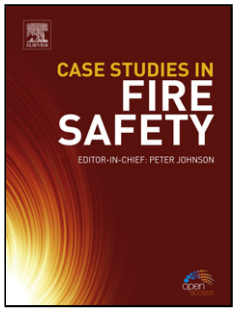

Title: Self-healing mechanisms in smart protective coatings: a review

Authors: Fan Zhang, Pengfei Ju, Mengqiu Pan, Dawei Zhang, Yao Huang, Guoliang Li, Xiaogang Li

PII: S0010-938X(17)32230-8
DOI: https://doi.org/10.1016/j.corsci.2018.08.005
Reference: CS 7641

To appear in:

Received date: 15-12-2017
Revised date: 30-7-2018
Accepted date: 6-8-2018

Please cite this article as: Zhang F, Ju P, Pan M, Zhang D, Huang Y, Li G, Li X, Self-healing mechanisms in smart protective coatings: a review, *Corrosion Science* (2018), https://doi.org/10.1016/j.corsci.2018.08.005

Self-healing mechanisms in smart protective coatings: a review

Fan Zhang[a], Pengfei Ju[b], Mengqiu Pan[a], Dawei Zhang[a,*], Yao Huang, Guoliang Li[c,*], Xiaogang Li[a]

a. Beijing Advanced Innovation Center for Materials Genome Engineering, Institute for Advanced Materials and Technology, University of Science and Technology Beijing, Beijing 100083, China

b. Shanghai Aerospace Equipment Manufacturer, Shanghai 200245, China

c. Institute of Process Engineering, Chinese Academy of Sciences, Beijing 100190, China

Corresponding author:
Dawei Zhang (dzhang@ustb.edu.cn); Guoliang Li (glli@ipe.ac.cn)

Abstract

Self-healing coatings inspired by biological systems possess the ability to repair physical damage or recover functional performance with minimal or no intervention. This article provides a comprehensive and updated review on the advantages and limitations associated with common autonomous and non-autonomous self-healing mechanisms in protective organic coatings used for anti-corrosion purposes. The autonomous healing mechanisms are often enabled by embedding polymerizable healing agents or corrosion inhibitors in the coating matrices. For non-autonomous mechanisms, the healing effects are induced by external heat or light stimuli, which trigger the chemical reactions or physical transitions necessary for bond formation or molecular chain movement.

A. Organic coatings; A. Polymer; C. Interfaces

1. Introduction

Corrosion poses a substantial economic burden and may result in severe safety and environmental hazards[1]. A recent study estimated the total annual cost of corrosion in China at over 310 billion US dollars, representing 3.34% of the country's GDP[2]. If the same percentage is applied to global economy, the total cost of corrosion worldwide amounts to ~2.5 trillion US dollars per year. Among the corrosion mitigation measures, organic protective coatings are the most widely used, and their costs add up to two-thirds of all anti-corrosion expenditures[2].

Protective organic coatings are essentially polymeric composites which possess