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Electrochemical performance of two-dimensional Ti_3C_2-Mn_3O_4 nanocomposites and carbonized iron cations for hybrid supercapacitor electrodes

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In this work, we present a simple two-step synthesis route to develop a cost effective high performance Ti_3C_2—Mn_3O_4 nanocomposite via a solvothermal process at 150 °C. The characterization of the composite material was obtained via various techniques. Electrochemical performance study of the material as a potential supercapacitor electrode demonstrated a maximum specific capacity of 128 mAh g^{-1}at a specific current of 1 A g^{-1} in a 6 M KOH aqueous electrolyte. A capacity retention of 77.7% of the initial value was recorded after over 2000 galvanostatic cycles at 10 A g^{-1} for the single electrode. More so, the as-prepared nanocomposite sample electrode also showed a relatively stable property with an energy efficiency of 83.5% after cycling tests. Interestingly, an assembled hybrid supercapacitor device with carbonized iron cations (C-FP) and the Ti_3C_2—Mn_3O_4 composite delivered a specific capacity of 78.9 mAh g^{-1}. The device yielded a high energy of 28.3 Wh $kg^{-1}$with an equivalent 463.4 W kg^{-1} power densityat 1 A g^{-1}. A good cycling stability performance with an energy efficiency of 90.2% in addition to a 92.6% capacity retention was observed for over 10,000 cycles at specific current of 3 A g^{-1} over a voltage window of 1.5 V.