Two-Dimensional Titanium Carbide (Ti_2CT_x) as Cathode Material for Mg-Ion Batteries

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Since its discovery in 2011 [1], MXenes have attracted much attention as a promising material for a range of applications, mostly due to its two-dimensional nature offering high electrical conductivity combined with hydrophilicity and good mechanical strength [2]. With an optimized surface termination, they have been proposed to be highly suitable as electrode material for both single- and multivalent ion batteries [3]. Although MXenes have been shown to electrochemically intercalate Mg^{2+} ions [4] and the demonstration of a Mg/Li-ion hybrid battery with a MXene cathode [5], no pure Mg-ion full cell with a MXene cathode has yet been successful.

Here, for the first time, a pure Mg-ion full cell based on a MXene cathode with substantial capacity is reported. The Ti_2CT_x cathode, where T denotes the surface termination of a mixture of -OH, -O and -F, was obtained by leaching out the Al from the Ti_2AlC (MAX phase) starting material. XRD and EDS confirmed the successful removal of Al. Assembled as cathode in a full cell comprising a Mg alloy anode, glass fiber separator and a typical Mg-ion electrolyte of all-phenyl-complex in tetrahydrofuran, showed promising electrochemical performance. Further optimization of the synthesis, particularly on the surface termination, is currently under study.

References:

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