrial solar inverters, MR gradient drivers, and high reliability Aviation and Traction applications
- Development, DFM, and transition to domestic and international supply chain partners for high volume power module materials and manufacturing
- Evaluate module level reliability, test equipment design, and impact to test conditions, materials, and processes for high temperature packaging solutions
- Integration of planar interconnects for ultra-low inductance packaging and thermal management solutions for SiC and GaN power devices for high density ruggedized applications

Electrical Engineer, Electronics Packaging and Miniaturization Lab

2010 – 2013

Development of high-density power electronics systems and packaging for military platforms, utility applications, transportation, and renewable energy resources.

- Project leader for power packaging efforts from device to system including SiC high frequency packages (1.2kV to 6kV) for military and commercial power conversion
- Develop integrated thermal management systems and technologies capable of operating 105°C and higher coolant capabilities
- Design low inductance module and system level packaging for high operating frequency with minimal parasitic effects
- High power silicon press pack packaging, materials and process development, and module to system level packaging
- Integrated 3D packaging for high density point-of-load dc-dc converters

National Center for Reliable Electric Power Transmission

UA, Fayetteville, AR

Power Packaging Project Leader/Research Assistant Professor

2008 – 2010

- Research and development of high-density power electronics systems and packaging for hybrid electric vehicles, utility applications, and renewable energy resources
- Design and implementation of high temperature attachment technologies for wide bandgap devices and modules
- Integration of packaging, controls, and advanced thermal management techniques for system level efficiency for power conversion, motor drives, and fault protection
- Simulation and modeling of electrical, thermal, and mechanical performance for circuits, packages, and systems
- Develop and perform reliability testing and failure analysis for extreme environment electronics
- Design and implementation of electrical test procedures and equipment for controls, safety, user interfaces, and data acquisition
- Provided training in power electronics, packaging materials and processes for visiting corporate or industrial researchers

Power Electronics Leveling Solutions, LLC

Fayetteville, AR

Research Engineer / Business Development Director / Partner

2004 – 2010

- Research and development relating to increased power density at both packaging and system levels
- Develop and prepare proposals for government sponsored research activities and interface with contracting agencies to manage current and future projects
- Manage budgets, personnel, and schedules related to multiple contracts and indirect research

Awarded Contracts:

NASA NNG05CA70C SBIR 2004-I

Co-Primary Investigator

Development of Modular Spray-Cooled Assemblies for High Heat Fluxes

- Development of system level spray cooling test bench for parametric evaluation
- Research and design of novel fluid management concepts to enhance heat flux removal

NASA NNG06CA07C SBIR 2004-II

Primary Investigator

Modular Spray-Cooled Assemblies for High Heat Fluxes

- Development, construction, and testing of a microgravity flight test bench for evaluating cooling technologies
- Design of an advanced modular spray box with enhanced fluid removal
- Research and development of multiple nozzle spray cooling evaporator

Office of Naval Research Award No. 00014-07-M-0040

Subcontract

High Voltage, High Power Density Bi-Directional Multi-Level Converters Utilizing Silicon and SiC Switches

- Design of high frequency, high power transformer for bidirectional power converters
- Research of advanced materials for increased power density and reduced physical density
- Simulation of power electronics components, converters, and systems

University of Arkansas

Fayetteville, AR

Distinguished Doctoral Fellow

2003 – 2007

- System Level Power Electronics for Renewable Energy
 - Design an intelligent power module for high power density ac-dc power conversion
 - Research and design on high frequency transformers utilizing nanocrystalline magnetics
 - Develop a novel dual-sided thermal management concept for implementing spray and jet impingement cooling with high volumetric efficiency
- Integrated 42V Motor Drive
 - Develop an integrated packaging solution for 42V auxiliary brushless dc motor drives
 - Integration of thermal spray materials technology to electronic packaging applications
 - Improved package thermal performance by 15% over current state-of-the-art
- High Density Ceramic Packaging
 - Investigate use of 50 and 75 μm green via structures in LTCC for high density 3D interconnects
 - Evaluate the impact of DuPont 943 and 951 dielectric systems with gold and silver conductor systems on manufacturing, electrical performance, and mechanical interconnection
- Millimeter Wave Design
 - Design millimeter wave (MMW) resonators and filters for operation in V and W band
 - Evaluate implementation of low loss waveguide structures utilizing common LTCC manufacturing processes

Dielectric Laboratories Inc.

Cazenovia, NY

DiPak® Product/Process Leader

2000 – 2002

- Design and development of new SMT LTCC-M technology for MW/MMW power amplifiers
- Implementation of high-speed solder dispensing operation and modified assembly operations to increase throughput in broadband capacitor production
- Manufacturing scheduling, throughput, prioritization, and inventory management along with cost analysis, estimates, and forecasts for standard and custom products

- Evaluate the capability and/or feasibility of new products with existing technology or short-term technology adaptations
- Develop capital and human resource requirements, product flow and yield data analysis
- Identify and evaluate potential offshore contract hybrid MMW assembly houses

DiPak® Process Engineer

1999 – 2002

- Research and development of LTCC formulations to improve properties and performance
- Develop, control, and document processes involved in the manufacture of an LTCC-M product line for millimeter wave packages of microstrip, stripline, and coplanar waveguide designs
 - Development of uniaxial and isostatic lamination procedures, optimization and development of furnace profiles, characterization, and controls for sintering and BBO
- Ensure departmental compliance to ISO 9001, ISO 14001, and OSHA standards

Howmet Corporation --- Wichita Falls Casting

Wichita Falls, TX

Monoshell Ceramist

1997 – 1999

- Develop and manage ceramic slurry-based systems of alumina and zircon for investment casting
- Assisted in the setup and performed startup and qualification of new facility's monoshell department
- Research and development on ceramic crucible systems and coatings to reduce spalling and wetting for life enhancement
- Ceramic core technical liaison for raw materials issues and properties
- Kaizen process focus teams on critical scrap and labor areas focusing on continuous improvement and process ownership

Awards and Recognition

2019 Early Career Alumni Award – University of Arkansas College of Engineering

2019 Arkansas Academy of Electrical Engineers Inductee

2014 GE MNST Technical Excellence Individual Award

2013 GE PCD Technical Achievement Team Award

2012 GE Whitney Team Award

2009 R&D 100 Team Award – High-temperature Silicon Carbide (SiC) Power Module

EDUCATION

University of Missouri-Rolla B.S. Ceramic Engineering 1997

University of Arkansas M.S. Electrical Engineering 2005
 MSEE Thesis: "Integrated motor drive for 42V automotive auxiliary motor applications."

University of Arkansas Ph.D. Electrical Engineering 2010
 Ph.D. Dissertation: "Large area double sided spray cooling for power converters"

SKILLS AND QUALIFICATIONS

6 Sigma Green Belt	Siemens/UG NX CAD	PLECS
Kaizen	SolidWorks/AutoCAD	Orcad/LT Spice
Lean Manufacturing	Matlab/Simulink	Ansoft HFSS/Designer
Labview	LTCC Processing	Package, Assembly and Test Equipment

PROFESSIONAL AFFILIATIONS

IEEE IEEE-PES IEEE-VTS IEEE-MTTS IMAPS
Arkansas Academy of Electrical Engineers – Board of Directors 2019-2022
Advanced Power Electronics and Packaging Symposium (IMAPS) – Steering Committee

PATENTS

C. Kapusta, R. Ramabhadran, K. Huh, B. Rowden, G. Claydon, A. Elasser, "Low inductance stackable solid-state switching module and method of manufacturing thereof," Patent #10,770,382: issued September 2020

B. Rowden, L. Stevanovic, "Power module," Patent #10,559,553: issued February 2020

B. Rowden, L. Stevanovic, "Power module," Patent #10,347,608: issued July 2019

B. Rowden, L. Stevanovic, "Robust low inductance power module package," Patent #9,972,569: issued May 2018

B. Rowden, L. Stevanovic, "System for a low profile, low inductance power switching modules", Patent #9,893,646: issued February 2018

E. Delgado, J. Glaser, and B. Rowden, "Low profile surface mount package with isolated tab", Patent #9,337,163: issued May 2016

E. Delgado, J. Glaser, and B. Rowden, "Power module package", Patent #9,142,484: issued September 2015

E. Delgado, J. Glaser, and B. Rowden, "Integrated power module package", Patent #8,872,328: issued October 2014

E. Delgado, R. Beaupre, and B. Rowden, "Flexible power connector", Patent #8,622,754: issued January 2014

T. Otsuka, K. Okumura, and B. Rowden, "High melting point soldering layer alloyed by transient liquid phase and fabrication method for the same, and semiconductor device", Patent #8,592,986: issued November 2013

E. Delgado, A. Gowda, A. Caiafa, B. Rowden, L. Stevanovic, R. Beaupre, "Coaxial power module", Patent #8,487,416: issued July 2013

D. Bates, S. Oot, R. Street, B. Rowden, "Surface Mount Ceramic Package," Patent #6,635,958; issue October 2003

Additional applications in progress.

PUBLICATIONS

B. Rowden et al., "Integrated Motors and Controllers for 42V Automotive Auxiliary Motor Applications", *8th IEEE Workshop on Power Electronics in Transportation (WPET 2004)*, Sheraton Detroit Novi, October 21-22, 2004.

B. Rowden, F. Barlow, "Motor Drive Semiconductor Power Device Package Utilizing Thermal Spray Technology," Provisional Patent filed, 2005.

B. Rowden, P. Selvam, and E. Silk, "Spray cooling development effort for microgravity environments", *Proceedings of the Space Technology and Applications International Forum (STAIF 2006)*, Conference on Thermophysics in Microgravity, Albuquerque, NM, Feb. 13-17, 2006.

B. Rowden et al., "Investigation of the Via Fill Process for High Density Multilayer LTCC Substrates", *39th International Symposium on Microelectronics (IMAPS 2006)*, San Diego, CA, October 8-12, 2006.

J. Carr, B. Rowden and J. Balda, "A Three-Level Full-Bridge Zero-Voltage Zero-Current Switching Converter with a Simplified Switching Scheme", *38th IEEE Power Electronics Specialists Conference (PESC 2007)*, Orlando, FL, June 17-21, 2007.

S. Ang, W. Brown, H. Mustain, B. Rowden, J. Balda, and A. Mantooth, "Packaging of silicon carbide power semiconductor devices," *ISTC 2008 - Proceedings of the 7th International Conference on Semiconductor Technology*, Proceedings - *Electrochemical Society*, PV 2008-1, p 604-609, 2008.

B. Reese, M. Schupbach, A. Lostetter, B. Rowden, R. Saunders, and J. Balda, "High voltage, high power density bi-directional multi-level converters utilizing silicon and silicon carbide (SiC) switches," *Conference Proceedings - IEEE Applied Power Electronics Conference and Exposition - APEC*, p 252-258, 2008.

B. Rowden, "High Temperature Device and Large Area Attachment Method," Invention disclosure and patent pending, 2008.

J. Carr, B. Rowden, and J. Balda, "A three-level full-bridge zero-voltage zero-current switching converter with a simplified switching scheme," *IEEE Transactions on Power Electronics*, v 24, n 2, p 329-338, 2009.

B. Rowden, D. Trowler, and J. Balda, "Double sided spray cooled bi-directional power conversion module," *2009 IEEE Electric Ship Technologies Symposium (ESTS 2009)*, p 207-10, 2009.

S. Ang, T. Tao, O. Saadeh, E. Johnson, B. Rowden, J. Balda, and A. Mantooth, "Packaging and characterization of silicon carbide thyristor power modules," *2009 IEEE 6th International Power Electronics and Motion Control Conference*, p 264-8, 2009.

A. Lostetter, J. Hornberger, B. McPherson, B. Reese, R. Shaw, M. Schupbach, B. Rowden, A. Mantooth, J. Balda, T. Otsuka, K. Okumura, and M. Miura, "High-Temperature Silicon Carbide and Silicon on Insulator Based Integrated Power Modules," *5th IEEE Vehicle Power and Propulsion Conference, VPPC 2009*.

B. Rowden, A. Mantooth, S. Ang, A. Lostetter, J. Hornberger, and B. McPherson, "High temperature SiC Power module packaging," *Proceedings of the ASME 2009 International Mechanical Engineering Congress & Exposition, IMECE 2009-12883*, 2009.

B. McPherson, J. Hornberger, J. Bourne, A. Lostetter, R. Schupbach, R. Shaw, B. Reese, B. Rowden, A. Mantooth, S. Ang, J. Balda, K. Okumura, and T. Otsuka, "Packaging of High Temperature 50 kW SiC Motor Drive Modules for Hybrid-Electric Vehicles," *42nd International Symposium on Microelectronics, IMAPS 2009*.

S. S. Ang, B. L. Rowden, J. C. Balda, and H. A. Mantooth, "Packaging of High-Temperature Power Semiconductor Modules," *The Electrochemical Society Transactions - CSTIC 2010*, vol. 27, pp 909-914, March 2010.

O. S. Saadeh, E. D. Johnson, M. S. Saadeh, A. M. Escobar, C. Schirmer, B. Rowden, A. Mantooth, J. Balda, S. Ang, "A 4 kV Silicon Carbide solid-state fault current limiter," *Energy Conversion Congress and Exposition (ECCE), 2012 IEEE*, vol., no., pp.4445-4449, 15-20 Sept. 2012.

K. Schirmer, B. Rowden, H. Mantooth, S. Ang, J. Balda, "Packaging and modeling of SiC power modules," *Gallium Nitride and Silicon Carbide Power Technologies – 220th ECS Meeting*, ECS Transactions, vol. 41, issue 8, pp. 183-188, 2011.

- A. Bolotnikov, P. Losee, G. Dunne, B. Rowden, J. Nasadoski, M. Harfman-Todorovic, F. Tao, P. Cioffi, F. Mueller, A. Permuy, L. Stevanovic, "Overview of 1.2kV-2.2kV SiC MOSFETs targeted for efficient operation in industrial power conversion applications," APEC 2015.
- R. Wang, J. Sabate, E. Delgado, F. Tao, X. Liu, B. Rowden, "High performance two stages H-bridge in cascaded gradient driver design with SiC power MOSFET," EPE 2015.
- X. She *et al.*, "High Performance Silicon Carbide Power Block for Industry Applications," in *IEEE Transactions on Industry Applications*, vol. 53, no. 4, pp. 3738-3747, July-Aug. 2017.
- P. A. Losee *et al.*, "SiC MOSFET design considerations for reliable high voltage operation," *2017 IEEE International Reliability Physics Symposium (IRPS)*, Monterey, CA, 2017, pp. 2A-2.1-2A-2.8.
- F. Carastro, J. Mari, T. Zoels, B. Rowden, P. Losee and L. Stevanovic, "Investigation on diode surge forward current ruggedness of Si and SiC power modules," *2016 18th European Conference on Power Electronics and Applications (EPE'16 ECCE Europe)*, Karlsruhe, 2016, pp. 1-10.
- X. She *et al.*, "High performance SiC power block for industry applications," *2016 IEEE Energy Conversion Congress and Exposition (ECCE)*, Milwaukee, WI, 2016, pp. 1-6.
- M. Harfman Todorovic *et al.*, "Design and Testing of a Modular SiC based Power Block," *PCIM Europe 2016; International Exhibition and Conference for Power Electronics, Intelligent Motion, Renewable Energy and Energy Management*, Nuremberg, Germany, 2016, pp. 1-4.
- M. H. Todorovic *et al.*, "SiC MW PV Inverter," *PCIM Europe 2016; International Exhibition and Conference for Power Electronics, Intelligent Motion, Renewable Energy and Energy Management*, Nuremberg, Germany, 2016, pp. 1-8.
- L. Stevanovic *et al.*, "High performance SiC MOSFET module for industrial applications," *2016 28th International Symposium on Power Semiconductor Devices and ICs (ISPSD)*, Prague, 2016, pp. 479-482.
- B. Rowden *et al.*, "Powering change: SiC for megawatt scale applications," Invited tutorial for Workshop on Wide Bandgap Power Devices (WiPDA), 2016.
- X. She *et al.*, "High performance SiC power block for industry applications," *IEEE Transactions on Industry Applications*, v. 53, n 4, pp. 3738-3747.
- B. Rowden, "ORNL XFC medium voltage hardware efforts," Invited talk for MW+ MD/HD Multiport Industrial Workgroup, March 2020.
- B. Rowden, Invited Expert Panel Session, Power America/DOE WBFSG Short Course, November, 2020.