Scanning Electrochemical Microscopy of Transition Metal Carbides ($Ti_3C_2T_x$) MXenes Phases with Different Interlayer Spacing for Renewable Energy

Wyatt Ringo[1], Minmin Hu[2], Xiaohui Wang[2] and Sanju Gupta[3]

[1] Department of Physics and Astronomy, Western Kentucky University, 1906 College Heights Blvd. Bowling Green, KY 42101 (USA)

[2] Gatton Academy of Mathematics and Science and Department of Physics and Astronomy, Western Kentucky University, 1906 College Heights Blvd. Bowling Green, KY 42101 (USA)

[3] Institute of Metal Research, Chinese Academy of Sciences (CAS), 72 Wenhua Road, Shenyang 110016 (China)

[1] Department of Physics and Astronomy, Western Kentucky University, 1906 College Heights Blvd. Bowling Green, KY 42101 (USA)

ABSTRACT

Two-dimensional (2D) layered materials are increasingly studied in effort to discover new compounds and the fascinating properties engineered by their sheet-like structure. Graphene, atomic layer of carbon, is the most researched among 2D materials, albeit limited to just carbon in its composition. Recently, a new emergent family of 2D transition metal carbides and carbonitrides – so called "MXene"- are synthesized that may have wide-ranging applications, including energy storage, polymer nanocomposite fillers, water purification, transparent optical conductive coatings and electronic devices. Nevertheless, before the best application is identified, the fundamental physics of these materials must be understood and therefore synthesis-structure-property relationships must be established. To our expanding interests in this emerging class of materials, we investigate the structure and properties of layered transition metal carbides ($Ti_3C_2T_x$) MXenes phases for renewable energy prepared by collaborator. We employed electron microscopy, optical absorption spectroscopy, Raman spectroscopy and advanced electrochemistry to determine surface morphology, nanoscale structure, lattice vibrational properties and surface sensitive electrochemical properties at solid/liquid interface.