

Developing 2D Materials for Cathodes of Rechargeable Post-Lithium-Ion Batteries

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In this talk, I will introduce some of our works on developing 2D materials for cathodes of rechargeable post-lithium-ion batteries. In particular, I will focus on the modification of Ti_3C_2 MXene and MoS_2 nanomaterials with hyperbranched polyethylene ionomers containing quaternary ammonium ions for cathode materials. This range of ionomers is uniquely synthesized by direct chain walking copolymerization of ethylene with acrylate-type quaternary ammonium ionic liquid monomers, which is facilitated with a Pd-diimine catalyst. With their positively charged quaternary ammonium ions, the ionomers can uniquely intercalate within the nanosheets of 2D nanomaterials such as Ti_3C_2 MXene and 1T- MoS_2 by binding onto their negatively charged surface through strong ionic interactions. Such an intercalation efficiently leads to expanded interlayer spacing, which offers expanded ion transport pathways for fast diffusion of electrolyte and enhanced effective surface sites for the insertion of the electrolytes in rechargeable magnesium batteries. Some improved electrochemical performances yield with the ionomer-modified 2D nanomaterial cathodes, including enhanced specific capacity, improved rate performance and cyclic stability.