Expanding the economic lifespan of $PSPC_{15}$ from 15 to 25 years by means of on board restorations

Fierens Rachel[1] and Florian Crab[1]

Antwerp Maritime Academy, Noordkasteel Oost 6, B-2030 Antwerp, Belgium
E-mail: rachel.fierens@telenet.be

Corrosion is an electrochemical process in which electrons are transferred between two parts of a metallic surface with a different potential. For corrosion to occur the presence of an electrolyte is necessary. At the cathode the excess of electrons is used to create hydroxide ions. ($O_2 + 2H_2O + 4e^-$ -> 4OH) . To replenish the electron supply material will be sacrificed at the anode (Fe -> $Fe^{2+} + 2e$). In the electrolyte the hydroxide- and the metal ions will join and create a brown substance called rust.

All seagoing vessels do rust. To prevent this corrosion, a number of possible solutions exist. One of them is applying a coating to the metal structure of the ship to create a barrier between the electrolyte and the metal.
Unfortunately no coating is perfect and damage will occur sooner or later. These small defects can be disastrous for the substrate. The damaged part becomes anodic and the intact part of the structure cathodic. Due to the difference in surface huge quantities of electrons will have to be furnished by a relatively small section. Consequently the corrosion process is concentrated around the failure in the coating and the degradation will proceed at an increased rate. This will lead to very local but severe damages of the metal.

$PSPC_{15}$ is an epoxy coating system that offers at least 15 years of protection if correctly applied and maintained on a well prepared surface in acceptable conditions. Due to the commercial operation of the ship damages to the tank coating cannot be excluded. Up till now, the restoration of an epoxy coating in ballast tanks, was impracticable with the on board resources. The repairs were postponed the next dry-dock visit, usually 2 times every 5 years. The worst case scenario is that the local corrosion process proceeds undisturbed for 3 years at a very high rate. Important, very expensive, steel replacements may become necessary much earlier than normal. The economic lifespan of a ship is 25 years. In case of an inadequate maintenance program of the ballast tank coating this may be put at risk.

The purpose of this research program is to develop a feasible technique to repair small coating damages following an external impact.
Driving idea is that the repair can be done by the crew without compromising the commercial activities of the ship. The surface tolerance and ease of application of the paint are key-elements of this maintenance philosophy.

This idea can result in another attractive possibility. At this moment $PSPC_{15}$ offers 15 years guarantee to keep a coating in a “good” condition. Maybe, by providing an easy repair technique this period can be stretched to 25 years, being the economical lifespan of the average merchant ship.

References

Eyres D.J. 2009. Corrosion control and anti-fouling systems. Ship Construction: 309-325.

Van Dokkum K. 2008. Ship knowledge. Chapter 14. Materials and maintenance: 314-337.