5th World Congress on

Smart and Emerging Materials

April 19-20, 2018 Dubai, UAE

Physicochemical properties of Ti-based MXenes obtained from SHS synthesized MAX phases and their application for energy storage

Sergii A Sergiienko

National University of Science and Technology MISiS, Russia

Methods of MXenes preparation described in the literature are often multi-stage and complicated. So the purpose of our work is the development of more simple and technologically acceptable method of MXenes preparation. In the literature the synthesis of MAX phases (precursors for MXenes synthesis) has been realized by different methods. We used one stage self-propagating and high-temperature synthesis (SHS) that seems most suitable due to simplicity, short reaction time, cost-effective and little demand on external energy. Commercially available Ti, Al and carbon black powders were used. Several phases (mainly Ti₃AlC₂, Ti₂AlC, TiC) were among the products after SHS. Obtained products are crushed in a roll crusher and then automatic agate mortar. For Al etching from the MAX phase a dilute solution of HF was used. Then delamination of MXenes in N, N-dimethylformamide and isopropanol mixture with sonication were lasted during 3 days. The content of unreacted MAX phase particles in MXene powder can be reduced by using hydro cyclone assembly and alcohol medium instead of water. Suspension stability of MAX phase particles decreases rapidly while suspension of MXene particles is fairly stable. Also alcohol medium can protect Ti₃C₂T_x Mxene from oxidation. Since both layered Ti₃C₂Tx and Ti₂CT_x obtained can be used as electrodes for super capacitors SHS method is suitable for Tix+1AlCx phase preparation. In 1M solution of Na₂SO₄ obtained electrodes demonstrated gravimetric capacitance up to 220 Fg⁻¹ at charge-discharge rates 2 mVs⁻¹.

sergeenko_sergei@ukr.net

Notes: