$Ti_3C_2T_x$ MXene-based functional epoxy resin coating for long-term anti-corrosion/wear

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Abstract Two-dimensional $Ti_3C_2T_x$ MXene, with characteristics of high specific surface area, excellent mechanical properties, high conductivity, abundant and easy-to-control surface functional groups, exhibits great potential in improving the protective performance of waterborne epoxy resin coatings. However, at present, the relevant research is still in its infancy. At present, the challenges that $Ti_3C_2T_x$ MXene-based polymer coating must face can be divided into four aspects: (a) the dispersity and compatibility of $Ti_3C_2T_x$ nanosheets in polymer matrix, (b) the high electrical conductivity of $Ti_3C_2T_x$, (c) the alignment direction of $Ti_3C_2T_x$ nanosheets in polymer matrix, (d) the single function of $Ti_3C_2T_x$[1].

To overcome the above bottlenecks, surface and interface engineering are applied to enhance the long-term anti-corrosion/wear performance of $Ti_3C_2T_x$ MXene-based epoxy resin coating. Firstly, $Ti_3C_2T_x$ MXene@MgAl-LDH heterostructure composites (Fig. 1a) were constructed to improve the corrosion/wear resistance properties of epoxy resin. The loaded MgAl-LDH decreased the high electrical conductivity of $Ti_3C_2T_x$ nanosheets and endowed epoxy resin coating with certain self-healing performance[2]. Then, a novel epoxy coating (f-$Ti_3C_2T_x$-ZB@EP) with self-healing function and good wear resistance was designed via incorporating with aminofunctionalized $Ti_3C_2T_x$ loading 2-methylimidazole zinc salt (ZIF-8) nanocontainer@benzotriazole (f-$Ti_3C_2T_x$-ZB) multifunctional composite filler[3]. To achieve the desired performance, electrophoretic deposition technique was utilized to realize the parallel arrangement of $Ti_3C_2T_x$ MXene nanosheets within epoxy resin coating. Herein, ZIF-8 was grown in-situ on amino-functionalized $Ti_3C_2T_x$ nanosheets and doped with cerium cations (P^+-$Ti_3C_2T_x$@ZCe), as shown in Fig.1b. The $Ti_3C_2T_x$-based composite was then parallel arranged within epoxy coating utilizing electrophoretic deposition technique to prepare a novel self-healing intelligent coating (PMX@ZCe)[4]. PMX@ZCe possesses satisfactory corrosion/wear protection

performance, thanks to the synergy of good interfacial interaction, parallel-aligned barrier effect and active-passive protection.

Keywords $Ti_3C_2T_x$ MXene, functionalization, epoxy resin, corrosion, wear

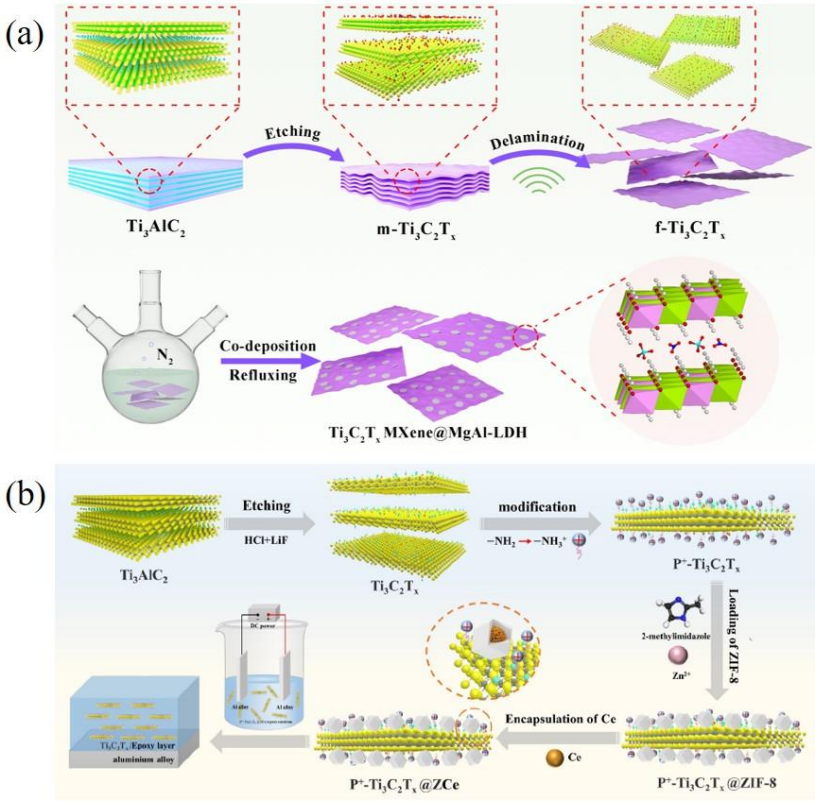

Fig. 1 Construction of functionalized $Ti_3C_2T_x$ MXene composites

Reference

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