Improving MXene Synthesis via HF Etching in Supercritical CO_2

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Abstract
MXenes are promising two-dimensional transition metal carbides/carbonitrides with metallic conductivity, hydrophilicity, and tunable surface chemistry for diverse applications [1]. In this work, Ti_3C_2, Ti_3CN, and $Mo_2Ti_2C_3$ MXenes were fabricated by a supercritical CO_2-assisted HF etching strategy, as schematically illustrated in Fig. 1. Compared with conventional wet etching, this approach markedly reduces HF consumption, shortens etching time, and better preserves the structural framework of layered MXenes by enhancing mass transport and interlayer penetration during etching [2]. The resulting products were systematically characterized by SEM, XRD, EDS, and XPS. As shown in Fig. 2, SEM images confirm the successful conversion of MAX precursors into etched MXenes with well-defined layered morphologies. After DMSO-assisted delamination, ultrathin nanosheets were obtained, showing enlarged surface area, reduced sheet resistance, and suppressed restacking. These results demonstrate an efficient and less aggressive route for producing high-quality MXene nanosheets with strong potential for scalable fabrication and future device integration [3].

References

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Figures

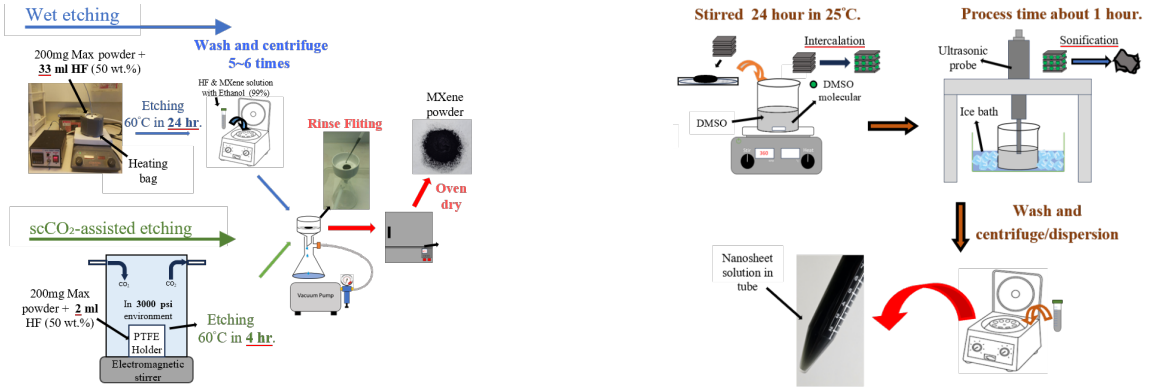

Figure 1: Schematic illustration. The etching process (Left). Nanosheet delamination process (Right).

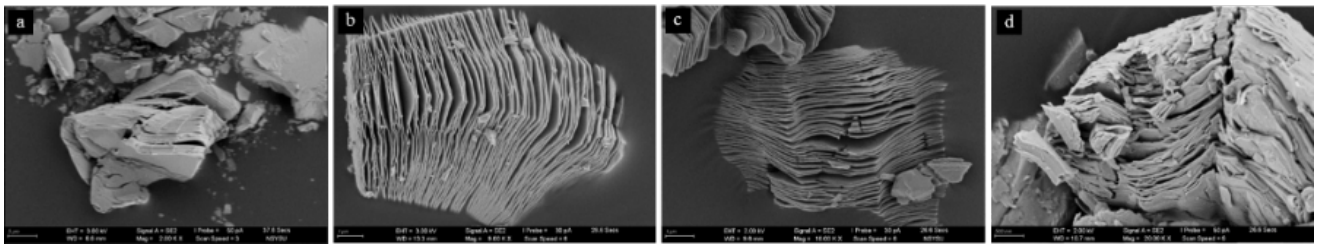

Figure 2: SEM images (a) MAX of Ti_3AlC_2; SCFs Etched MXenes of (b) Ti_3C_2 (c) Ti_3CN, and (d) $Mo_2Ti_2C_3$