DEPARTMENT OF CHEMISTRY AND ENVIRONMENTAL SCIENCE
SEMINAR SERIES
FALL 2021

DATE: WEDNESDAY, OCTOBER 20, 2021

LOCATION: TIERNAN HALL LECTURE 1
TIME: 1:00-2:20PM

GUEST SPEAKER
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TOPIC
Superprotonic Solid Acid Compounds for Sustainable Energy Technologies

ABSTRACT
The compound CsH$_2$PO$_4$ offers several advantages as a proton conducting electrolyte for electrochemical energy technologies. This material is a member of the general class of compounds known as solid acids or acid salts, in which polyanion groups are linked together via hydrogen bonds, and monoatomic cations provide overall charge balance. Several solid acids display a superprotonic transition to a structurally disordered phase of high conductivity at which the conductivity jumps by 3-5 orders of magnitude and the activation energy for proton transport drops to a value of ~ 0.35 eV. In the case of CsH$_2$PO$_4$ the transition occurs at 228 °C and the conductivity rises to ~ 10$^{-2}$ S/cm at 240 °C. Thus, devices based superprotonic CsH$_2$PO$_4$ comfortably operate at temperatures between 230 and 260 °C. We present here an overview of the proton transport characteristics of CsH$_2$PO$_4$ and the current status of electrochemical technologies based on this material. Relevant technologies include hydrogen fuel cells, direct methanol fuel cells, and ammonia-to-hydrogen electrochemical conversion cells.

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