**Two-dimensional Titanium Carbide (MXene) as a Redox Charge Storage Host**

Narendra Kurra

Department of Chemistry, Indian Institute of Technology Hyderabad, Kandi-502284, Sangareddy, Telangana State, India.

Email: narendra@chy.iith.ac.in

MXenes - an emerging class of two-dimensional (2D) transition metal carbides, nitrides, and carbonitrides – have shown promise towards development of high-rate energy storage devices.[1] MXenes are usually produced by top-down synthesis, namely wet chemical extraction of ‘*A*’ atomic layers from the layered ternary carbide precursors, such as MAX phases. The resulting MXenes with surface terminations (-O, -F, -OH) impart negative surface charges, key for stable MXene dispersions in water and polar organic solvents which enable solution processing to ease the design of electrode architectures. The available 2D gallery spaces for intercalation of ions, accessible redox sites at the transition metal oxide-like surface, and metallic conductivity make MXenes promising materials for high-rate capacitive energy storage applications.[2,3] The ability of MXenes to intercalate a variety of cations at high rates leads to their widespread usage in a variety of electrochemical energy storage applications including pseudocapacitive energy storage and hybrid metal-ion capacitors.The electrochemical storage of aqueous and non-aqueous cations across Ti3C2T*x* MXene galleries and the role of solvation effects and surface chemistry will be discussed. Besides the role of Ti3C2T*x* MXenes as active charge storage materials, metallicity (electronic conductivity beyond 20,000 S/cm) enables current collector-free fabrication of energy storage devices,[4] substantially decreasing their size and weight.

References

[1] M.R. Lukatskaya, S. Kota, Z. Lin, M.-Q. Zhao, N. Shpigel, M.D. Levi, J. Halim, P.-L. Taberna, M.W. Barsoum, P. Simon, Y. Gogotsi, *Nat. Energy* **2017**, *2*, 17105.

[2] T.S. Mathis, N. Kurra, X. Wang, D. Pinto, P. Simon, Y. Gogotsi, *Adv. Energy Mater.* **2019**, *9*, 1902007

[3] N. Kurra, S. Uzun, G. Valurouthu, Y. Gogotsi, *Energy Storage Mater.***2021**, *39*, 347-353.

[4] Q. Jiang, N. Kurra, K. Maleski, Y. Lei, H. Liang, Y. Zhang, Y. Gogotsi, H.N. Alshareef, *Adv. Energy Mater.* **2019**, *9*, 1901061