Synthesis and uses of MXene Derivatives in Energy Conservation and Storages

Suru Ren *

Editorial Office, Research and Reviews in Electrochemistry, UK

*Corresponding author: Suru Ren, Editorial Office, Research and Reviews in Electrochemistry, UK, E-Mail:

publisher@tsijournals.com

Editorial

Transition metal carbides or nitrides (MXene) have shown promising applications in energy convention and storage (ECS), owing to their high conductivity and adjustable surface functional groups. In the past several years, many MXene derivatives with different structures have been successfully prepared and their impressive performance demonstrated in ECS. The mechanics involved in photocatalysis, electrocatalysis, and rechargeable batteries are also discussed, as well as their performance. In addition, the difficulties of MXene derivatives in ECS are discussed. Graphene, transition metal dichalcogenides, hexagonal boron nitrides, black phosphorene and silene are two-dimensional (2D) materials that have showed promise in Energy Conversion and Storage (ECS). MXenes, or transition metal carbides or nitrides, are the next-generation 2D materials.

MXenes are made by selectively removing a layer from MAX precursors (where M stands for early transition metal element, A for group IIIA, IVA, and X for C and/or N).More than 30 different MXenes have been synthesised so far from the appropriate MAX phase. They feature a variety of intriguing qualities that make them ideal for ECS applications.

- Large planes for charge storage and 2D channels for ion transfer resemble other 2D materials
- Excellent electrical conductivity owing to the metallic bone, whose bandgap can be tuned by surface functional groups
- Abundant functional groups on the surface (–F groups, –OH groups, –O groups), resulting in the hydrophilic surface and their superior performance in the ECS application

The MAX phase, in which M and X atoms occupy the apex and centre of the hexagonal crystal, while A atoms interleave in MX layers, is used to make the majority of MXenes. MX layers might be sustained after removing A atoms from MAX phases by utilising this "laminar" structure. In contrast to other layered materials like graphene, mechanical exfoliation of 2D MXenes is difficult due to the strong contact between layers.

HF and in-place. The most common methods for preparing MXene are HF-etching and HF-etching. By selectively etching Al from bulk Ti3AlC2 in HF solution, Gogotsi and coworkers first reported the loosely packed accordion-like MXene structure.The Al layers were dissolved by HF, which broke Ti-Al connections and produced a lot of H2. At the start of the reaction, there was a powerful bubbling phenomenon. At the same time, functional groups such as -F, –OH, and –O were bonded to Ti atoms on the surface, resulting in high hydrophilicity and distinct electrochemical properties. Because of the high risk and toxicity of HF, numerous attempts have been undertaken to develop gentler and safer synthesis procedures. In 2014, instead of utilising HF solution, a combination of LiF and HCl was used to create a few-layer MXene with greater interlayer spacing and fewer surface defects. Controlling the concentrations of LiF and HCl in this improved process allowed the size and quality of sheets to be controlled. To replace the original etchant, mixtures of various fluoride salts (such as KF, NaF, and CaF2) and acid (H2SO4) are utilised. The use of these fluorinated salts, however, cannot totally prevent the creation of HF, and the –F groups also limit MXene's employment in electrochemical fields.