

CURRICULUM VITAE: Rex E. Gerald II, Ph.D.

Current Address

Department of Electrical & Computer Engineering
Missouri University of Science & Technology
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University of Chicago

1984 B.A. General and Special Honors; Sigma Xi 1st Place for Undergraduate Research (Chemistry)

University of Illinois/Chicago; Max Plank Institute/Heidelberg (conjoint thesis)

1994 Ph. D. (Physical Chemistry, Gas-Phase NMR, UIC)
(Molecular Crystal Physics, Solid-State NMR, MPI)

Argonne National Laboratory, Chemistry Division, Postdoctoral Fellow (Solid-State NMR Spectroscopy and Imaging), 1994-1995; Chemical Technology Division, Postdoctoral Fellow (Electrochemistry-NMR), 1995-1998

Languages: English and Spanish

- Research Professor (Applications of Fiber Optic and RF Sensors for Investigations of Traumatic Brain Injuries, SARS-CoV-2, Foundry Processes, Gravity Waves, and Physicochemical Phenomenon.) Department of Electrical & Computer Engineering, MS&T, Sep. 2020- Present
- Visiting Professor (Advanced Photonic Sensors) Department of Electrical & Computer Engineering, MS&T, Dec. 2018- Aug. 2020
- Visiting Associate Research Professor (Fiber Optic Devices) Department of Electrical & Computer Engineering, MS&T, Apr. 2018- Nov. 2018
- Adjunct Professor (Chemistry) Chemistry Department, Ozark Technical College, Aug. 2017- Dec. 2020
- Adjunct Professor (Chemistry) Chemistry Department, College of the Ozarks, Jan. 2017- May 2017
- Adjunct Professor (Chemistry) Physical Science Department, Moraine Valley College, Jun. 2016- Jul. 2016
- Inventor of devices for subdividing transverse magnetic fields for high sample throughput using high-resolution benchtop NMR spectrometers, MS&T, Jun. 2014- Nov. 2015; College of the Ozarks, Jan. 2017- May 2017
- Inventor and developer of the Acupuncture-MRI probe for early-stage detection of skin cancers, MS&T, Oct. 2015- Present (collaboration with Prof. J. Huang)
- Inventor and marketer of CapPack® devices for calibration of NMR (qNMR) and MRI scanners, MS&T, Jun. 2013- Present (collaboration with Prof. K. Woelk)
- Senior Research Scientist (Solid-State Nuclear Magnetic Resonance), Professor of Physical Chemistry Laboratory/Advanced NMR/MRI, Manager of NMR Institute, Department of Chemistry, MS&T, Aug. 2010- Nov. 2015
- Chemical Physicist/Inventor (NMR/MRI Detectors), Chemical Sciences & Engineering Division, Argonne National Laboratory 2003-2012 (STA, 2008-2010; Argonne Collaborator, 2010-2012)
- Adjunct Professor (Chemical Physics) Department of Chemical Engineering, UIC, 2007-2010

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- Consultant (NMR Detectors w/C. Landis) Department of Chemistry, University of Wisconsin, Madison, 2007-2011
 - Nuclear Forensics QA Coordinator (FBI program), New Brunswick Laboratory, 2008
 - Consultant (NMR) Dept. of Biochemistry and Molecular Biology, University of Chicago, 2001-2002
 - Assistant Chemical Physicist (Electrochemistry and Nuclear Materials w/J. Rathke), Chemical Technology Division, Argonne National Laboratory, 1998-2003
 - Assistant NMR Facility Manager (NMR Spectroscopy and Imaging w/R. Botto), Chemistry Division, Argonne National Laboratory, 1993-1994
 - Max-Planck-Institute Predoctoral Fellow (Molecular Crystal Physics w/U. Haeberlen), MPI-Heidelberg, 1990
 - Allied Signal Fellow (Physical Chemistry w/C. Jameson), University of Illinois/Chicago, 1988
 - NMR Spectroscopist (Solid State NMR w/M. Munowitz) Amoco Research Center, 1986-1988
 - Chemist I (Organic Chemistry), Velsicol Chemical Corp., 1985-1986
 - NSF Predoctoral Fellow (Physical Chemistry w/N.C. Yang) University of Chicago, 1984
 - Summer Research Student (Particle Physics, Photochemistry, Organic Chemistry w/M. Wasielewski), Argonne National Laboratory, 1981, 1983-1984
 - Undergraduate Research (Physics), University of Chicago, 1981

University of Chicago Dean's List (GPA 3.25/4.00), 1981-1984

University of Chicago B.A. with General Honors (GPA 3.25/4.00) and Special Honors (Research Paper), 1984
SIGMA XI First Place for Undergraduate Research, 1984

ComEd-100 Illuminator for Outstanding High-School Mentor, 2004

United States Department of Energy Outstanding Undergraduate Mentor, 2004

Hispanic Engineer National Achievement Award Corporation (HENAAC) Outstanding Technical Achievement Award-National Laboratory, 2006

Coleman Foundation Fellow, 2009

Selected patents, publications, and presentations from: 26 patents; >60 publications; >250 presentations

M. Roman, C. Zhu, R.J. O'Malley, R.E. Gerald, and J. Huang, Distributed Fiber-Optic Sensing With Low Bending Loss Based on Thin-Core Fiber, IEEE Sensors Journal 21 (6), 2021

Chen Zhu, Rex E Gerald II, and Jie Huang, Ultra-Sensitive Microwave-Photonic Optical Fiber Interferometry Based on Phase-Shift Amplification, IEEE Journal of Selected Topics in Quantum Electronics, vol. 27, no. 6, pp. 1-8, Nov.-Dec. 2021

Yiyang Zhuang, Qingbo Yang, Taihao Han, Ryan O'Malley, Aditya Kumar, Rex E Gerald II, and Jie Huang, Fiber optic sensor embedded smart helmet for real-time impact sensing and analysis through machine learning, Journal of Neuroscience Methods, Volume 351, 1 March 2021

Chen Zhu, Yan Tang, Jing Guo, Rex E Gerald, and Jie Huang, High-Temperature and High-Sensitivity Pressure Sensors based on Microwave Resonators, IEEE Sensors Journal, 2021

C Zhu, RE Gerald, and J Huang, Metal-organic Framework Materials Coupled to Optical Fibers for Chemical Sensing: A Review, IEEE Sensors Journal, 2021

C Zhu, RE Gerald, and J Huang, Progress Towards Sapphire Optical Fiber Sensors for High-temperature Applications, IEEE Transactions on Instrumentation and Measurement, Volume: 69,

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Issue: 11, Nov. 2020

Ming Huang, Sisi Chen, Jie Huang, Rex E. Gerald, and Klaus Woelk, NMR studies of materials loaded into porous-wall hollow glass microspheres, *Materials Science and Engineering: C*, Volume 116, 2020

Zhu, Chen, Rex E. Gerald, and Jie Huang, Microwave device inspired by fiber-optic extrinsic Fabry-Perot interferometer: a novel ultra-sensitive sensing platform, *Journal of Lightwave Technology* (2020)

Zhu, Chen, Rex E. Gerald II, and Jie Huang, Highly sensitive open-ended coaxial cable-based microwave resonator for humidity sensing, *Sensors and Actuators A: Physical* 314 (2020): 112244

Zhu, Chen, Jason A. Perman, Rex E. Gerald, Shengqian Ma, and Jie Huang, Chemical Detection Using a Metal–Organic Framework Single Crystal Coupled to an Optical Fiber, *ACS applied materials & interfaces* 11, no. 4 (2019): 4393-4398

Jothibas, Sasi, Yang Du, Sudharshan Anandan, Gurjot S. Dhaliwal, Rex E. Gerald, Steve E. Watkins, K. Chandrashekhara, and Jie Huang, Spatially continuous strain monitoring using distributed fiber optic sensors embedded in carbon fiber composites, *Optical Engineering* 58, no. 7 (2019): 072004

Chi, Lingyu, Ming Huang, Annalise R. Pfaff, Jie Huang, Rex E. Gerald, and Klaus Woelk, Capillary-tube package devices for the quantitative performance evaluation of nuclear magnetic resonance spectrometers and pulse sequences, *Review of Scientific Instruments* 89, no. 12 (2018): 123115

Rex E. Gerald II, Magnetic Resonance Imaging Cancer Probe and Method of Use, *USPTO Pro Se Filing*, Filed date: March 15th, 2018

Yiyang Zhuang, Yizheng Chen, Chen Zhu, Rex E. Gerald II, and Jie Huang, Probing changes in tilt angle with 20 nanoradian resolution using an extrinsic Fabry-Perot interferometer-based optical fiber inclinometer, *Optics Express*, Vol. 26, No. 3, 5 Feb 2018

Chen Zhu, Yizheng Chen, Yiyang Zhuang, Yang Du, Rex E. Gerald II, Yan Tang and Jie Huang, An Optical Interferometric Triaxial Displacement Sensor for Structural Health Monitoring: Characterization of Sliding and Debonding for a Delamination Process, *Sensors* 2017, 17, 2696; DOI:10.3390/s17112696

Yiyang Zhuang, Yang Du, Chen Zhu, Mohammed Farhan Ahmed, Yizheng Chen, Rex E. Gerald II and Jie Huang, A Microwave Photonics Fiber Loop Ring-down System, DOI 10.1109/JSEN.2017.2745199, *IEEE Sensors*

Chen Zhu, Yizheng Chen, Yang Du, Yiyang Zhuang, Fengxue Liu, Rex E. Gerald II and Jie Huang, A Displacement Sensor with Centimeter Dynamic Range and Submicrometer Resolution Based on an Optical Interferometer, DOI 10.1109/JSEN.2017.2729281, *IEEE Sensors*

R. E. Gerald II, Solid-state Nuclear Magnetic Resonance in *Encyclopedia of Analytical Chemistry*, Eds., R. A. Meyers, John Wiley, Chichester. DOI: 10.1002/9780470027318.a6115.pub3. Published March 28th, 2017

Rex E. Gerald II, Jie Huang, Klaus Woelk, Robert Block, and Sierra Herndon, Magnetic Resonance Imaging Probe and Method of Use, *Docket No. 16MST038/UNOM.271878*, Filed date: March 15th, 2017

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Emmalou T. Satterfield, Annalise R. Pfaff, Wenjia Zhang, Lingyu Chi, Rex E. Gerald II and Klaus Woelk, EXponentially Converging Eradication Pulse Train (EXCEPT) for solvent-signal suppression in investigations with variable T_1 times, *J. Magn. Reson.*, vol. 268, pp. 68–72, July 2016

Rex E. Gerald II, Device for Subdividing Magnetic Field and Simultaneous Detection of Magnetic Resonance Signals from Multiple Sample Compartments, *Docket No. 15MST010prov*, Filed date: July 30th, 2015

Lingyu Chi, Rex E. Gerald II, Ming Huang, Klaus Woelk, Solid State NMR Spectroscopy/Imaging *In Situ* Measuring Devices and Methods for Calibration and Determining One or More Quantitative Properties of a Target Sample, *Docket No. 15MST021/UNOM.242231*, Filed date: November 13th, 2015

Lingyu Chi, Ming Huang, Rex E. Gerald II, Jie Huang, Annalise R. Pfaff, Klaus Woelk, *In Situ* NMR/MRI Monitoring System and Methods for Measuring pH and Temperature, *Docket No. 14MST020/UMON.243356*, Filed date: October 15th, 2015

Lingyu Chi, Jie Huang, Ming Huang, Rex E. Gerald II and Klaus Woelk, Two CapPack Devices for Solution and Solid State NMR Applications, Poster Presentation at the 55th ENC, Boston, Massachusetts, March 23-28, 2014

Rex E. Gerald II, Klaus Woelk, Baojun Bai, Lingyu Chi, Ming Huang and Annalise Pfaff, Subdivision of Zeeman NMR Fields by Static and Dynamic Magnetic Field Distributions and Capillary Tube Compartments: Applications of Quantitative NMR/MRI Employing Cap-Pack Devices, Oral Presentation, CM/Bio/ECE Seminar, Department of Physics and Astronomy, University of Missouri, Columbia, Columbia, Missouri, October 30, 2013

Ming Huang, Aligul Buyukaksoy, Rex E. Gerald II and Klaus Woelk, Analysis of Simultaneous T_1 Measurements of Non-Interacting Samples, Poster Presentation at the 54th ENC, Pacific Grove, California, April 14-19, 2013

Rex E. Gerald II, Lingyu Chi and Klaus Woelk, Spin-Lattice Relaxation Time-Constant Distributions of Heterogeneous Samples Used as Models for Shale, Poster Presentation at the 53rd ENC, Miami, Florida, April 15-20, 2012

R. E. Gerald II, K. J. Ruscic, D. N. Sears, L. J. Smith, R. J. Klingler, and J. W. Rathke, Unique Battery with a Multi-Functional, Physicochemically Active Membrane Separator/Electrolyte-Electrode Monolith and a Method Making the Same, US Patent # 8,592,075 issued November 26, 2013; US Patent # 8,227,105 issued July 24, 2012; US Patent # 8,119,273 issued February 21, 2012

R. E. Gerald II, K. J. Ruscic, D. N. Sears, L. J. Smith, R. J. Klingler, and J. W. Rathke, Active Membrane Having Uniform Physico-Chemically Functionalized Ion Channels, US Patent # 8,541,129 issued September 24, 2013

R. E. Gerald II and J. W. Rathke, NMR Apparatus for In Situ Analysis of Fuel Cells, US Patent # 8,310,235 issued November 13, 2012

D. Dambournet, K. W. Chapman, P. J. Chupas, R. E. Gerald, II, N. Penin, C. Labrugere, A. Demourgues, A. Tressaud, and K. Amine, Dual Lithium Insertion and Conversion Mechanisms in a Titanium-Based Mixed-Anion Nanocomposite. *J. Am. Chem. Soc.*, 133 (34): 13240–13243 (2011)

R. E. Gerald II, Solid-state Nuclear Magnetic Resonance in *Encyclopedia of Analytical Chemistry*, Eds., R. A. Meyers, John Wiley, Chichester. DOI: 10.1002/9780470027318.a6115.pub2.

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Published March 15th 2011

R. E. Gerald II, R. J. Klingler, and J. W. Rathke, Aluminum Oxyhydroxide Based Separator/Electrolyte and Battery System, and a Method of Making the Same, US Patent # 7,887,970 issued February 15, 2011; US Patent # 7,901,830 issued March 8, 2011

R. E. Gerald II, R. J. Klingler, J. W. Rathke, R. Diaz, and L Vukovic, NMR Characterization of Thin Films (*for battery applications*), US Patent # 7,737,691 issued June 15, 2010

R. E. Gerald II, L Vukovic, and J. W. Rathke, Apparatus and Method for Generating a Magnetic Field by Rotation of a Charge Holding Object, US Patent # 7,602,181 issued October 13, 2009

R. E. Gerald II, R. J. Klingler, J. W. Rathke, R. Diaz, and L Vukovic, Molecule Nanoweaver, US Patent # 7,501,483 issued March 10, 2009

R. E. Gerald II and J. W. Rathke, Compact Orthogonal NMR Field Sensor, US Patent # 7,486,078 issued February 3, 2009

M. Parris, B. MacKay, J. Rathke, R. Klingler, and R. Gerald, Influence of Pressure on Boron Cross-Linked Polymer Gels. *Macromolecules* 41: 8181-8186 (2008)

R. E. Gerald II, J. W. Rathke, and R. J. Klingler, High Cation Transport Polymer Electrolyte, US Patent # 7,226,549 issued June 5, 2007

R. E. Gerald II, R. J. Klingler, and J. W. Rathke, Rotational Exchange Gradient Imager for In Situ Magnetic Resonance Analyses in Ultracentrifuge Sedimentation of Biological Materials and Rheology Investigations, US Patent # 6,720,769 issued April 13, 2004

R. E. Gerald II, L. E. Iton, and J. W. Rathke, NMR Detector for Supported Monolayer and Multilayer Films, US Patent # 6,791,326 issued September 14, 2004

R. E. Gerald II, R. L. Greenblatt, and J. W. Rathke, Two-Dimensional B₁-Gradient NMR Imager, U. S. Patent # 6,538,444 issued March 25, 2003

R. E. Gerald II, R. J. Klingler, J. W. Rathke, G. Sandí, and K. Woelk, In Situ Imaging of Charge Carriers in an Electrochemical Cell, in Chapter 9 of *Spatially Resolved Magnetic Resonance*, Eds., P. Blümler, B. Blümich, R. Botto, and E. Fukushima, Wiley-VCH, New York, pp. 111-119 (1998)

R. E. Gerald II, R. E. Botto, and A.O Krasavin, A Selective-Echo Method for Chemical-Shift Imaging of Two-Component Systems. *J. Magn. Reson. A* 123: 201-206 (1996)

R. E. Gerald II, T. Bernhard, U. Haeberlen, J. Rendell, and S. Opella, The Chemical Shift and the Electric Field Gradient Tensors for the Amide and Carboxyl Hydrogens in the Model Peptide N-Acetyl-D, L-Valine. A Single Crystal Deuterium NMR Study. *J. Am. Chem. Soc.* 115: 777-782 (1993)

Undergraduate Mentors: I. Abella (UC), N. C. Yang (UC), G. Fleming (UC), M. Wasielewski (ANL)

Graduate Advisors: C. Jameson (UIC), K. Jameson (Loyola), U. Haeberlen (MPI)

Postdoc Advisors: R. Botto (ANL), J. Rathke (ANL)

Recent Collaborators: C. Jameson (UIC), S. Murad (UIC), M. Espe (U Akron), C. Landis (U Wisconsin)

Past Collaborators: M. ter Horst (UNC), R. Klingler (ANL), C. Johnson (ANL), G. Sandí (ANL), L. Iton (ANL), L. Scanlon (W-P USAFB), K. Woelk (UMR), O. Han (KBSI)

• International research and teaching activities:

Visiting Research Scientist and Lecturer, University of Bonn, Germany, 2000

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Visiting Research Scientist and Lecturer, Korea Basic Science Institute (KBSI), South Korea, 2005
Korea BrainPool, Korea Science and Engineering Foundation (KOSEF), South Korea, 2006

- Undergraduate research students in our lab presented projects at international conferences, published manuscripts in peer-reviewed journals, and patented inventions (>10 students have issued US patents); Office of Science Outstanding Mentor, DOE, 2004
- High school research students mentored in advanced science fair projects; ComEd-100 Illuminator Award, 2004
- Educational outreach to minorities through KIPP Chicago Public School Saturday School Program (presenting “The Argonne Adventure: Extreme Science” program) and the Argonne Hispanic/Latino Club (past president); introduced 6th, 7th, and 8th graders to basic concepts in science and connected them to research facilities and programs at Argonne, 2006-2007
- Innovation Workshop: Educational outreach to selected students at private academies for early exposure to the process of invention. Microcontrollers, sensors, and output devices comprised an invention platform accessible to students from 6th to 8th grade, St. Gregory Academy, Tucson, Arizona, 2010-2011
- Courses taught at UIC: ChE 505 (Spring ‘08) Advanced Statistical Thermodynamics; ChE 381 (Fall ‘08, ‘09) Unit Operations Laboratory I; ChE 382 (Spring ‘09, ‘10) Unit Operations Laboratory II; ChE 392 (Spring ‘08, ‘09, ‘10; Fall ‘09, ‘10) Undergraduate Research, UIC, 2008-2010
- Courses taught at MS&T: CHEM 244 (Fall ‘10, ‘11, ‘12) Physical Chemistry Laboratory, Kinetics; CHEM 242 (Spring ‘11, ‘12, ‘13) Physical Chemistry Laboratory, Thermodynamics; Weekly Seminar Series, Nuclear Magnetic Resonance Spectroscopy and Imaging (Fall ‘10, ‘11; Spring ‘11); CHEM 401 (Fall ‘11, ‘12) Nuclear Magnetic Resonance Spectroscopy and Imaging; CHEM 300 (Fall ‘11, ‘12) Undergraduate Research
- Courses developed at MS&T: CHEM 401 (Fall ‘11) Nuclear Magnetic Resonance Spectroscopy and Imaging, 3 credit-hours; CHEM 244-242 (Spring ‘13, ‘14, ‘15) Accelerated Physical Chemistry Laboratory, 2 credit-hours, Combined Kinetics/Thermodynamic; CHEM 6001 (Summer ‘15) Advanced NMR/MRI, 3 credit-hours, including lab
- Course taught at Moraine Valley College: CHM 132 (Summer ‘16) Chemistry (University Oriented) II
- Courses taught at College of the Ozarks: CHE 104 (Spring ‘17) Principles of Chemistry; CHE 314 (Spring ‘17) Physical Chemistry I (Thermodynamic)
- Courses taught at Ozark Technical College-Table Rock: CHM 101 (Fall ‘17, ‘18, ‘19, ‘20; Spring ‘18, ‘19, ‘20) Basic Chemistry
- Graduate students mentored at MS&T: Sisi Chen (Ph.D., 2017); Lingyu Chi (MS w/thesis, 2015; Ph.D., 2018); Ming Huang (MS w/thesis, 2017; Ph.D., 2019)