MXene Scrolls - A Vanadium Carbide (V_2C) Papyrus-Like Structure for Energy Applications

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Abstract

V_2C MXene theoretically has one of the highest energy capacitance properties compared to other MXenes [1-2] and as a result there is big interest toward this area. Herein, we report one of the purest V_2C results through "in-situ" HF synthesis at <60ºC (No need for autoclave) with high delamination rate and low oxidation level due to the self-assembling nanoscrolls of single and/or few flakes of V_2C during the post-synthesis procedure of the intercalation/delamination step with an organic solvent (e.g. quaternary ammonium salt: TMAOH, TEAOH, etc.). The morphology and structure of the V_2CT_z MXene was characterized by X-ray diffraction, scanning/transmission electron microscopy, Raman spectroscopy, X-ray photoelectron spectroscopy and BET Surface Area Analysis. Furthermore, the papyrus-like V_2C structure capacitance properties are investigated by cyclic voltammetry, galvanostatic charge–discharge and electrical impedance spectroscopy.

References

[1] M. Ashton, R.G. Hennig & S.B. Sinnott, Applied Physics Letters, 108, (2016) 033102
[2] J. Hu, B. Xu, C. Ouyang, S.A. Yang & Y. Yao, J. Phys. Chem. C, 118 (2014) 24274-24281

Figures

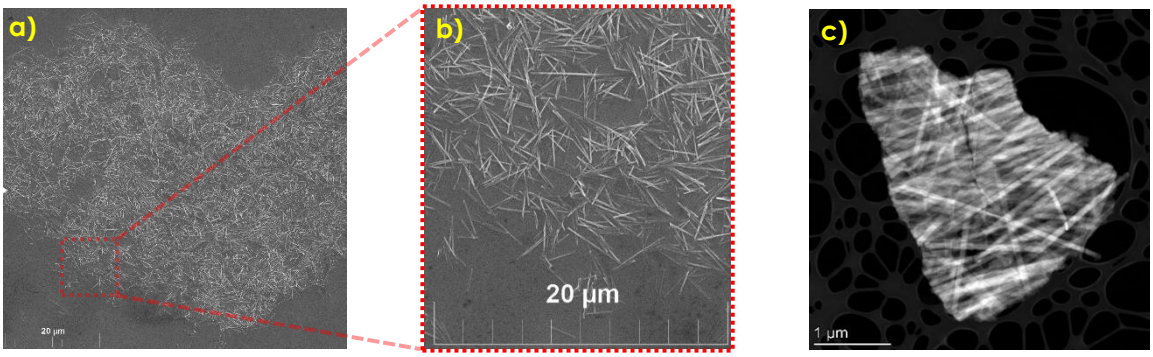

Figure 1: a, b) SEM images of V_2C MXene showing the papyrus-like structure & c) wide-field TEM

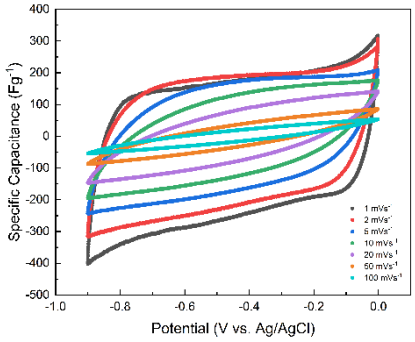

Figure 2: Electrochemical performance of V_2C scrolls electrode. Cyclic voltammograms (CVs) at different scan rates in 1M Na_2SO_4