Construction and performances of thermal-sprayed long-term durable antifouling coatings

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Abstract Marine biofouling is a major problem deteriorating the service performance and lifespan of marine infrastructures. Developing a durable, long-term and environmental-friendly antifouling coating is therefore of significant importance but still a critical challenge in maritime engineering. Herein, we developed two types of long-term durable antifouling coatings by plasma spraying. The one is a composite Cu-X coating (X is a kind of metal with more positive potential than Cu) with novel micron-sized alternating Cu/X laminated-structure This coating was designed to controlled release Cu ions by galvanic dissolution of Cu laminates from the Cu/X micro-galvanic cell in aqueous solution, and therefore to achieve long-term, self-polishing and environmental-friendly antifouling capability with high mechanical durability simultaneously. The other is a micro/nano bimodal porous-structured slippery liquid infused porous surfaces (SLIPS) coating. The effect of spraying parameters on the coating microstructure and long-term antifouling performances were investigated and the underlying mechanisms were revealed.

In the case of the Cu-X coating, results showed that remarkable antifouling efficiency against bacteria survival and adhesion up to ~100% was achieved. Cu/X micro-galvanic cell was confirmed to be formed within Cu-X coating and responsible for the Cu ions release and its excellent antifouling performance. For the SLIPS coating, it demonstrated superior reduction rates of 87 %, 92 %, and 94 % for the settlement of *E. coli, Chlorella*, and *P. tricornutum*, respectively, after 20 days of incubation assay. These two novel coatings would provide new and effective antifouling strategies in maritime engineering.

Keywords: plasma spraying; antifouling; Cu-X coating; SLIPS; long-term durability