Dr. M. Stanley Whittingham

The Origins of the Lithium Battery and Future Chemistry and Materials Challenges

Friday, April 16, 2021

A Webinar Event with In-Person Audiences in Leach Theatre and Additional Zoom Rooms

Schedule online, see:

https://chem.mst.edu/seminars/colloquium/

https://chem.mst.edu/seminars/stoffer-lecture/

Department of Chemistry

Missouri University of Science and Technology

Founded as the Department of Chemistry and Metallurgy in 1871, one short year after Missouri School of Mines was established, it was later to become the Department of Chemistry and Chemical Engineering, and finally to become the Department of Chemistry in 1968. The department academic staff includes 22 regular faculty, 10 emeritus faculty members, and 7 adjunct faculty. The department's current faculty comprise one of the highest external research grant-generating departments at Missouri S&T.

Whether it's replacing the chromium in aircraft coatings, using algae as an alternative energy source or treating lead poisoning, at Missouri S&T's Department of Chemistry, it's all about interdisciplinary research that will have a positive impact on the world.

The Department offers a Bachelor of Arts with emphasis in Secondary Education and a Bachelor of Science which is certified by the American Chemical Society and places strong emphasis on the integration of research into undergraduate education. The graduate programs include a Master of Science (M.S. with or without thesis), a Master of Science for Teachers (M.S.T.), and the Doctor of Philosophy degree with research in all areas of Chemistry.

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Missouri University of Science and Technology

The 5th Annual James O. Stoffer Lecture in Chemistry

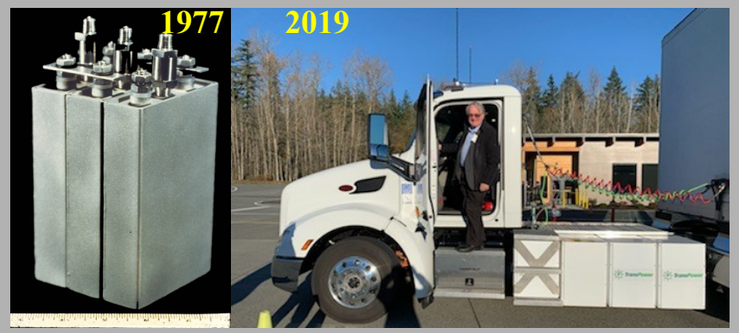
April 16, 2021

Presented By
Missouri S&T, Department of Chemistry

Co-sponsored by the University of Missouri Sesqui-centennial Committee, the Brewer Science Company and Mo-SCI Corporation

Dr. M. Stanley Whittingham

Stan Whittingham is a SUNY distinguished professor of chemistry and materials at Binghamton University and the 2019 Chemistry Nobel Laureate. He received his BA and D Phil degrees in chemistry from Oxford University. He has been active in Li-batteries since 1971 when he won the Young Author Award of the Electrochemical Society for his work on the solid electrolyte beta-alumina. In 1972, he discovered the role of intercalation in battery reactions, which resulted in the first commercial lithium rechargeable batteries that were built by Exxon. In 1988 he returned to academia at SUNY Binghamton to initiate a program in materials chemistry. He was awarded a JSPS Fellowship in the Physics Department of the University of Tokyo in 1993. He is presently Director of the NECCES EFRC based at Binghamton. In 2018, he was elected a member of the National Academy of Engineering and received the Turnbull Award from MRS. In 2019 he shared the Nobel Prize in Chemistry along with John Goodenough and Akira Yoshino for the development of the chemistry of the lithium ion battery. Whittingham's contribution to the current lithium ion battery was that he made the first functioning lithium ion battery and later used titanium disulphide as the cathode. Goodenough's contribution was the use of cobalt oxide as the cathode and Yoshino's contribution was the use of petroleum coke as the anode. Thus the current make-up of the lithium ion battery.



The Origins of the Lithium Battery and Future Chemistry and Materials Challenges

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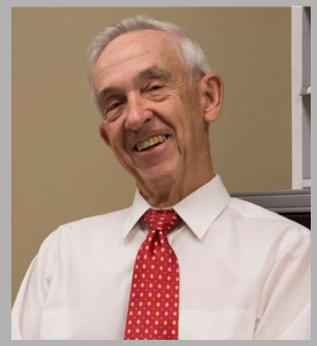
Abstract. The success of lithium-ions arose from a fundamental understanding of what controls fast ion transport in solids. Intercalation reactions have been the basis of all rechargeable lithium batteries since their inception 50 years ago, because usually these result in less structural change and the compounds show high solubility for lithium ions, as in Li_xTiS_2 , where $0 \le x \le 1$. However, 40+ years later, commercial cells attain only 25% of their theoretical energy densities. The dominant NMCA cathodes can now attain over 200 Wh/kg commercially at the cell level, and the Battery500 consortium has attained around 350 Wh/kg in full cells, out of a theoretical 1000 Wh/kg. The scientific challenges to improving the energy density will be discussed; these include the need for higher ionic and electronic conductivities, as well as greater stability of the solid materials and the liquid or solid electrolytes.

About the Dr. James O. Stoffer Lecture Series

The purpose of this lecture series is to invite highly respected and qualified professionals to Missouri S&T to discuss topics relevant to chemistry, especially polymer chemistry. Speakers shall address the faculty and students of the department, as well as the university community. The topics chosen should vary in order to cover a full spectrum of the fields of interest relevant to the department. Preference shall be given to speakers from the chemistry department alumni and/or those specializing in polymer chemistry and shall be chosen in a collegial manner by a means normal to the operation of the department. Annually, the lecture series provides an opportunity for an alumnus or another outstanding individual to speak to students and the campus community about the impact and importance of education on their career.

This year's lecture is co-sponsored by a grant from the Missouri S&T 150th Anniversary Mini-Grant Program and by industrial sponsors Brewer Science and MO-SCI.

Dr. James O. Stoffer



James Stoffer is Curators' Professor Emeritus of Chemistry and Past Director of the Graduate Center for Materials Research. He taught many courses in the Department of Chemistry including Freshman Chemistry, Organic Chemistry and Polymer Chemistry. Additionally his experience includes the teaching of paint short courses at Rolla for over 30 years, as well as at the National Paint Show and at the American Chemical Society meeting each year. He advised some fifty graduate students and his research with these graduate students includes the first papers on microemulsion polymerization processes, one of the first papers on polymerization of liquid crystals, the first papers on ultrasonic dispersion of pigments for paints, on ultrasonically initiated and microwave initiated free radical catalyzed polymerizations, and on transparent composites. Most of his research deals with the preparations and properties of coatings and polymers. Since 1992, working with Dr. Tom O'Keefe and his group, he was developing a replacement for chromium as the corrosion inhibitor for aluminum of Aircraft. Dr. Stoffer published over 150 publications and authored 12 patents, one of which provides royalties to fund this lecture.

Previous Dr. James O. Stoffer Lecturers

2016 - Dr. Janet Lynn Kavandi
2017 - Dr. Eric Peterson
2018 - Dr. William James
2019 - Dr. Delbert Day
2020 - Deferred due to Pandemic