

Curriculum Vitae: MARK STEVEN FERRIS

Research Associate, University of Colorado, Boulder with joint affiliation at the National Institute of Standards and Technology

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Summary

Research chemical engineer with a focus on designing novel, next-generation sensors, diagnostics, and imaging tools. Experience with both optical and magnetic modalities, which provide complementary advantages. Additional expertise in polymers, hydrogels and smart hydrogels, and single-sided NMR profiling. Professional service includes serving on the organizing committee for the Front range Industry and Postdoc Summit and frequently advising undergraduate researchers.

Research Interests

Size Changing, Analyte-Responsive Smart Hydrogels. Smart hydrogels are functionalized to change their degree of swelling based on a target analyte concentration and can be used for sensors and actuators. Research is aimed at improving the selectivity, response time, degree of swelling, and developing smart hydrogels for new analyte targets to broaden the capabilities of smart hydrogel-based systems.

High-Sensitivity, Magnetics-Based Mobile Health Platforms. Combining smart hydrogels and magnetics to create mobile sensor platforms that are low cost, accessible, and have the sensitivity to compete with expensive laboratory instruments.

Polymer Analysis Via NMR Profiling. Analyzing the swelling dynamics of smart hydrogels with a low-cost, non-contact analytical method. Other projects include measuring hydrogel working curves hydrogel tortuosity.

Fluorescent, Polymeric Nanosensors. Developing and utilizing nanoscale, light-emitting particles for 3D-spatiotemporal analysis of particular analytes, including glucose, sodium, potassium, oxygen, and lithium.

Professional Appointments

University of Colorado, Boulder, <i>Department of Physics</i> PREP Research Associate	06/2024 - Present
University of Colorado, Boulder, <i>Department of Physics</i> PREP Postdoctoral Fellow	11/2021 – 06/2024
National Institute of Standards and Technology, <i>Applied Physics Division</i> (Boulder, CO) NRC Postdoctoral Fellow	11/2019 – 11/2021
Colorado School of Mines, <i>Department of Chemical and Biological Engineering</i> (Golden, CO) Research Associate	07/2019 – 11/2019

Education

Ph.D. Chemical Engineering <i>Doctoral Advisor:</i> Kevin Cash <i>Thesis title:</i> Advances in Polymeric Nanosensor Technology for Biological Analysis Colorado School of Mines, Golden, CO	Graduated 2019
B.S. Chemical Engineering The Ohio State University, Columbus, OH	Graduated 2014

Publications

Ferris, M.; & Zabow, G. (2024). Quantitative, high-sensitivity measurement of liquid analytes using a smartphone compass. *Nature Communications*, 2024 15(1).

Gruber, D.; **Ferris, M.**, & Zabow, G. (2023). Real-time in-situ measurement of hydrogel swelling by single sided NMR. *Polymer*, 281(March), 126108.

Ferris, M.; Chesney, A.; Ryan, B.; Ramesh, U.; Panthani, M.; “Silicon Nanocrystals as signal transducers in ionophore-based fluorescent nanosensors.” *Sens. Actuator B-Chem*, 2021; 331; 129350

Ferris, M.; Behr, M.; Cash, K.; “An Ionophore-Based Persistent Luminescent ‘Glow Sensor’ for sodium detection.” *RSC Advances*. 2019; 9 (56) 32821-32825

Ferris, M., Elms, M, Cash, K.; “Enzyme-Conjugated Nanosensors with Tunable Detection Limits for Small Biomolecule Determination.” *AIChE J.* 2019; 65 (9); e16698

Ferris, M.; Katageri, A.; Gohring, G.; Cash, K.; “A Dual-Indicator Strategy for Controlling the Response of Ionophore-Based Optical Nanosensor.” *Sens. Actuator B-Chem*, 2018; 256; 674-681.

Presentations

Ferris, M.; Adesso, A.; Meurer-Zeman, B.; Zabow, G; “Utilizing the Smartphone Magnetometer with Magnetic Hydrogel Bilayers for Accessible, Quantitative Analysis of Fluids.” 10th Front Range Advanced Magnetism Symposium; Colorado Springs, CO: 2024

Ferris, M.; Oberdick, S.; Zabow, G; “Microfabrication of GEM Sensors for Quantitative Glucose Mapping and Multiplexing with MRI.” Annual meeting of the American Society of Chemical Engineers; Boston, MA: 2022

Ferris, M.; Oberdick, S.; Zabow, G; “Multiplexed detection of bio-analytes with MRI-based geometrically encoded magnetic (GEM) sensors.” 28th Annual NIST Sigma Xi Postdoctoral Poster Presentation (PPP) @ NIST; Boulder, CO: 2021

Ferris, M.; Behr, M.; Cash, K.; “A Long-Lifetime Phosphorescent 'Glow' Sensor to Avoid Background Noise in Biological Samples.” Graduate Research and Discovery Symposium (GRADS) @ Mines; Golden, CO: 2019

Ferris, M.; Behr, M.; Cash, K.; “Sodium Detection in Biological Samples with Persistent Luminescence to Avoid Background Interference.” Society for Laboratory Automation and Screening (SLAS) Annual Meeting; Washington D.C.: 2019

Ferris, M.; Elms, M.; Cash, K.; “Enzyme-Conjugated Nanosensors with Tunable Detection Limits for Monitoring Small Bio-Molecules.” Annual meeting of the American Society of Chemical Engineers; Pittsburgh, PA: 2018

Ferris, M.; Elms, M.; Cash, K.; “Enzyme-linked nanosensors for small molecule monitoring.” Lifespan Research: from Pregnancy through Aging; Longmont, CO: 2018

Ferris, M.; Elms, M.; Cash, K.; “Enzyme-linked nanosensors for small molecule monitoring.” Graduate Research and Discovery Symposium (GRADS) @ Mines; Golden, CO: 2018

Ferris, M.; Katageri, A.; Gohring, G.; Cash, K.; “Dynamic range optimization with optical nanosensors.” NREL-Mines Joint Bio workshop; Golden, CO: 2017

Ferris, M.; Katageri, A.; Gohring, G.; Cash, K.; “A Dual-Indicator Strategy for Controlling the Response of Ionophore-Based Optical Nanosensor.” Annual meeting of the American Society of Chemical Engineers; Minneapolis, MN: 2017

Ferris, M.; Katageri, A.; Gohring, G.; Cash, K.; “Dynamic range optimization with optical nanosensors.” Graduate Research and Discovery Symposium (GRADS) @ Mines; Golden, CO: 2017

Ferris, M.; Yu, M.; Wu, Y.; “Methods for synthesis of P-Type Semiconductors for Dye-Sensitized solar cells.” The Devon Walter Meek Lectures Poster Session; Columbus, OH: 2013

Ferris, M.; Benzing, J.; Van Avermaete, M.; Yu, M.; Wu, Y.; “Methods for synthesis of P-Type Semiconductors for Dye-Sensitized solar cells.” The Devon Walter Meek Lectures Poster Session; Columbus, OH: 2012

Patents

Ferris, M.; Zabow, G.; “ANALYTE FLEXURE SENSOR AND SENSING AN ANALYTE.” PCT application serial number PCT/US2024/039676

Teaching and Professional Service

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| • NIST Applied Physics Division Action Committee for Diversity, Equity, Inclusion, and Accessibility | 2024-present |
| • Summer Undergraduate Research Fellowship (SURF) Advisor | 2023, 2024 |
| • Front Range Industry and Postdoc Summit (FRIPS), Organizing Committee Member | 2021, 2022 |
| • NIST Postdoctoral and Early Career Researcher Association Leadership Team Member | 2020-2024 |
| • Teaching Assistant, CBEN 110: Fundamentals of Biology 1, Colorado School of Mines | 2014-2019 |

Awards and Honors

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| • Featured in Editors’ Highlights page of Nature Communications (Quantitative, high sensitivity measurement of liquid analytes using a smartphone compass) | 2024 |
| • National Research Council Research Associateship Program (NRC RAP) Fellowship Recipient | 2019 |
| • Tony B Award Winner, Society of Laboratory Automation and Screening | 2018 |
| • Kentucky Society of Petroleum Engineering Scholarship Recipient | 2010-2014 |
| • Parsons Engineering Science Scholarship Recipient | 2010-2013 |
| • Ohio State Provost Scholarship Recipient | 2009 |