

Introduction

- As the performance of large cargo ships increases, **cavitation erosion** on the surfaces of ship components becomes more prominent.
- After the ship enters the seawater, the surface of the ship's power components will be attached by **fouling** organisms, increasing the resistance to navigation.
- Ship power components are exposed to seawater erosion in seawater as well, causing galvanic **corrosion**.



Cavitation



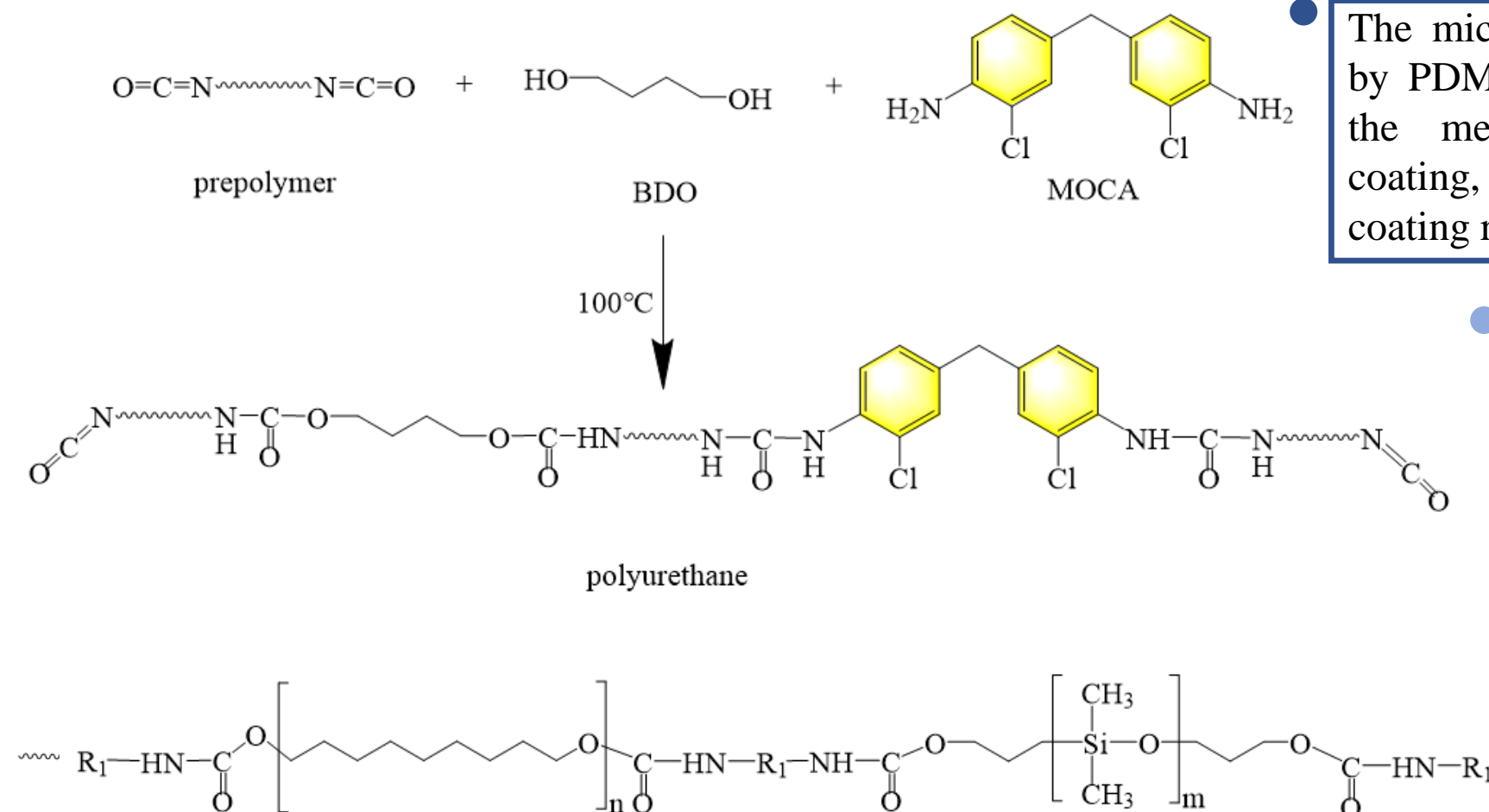
Fouling



Corrosion

Solution Strategies

We addressed the above problem by applying PDMS-modified polyurethane coatings to the ship's power components.



The micro-phase separation generated by PDMS and polyurethane improves the mechanical properties of the coating, which in turn makes the coating resistant to cavitation.

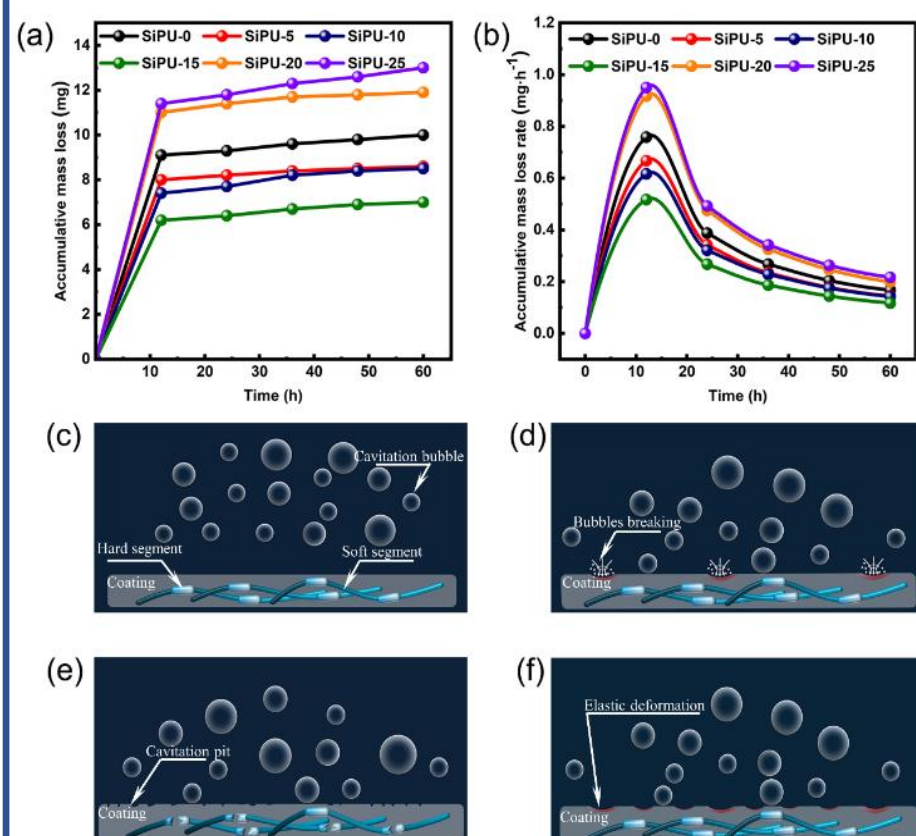
PDMS has the advantage of low surface energy, which protects the coating from fouling and adhesion.

Polyurethane has high adhesion and protects the substrate from seawater erosion.

Result and Conclusion

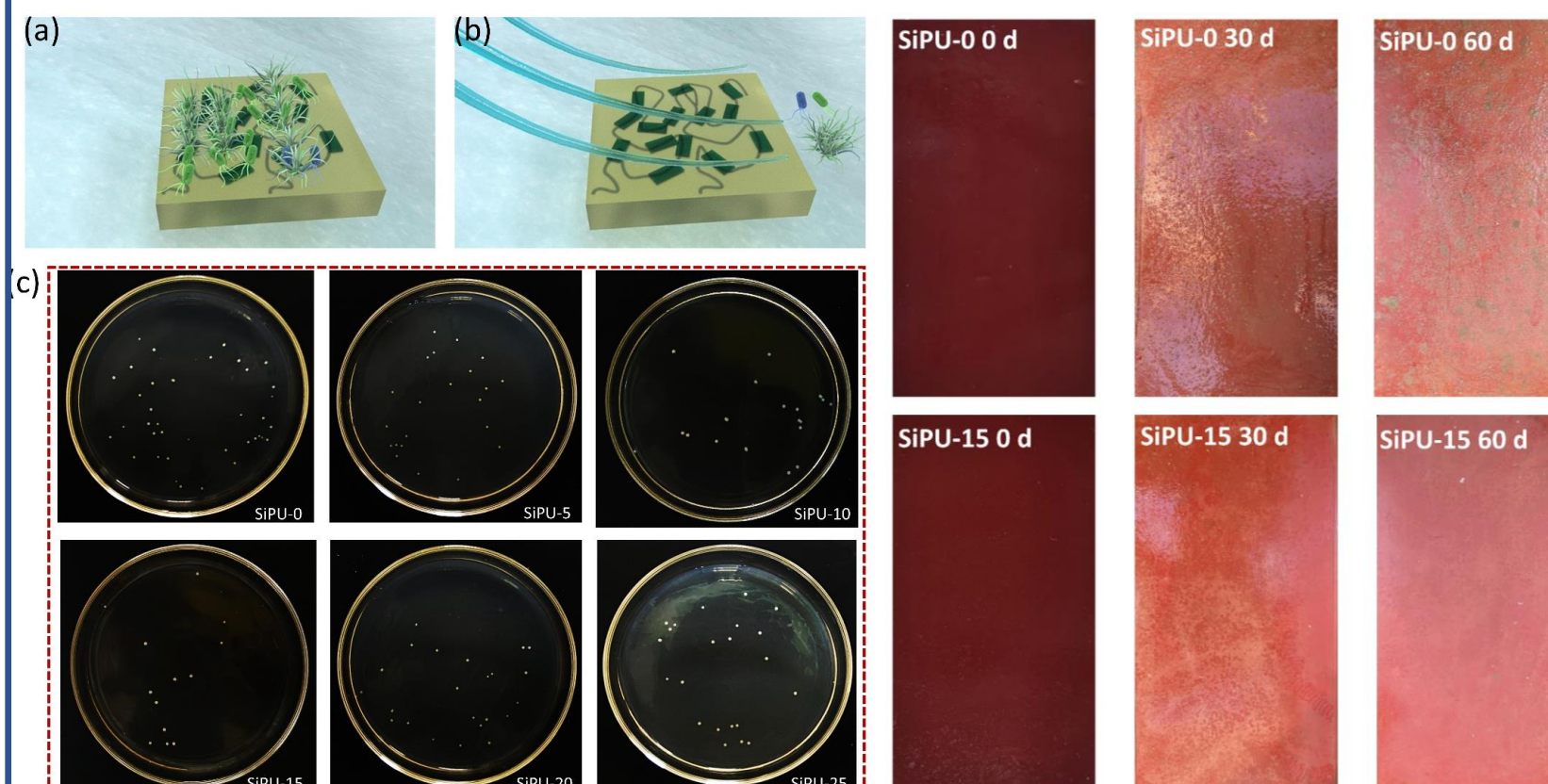
anti-cavitation

SiPU-15 exhibits excellent tensile strength and elasticity, and will deform itself to resist cavitation under repeated impacts of shock waves or microjets, with a cavitation mass loss of only **7.1 mg** after 60 hours of continuous cavitation.



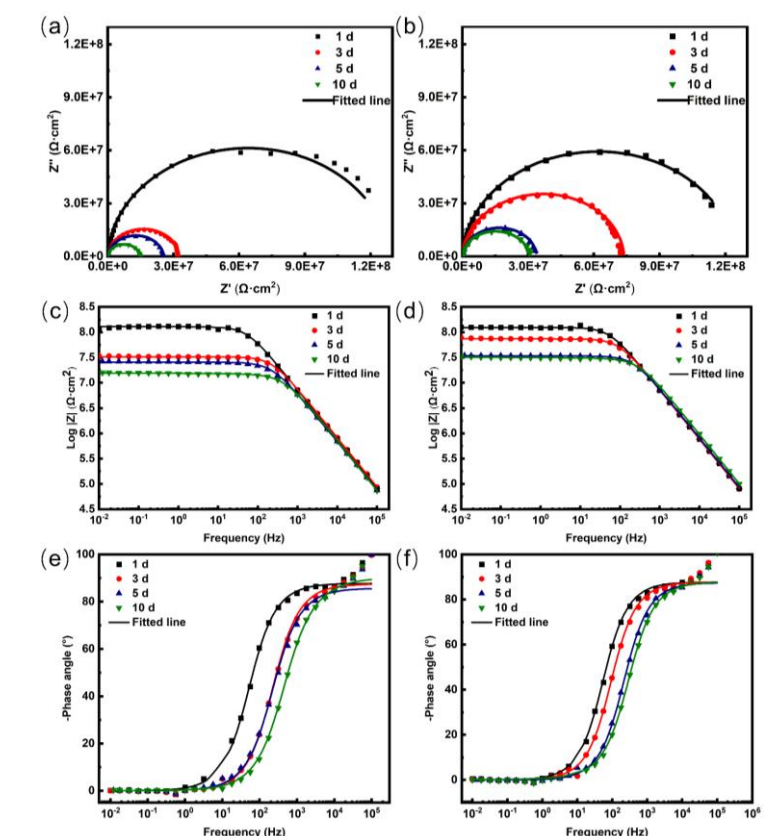
antifouling

SiPU-15 has an appropriate degree of microphase separation, making it difficult for bacteria to adhere to the surface of SiPU-15, with a maximum antibacterial rate of **67.4%**. At the same time, we soaked SiPU-15 in real ocean for 60 days and found that the coating did not adhere to large organisms such as seaweed.



anticorrosion

The $|Z|_{0.01\text{Hz}}$ of SiPU-15 coating can still maintain $3.33 \times 10^7 \Omega \cdot \text{cm}^2$ after immersed in 3.5 wt% NaCl for 10 days, indicating that SiPU-15 has superior anticorrosion ability.



The modified polyurethane coating with anti-cavitation, antifouling, and anticorrosion functions was successfully synthesized by introducing OH-PDMS into the polyurethane. This work provides a heuristic perspective on the design of polymer materials with cavitation, fouling, and corrosion resistance performance.