Tribological and anticorrosive performances of graphene coatings on stainless steel substrates constructed by metal ion-induced self-assembly

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ABSTRACT

The preparation of functional coatings with low friction, good wear resistance and corrosion resistance on the surface of stainless steel by means of surface engineering technology is one of the effective methods to improve the service performance of components. In recent years, graphene is often used as a solid lubricant and corrosion protection material in the field of mechanical engineering due to its unique layered structure. However, graphene only connected to each other by van der Waals forces, and its weak interlayer bonding limits its service performance. Based on this, a series of graphene oxide (GO) thick coatings with layered structure were designed and constructed on the stainless steel surface by introducing different kind of metal ions such as Al^{3+}、Cr^{3+}、Fe^{3+}、Fe^{2+} and Ca^{2+} through liquid phase impregnation in virtue of the metal ion-induced GO nanosheets layer-by-layer self-assembly (LBLSA) technique (as shown in Fig.1). The influences of type and valence state of metal ions, microstructure and chemical compositions of GO nanosheets on the friction, wear and corrosion protection properties of the prepared coatings were systematically investigated. Moreover, the lubrication mechanism under various working conditions and corrosion protection action under seawater working conditions of the prepared coatings were explored and revealed, and some interesting results and conclusions are obtained[1-3].

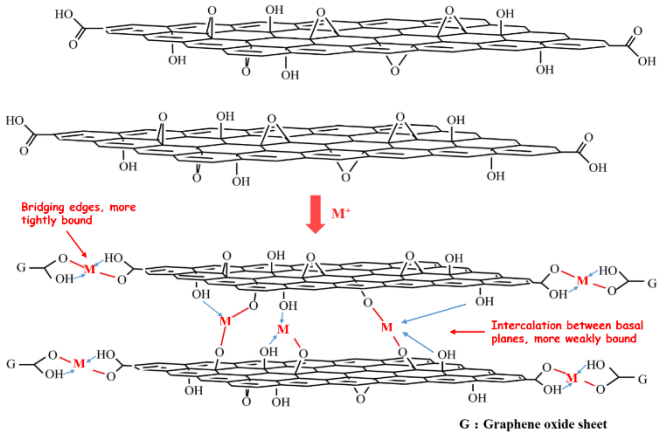

Fig.1 Coordination diagram between metal ion (M^+) and GO nanohseets

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