Self-healing protective coatings based on epoxy-loaded polymeric microcapsules

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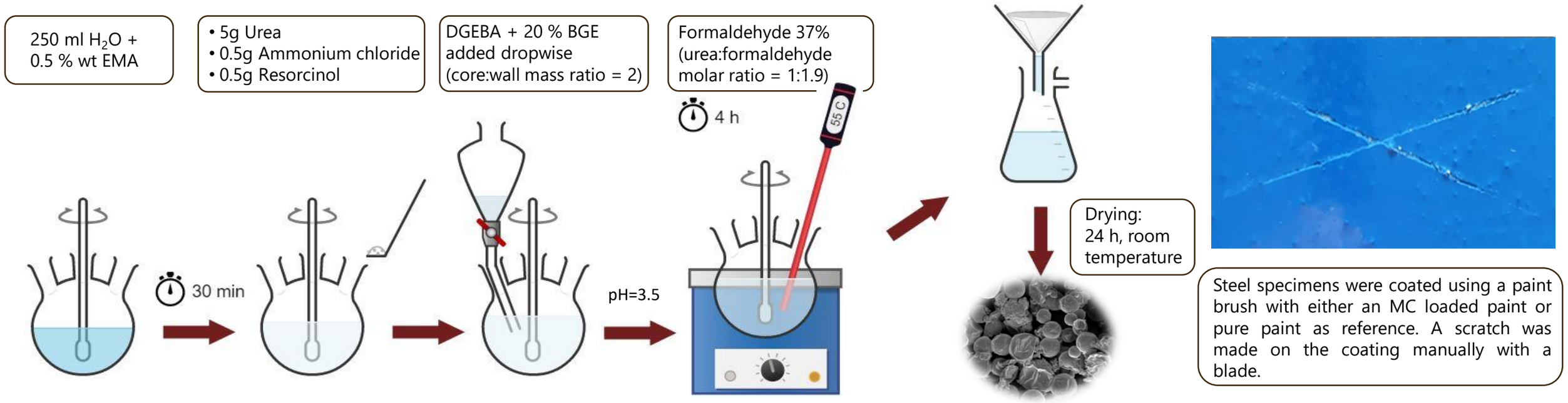
Introduction

Protective coating failure leads to substrate wear, increasing the need for maintenance. Self-healing systems can offer autonomous crack repair and increase the coating service lifetime, e.g. for marine applications. Polymeric microcapsules (MCs) containing healing agents can be used in that perspective. In case of micro-cracks, MCs are ruptured and the healing agent flows into the crack. The released agent comes into contact with the catalyst embedded also in the matrix and is polymerized, bonding the crack faces.
Epoxy loaded MCs with poly(urea-formaldehyde) shell were herein successfully prepared, using one step *in situ* polymerization.
The prepared MCs were dispersed in a commercially available alkyd-based paint along with the catalyst. Electrochemical impedance spectroscopy (EIS) was used to evaluate the self-healing properties of the coating.

Methodology

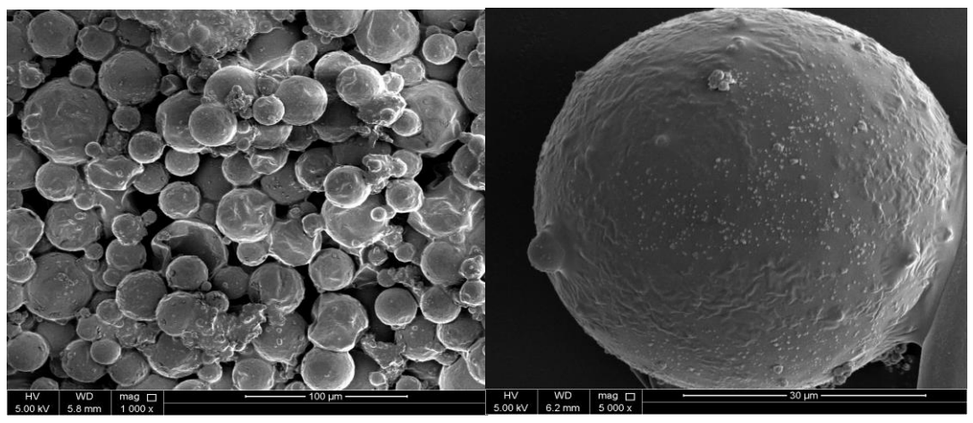


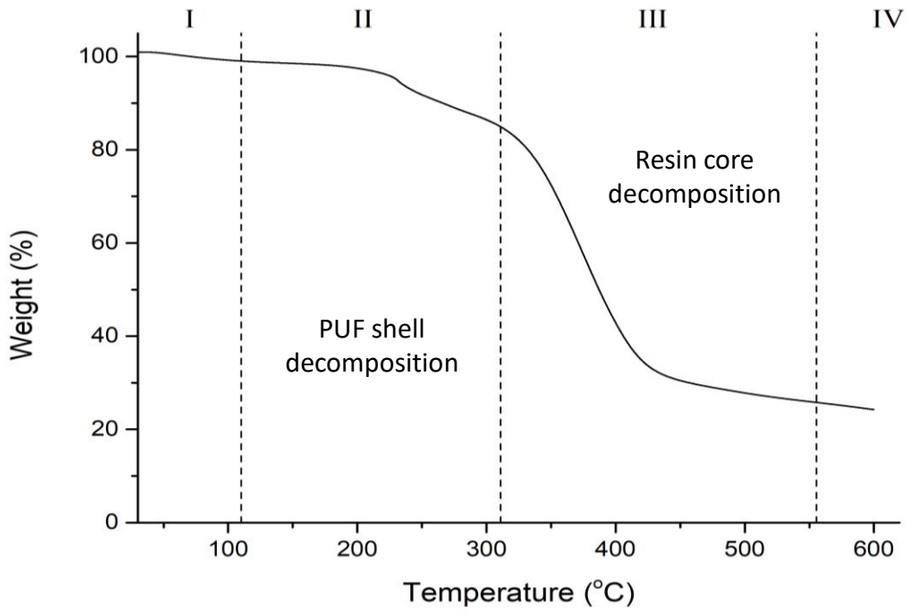
Steel specimens were coated using a paint brush with either an MC loaded paint or pure paint as reference. A scratch was made on the coating manually with a blade.

Results

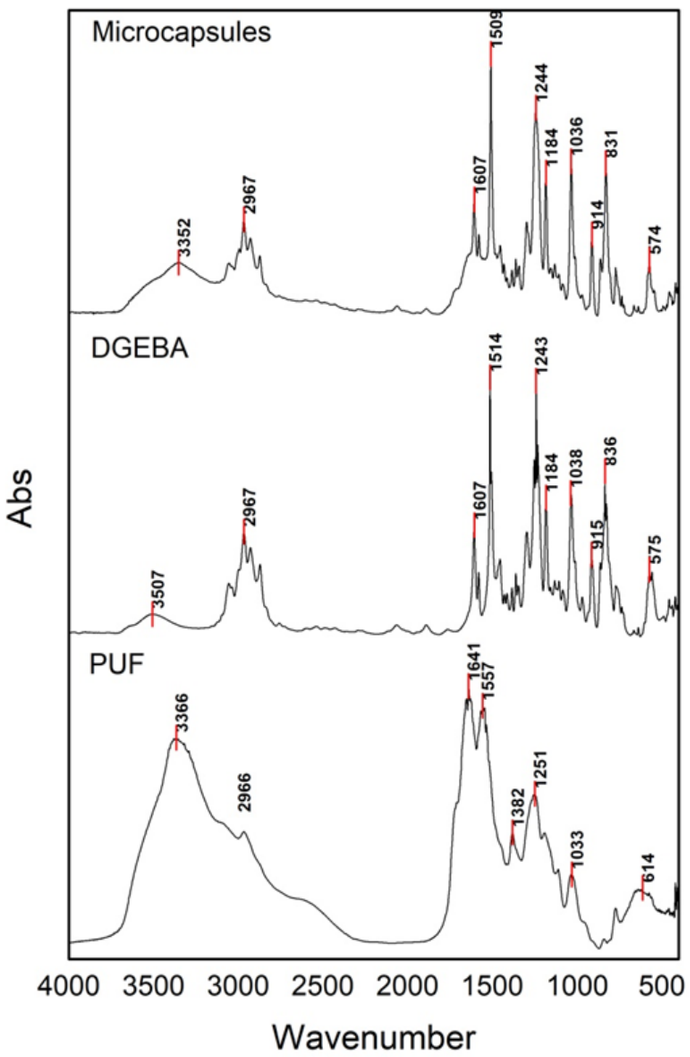
In situ polymerization

Mean diameter: 37 μm, Encapsulation efficiency: 78 %

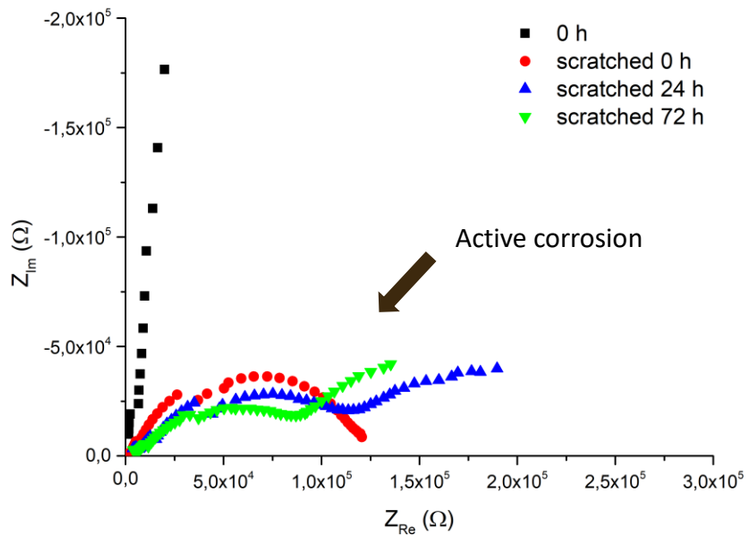


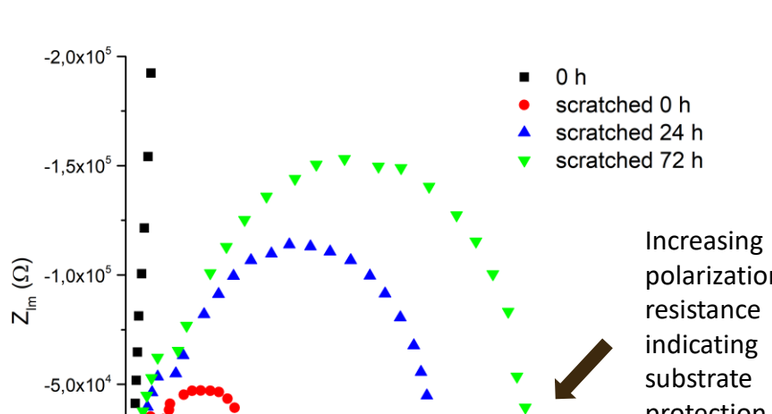


FTIR suggests high crosslinking extent of the PUF shell



Electrochemical Impedance Spectroscopy





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