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A Multidisciplinary Study for the Evaluation of Barrier Properties of Antifouling Coatings on Naval Steel

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Nowadays, antifouling coatings are applied on naval structures immersed in sea water. They offer protection against corrosion and biofouling, in order to improve the life-time of the structure and its hydrodynamic properties, hence increasing the energy efficiency. In the present work, different antifouling coatings on naval steel were evaluated by implementing a combined approach. Hence, coated steel specimens were studied by electrochemical, optical and mechanical methods.

An epoxy and a silicon based antifouling coating were examined. The coatings were applied on Grade A naval steel. Both coatings consisted of four layers, giving a mean dry film thickness of 600μm.

The deterioration of the coated specimens was examined by UV exposure and salt spray accelerated aging, laboratory and field immersion tests. The mechanical properties of the coatings were determined by König pendulum damping and cupping tests. Optical characterization was performed by colorimetric measurements, stereoscopic observations and visual inspections, according to ASTM standards. Electrochemical characterization of the coating was performed by electrochemical impedance spectroscopy (EIS) and linear polarization, in order to determine the water penetration through the coating by evaluating the capacitance, pore resistance and polarization resistance of the specimens.

The coating with the optimum performance was the silicon based, as determined by the comparison of measurements of all the techniques employed. This is attributed to the presence of the siloxane group, which offers superior durability against photo-degradation, heating, water permeation, chemical and biological attack.

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