**Title: MXene based sulfur hosts in Lithium Sulfur Batteries**

Compact energy storage devices with eminent gravimetric and volumetric energy densities are imperative needs in the field of modern mobile electronic devices, unmanned aerial vehicles, and electric vehicles. Thanks to their high specific energy and cost-effectiveness, lithium-sulfur batteries (LSBs) are well-positioned to succeed the use of lithium-ion batteries. In fact, LSBs have been shown to offer specific energies in the order of 500 to 600 W h/kg – significantly better than the 150 to 250 W h/kg achieved by lithium-ion batteries. However, the sluggish reaction kinetics and severe shuttle effect of the sulfur cathodes hinder their practical applications. To address these issues, the 2D layered MXene with high conductivity, outstanding hydrophilicity, and excellent chemical/mechanical stability could be a potential host material for sulfur cathode. The surfaces of MXene are terminated with rich polar groups, such as −OH, O, and F, which could provide strong chemical interactions for LiPS trapping. Following the approach, the main aim of this project is to design a 3D lightweight, flexible, conductive MXene scaffold with high mechanical strength, thus realizing high current density and large capacity for Li-S cathodes. All research within the components will be realized in the form of pouch cells produces at the Ford PERDC facility at Windsor.

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