ELECTRODEPOSITED ZINC-NANOCOMPOSITE-COATINGS AND MULTI-COMPONENT-COATINGS FOR SMART CORROSION PROTECTION

T. H. Tran [1], A. Vimalanandan [1], D. Crespy [2], J. Fickert [2], K. Landfester [2], J. Kron [3], G. Schottner [3], K. Egly [3], G. Sextl [3], M. Jobmann [4], B. Paulke [4], F. Börner [4], M. Rohwerder [1]

[1] *Max-Planck-Institut für Eisenforschung GmbH, Max-Planck Str. 1, 40237 Düsseldorf, Germany – e-mail: tran@mpie.de; vimalanandan@mpie.de, rohwerder@mpie.de,*
[2] *Max-Planck-Institute for Polymer Research, Ackermannweg 10, 55128 Mainz, Germany – e-mail: crespy@mpip-mainz.mpg.de;*
[3] *Fraunhofer Institut für Silicatforschung ISC, Neunerplatz 2, 97082 Würzburg, Germany – e-mail: johanna.kron@isc.fraunhofer.de; gerhard.schottner@isc.fraunhofer.de; karine.egly@isc.fraunhofer.de, gerhard.sextl@isc.fraunhofer.de*
[4] *Fraunhofer Institut für angewandte Polymerforschung IAP, Geiselbergstraße 69, 14476 Potsdam-Golm, Germany – e-mail: monika.jobmann@iap.fraunhofer.de; paulke@iap.fraunhofer.de; frank.boerner@iap.fraunhofer.de*

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ABSTRACT

Corrosion is one of the main factors for the deterioration of technical components, especially for metallic ones. Therefore the development of smart corrosion protection systems for metallic components is of upmost importance. In this work, two concepts for smart corrosion protection are shown.
Smart corrosion protection stands for a targeted delivery of corrosion inhibitors to a corrosion site when this starts to actively corrode, and only then. In the meanwhile, the inhibitors should be safely stored inside the coating, if possible even for decades. Storing them inside protective zinc coatings seems to be the ideal choice. For that purpose, surface modified mesoporous silicon based nano-carriers filled with corrosion inhibitors were incorporated into zinc coatings. Mesoporous silicon based nano-spheres are used as nano-carriers because of their high stability and insolubility at acidic electrodepostion conditions of the galvanizing bath and their solubility at higher pH. The idea is that they are released when zinc is corroding and then slowly release their content by dissolving at the higher pH, especially at the cut edge. It will be shown by Scanning Kelvin Probe (SKP) measurements at the cut edge that a slow but steady passivation of the surface under corrosive conditions can thus be achieved.
After corrosion inhibition the next step is real site selective self-healing by forming a protective polymeric barrier film isolating the inhibited metal surface from aggressive and corrosive media. For that purpose a 2-component layer system consisting of a zinc coating with incorporated surface modified nano capsules filled with catalyst and an organic top coating with embedded nano capsules filled with healing agents is used. By contact of healing agent and catalyst a ROMP (ring opening metathesis polymerization) is initiated which leads to the formation of a thin polymer film that seals off the defect and stops the further corrosion.