Inhibition of magnesium corrosion by an algal symbiotic bacterium

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Abstract: The composition of the biofouling layer is complex in the ocean, and its formation process is mainly dominated by the preferential attachment of microorganisms, which then attract the spores or larvae of plankton. Finally, large fouling-organisms such as barnacles and mussels further adhere, through internal cooperation and competition, forming the fouling biofilms with complex structures. However, there has been little research on the effect of different types of organisms in the fouling layer on metal corrosion until now. Thus, the effects of *Phaeodactylum tricornutum* (a diatom with obvious fouling characteristics) and its symbiotic bacterium *Bacillus altitudinis* on magnesium alloys used in marine environment were studied in this paper.

It was found that algae could not grow on the magnesium matrix and could not form algal fouling biofilm in the short term. However, it is surprisingly found that the bacterium survived in such a harsh condition with high alkalinity, which did not accelerate the corrosion of Mg. Instead, the corrosion was even be suppressed by one order of magnitude. The suppressed corrosion could be ascribed to deposition of biofilm mainly made of EPS, and up-regulated metabolites a crystal $MgNH_4PO_4 \cdot 6H_2O$ layer, formation of a bacterial in the biofilm. Based on this, further research found that the algae symbiotic bacteria can effectively improve the anode efficiency of magnesium as a sacrificial anode material, which can be up to 79%.

Keywords：Microorganism; Biofilm; Magnesium; Corrosion control; Sacrificial anode