ION CONDUCTING MEMBRANES FOR CLEAN ENERGY SYSTEMS. **Jasneet Kaur,** Brock University, Department of Physics and Yousef Haj Department of Engineering, 1812 Sir Isaac Brock Way, St. Catharines, ON L2S 3A1 (jkaur2@brocku.ca) and Hadis Zarrin, Department of Chemical Engineering, Toronto Metropolitan University, Toronto, ON M5B 2K3, Canada (jkaur2@brocku.ca)

Ion conducting membranes have been employed as electrolytes in clean energy conversion, and storage systems, such as water electrolyzers, supercapacitors and batteries. These electrolytes serve as one of the core components and directly determine the performance and durability of electrochemical devices. However, the traditional proton exchange membranes and anion exchange membranes suffer from highly toxic preparation procedures, poor chemical, and electrochemical stabilities, and low ionic conductivities. This has initiated scientists to explore alternative inorganic building blocks and innovate novel material designs for improving the performance and stability of devices. The recently growing research on two-dimensional (2D) materials has shown exceptional properties, including high ionic conductivities, which enhances the feasibility of fabricating high performance 2D material-based electrolytes. In this work, we have created superionic solid-state electrolytes by nanoengineering the surface of 2D material, hexagonal boron nitrides (h-BN) and integrating them in polymer structure to cast specific ion conducting membranes. 2D h-BN nanoflakes and the developed electrolytes are characterized by advanced spectroscopic and microscopic techniques, including electrochemical impedance spectroscopy. The 2D h-BN electrolytes turn out to be highly conductive, electrochemically stable, and mechanically robust, allowing selective ion conduction for various types of ions, including protons, hydroxides, and lithium ions.