Autonomic Materials™

Problem

- Corrosion costs the global economy **$2 trillion per year**. It is inevitable; it is everywhere; and it is not going away.

- Typical protective coatings are passive and **suffer from a performance deficit after damage.**

- The deficit in the ability of coatings to protect the underlying substrate **shortens the lifecycles of critical assets leading to costly downtime and catastrophic failure.**

- Repainting is time-consuming, laborious, and expensive.



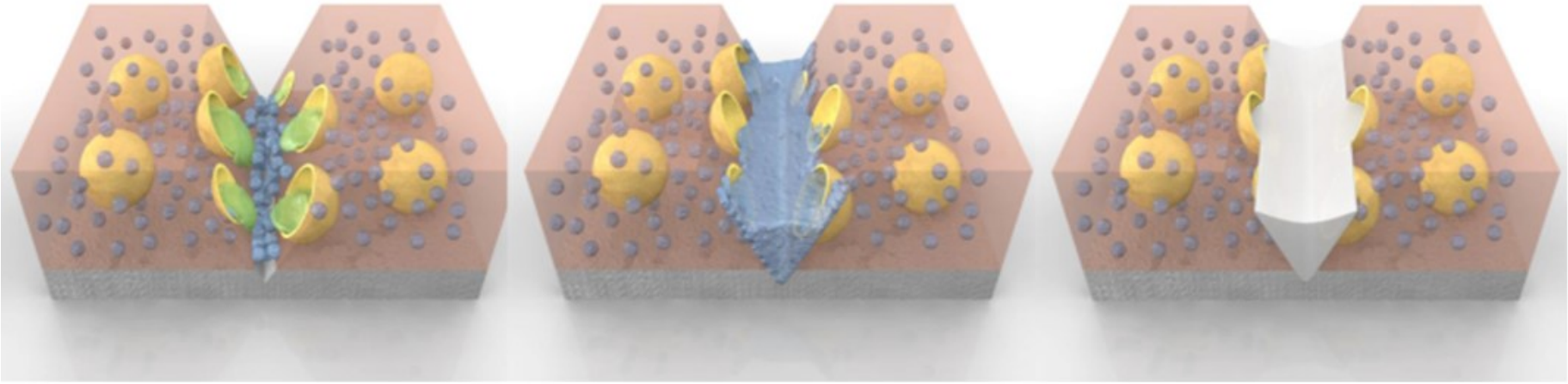



Solution

- Microencapsulated healing agents enable coatings to “heal” after damage
- Inspired by nature; as blood clotting heals wounds, coatings incorporating AMI products polymerize to heal damage.
- Autonomic: acting or occurring involuntarily. The healing occurs without external intervention.
- AMI’s proprietary solutions enable coatings, sealants and adhesives to “self-heal” thereby extending their service life and protecting underlying assets from corrosion.
- Paint with “AMI inside” makes conventional paint obsolete!

How it Works

*Self-healing coatings **enabled by AMI's technology** maintain corrosion resistance after damage through the encapsulated delivery of proprietary liquid healing agents.*



Microcapsules ruptured by damage → Healing agent released to damage site → Healing agent polymerizes and heals damage

Where is it Relevant?

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Protection of metal assets that are likely to be damaged before or during installation, are operated in corrosive environments, can be difficult to access for maintenance and downtime is very costly.

Industrial Maintenance

Oil & Gas

Infrastructure

Transportation

Military & Marine

Consumer

The Results are Dramatic!

AMI's Self-healing additives maintain corrosion resistance after coating damage.

TRADITIONAL COATINGS FOR PROTECTION OF METAL ASSETS

IMPROVED CORROSION RESISTANCE WITH SELF-HEALING TECHNOLOGY

Self-Healing Leads to Cost Savings

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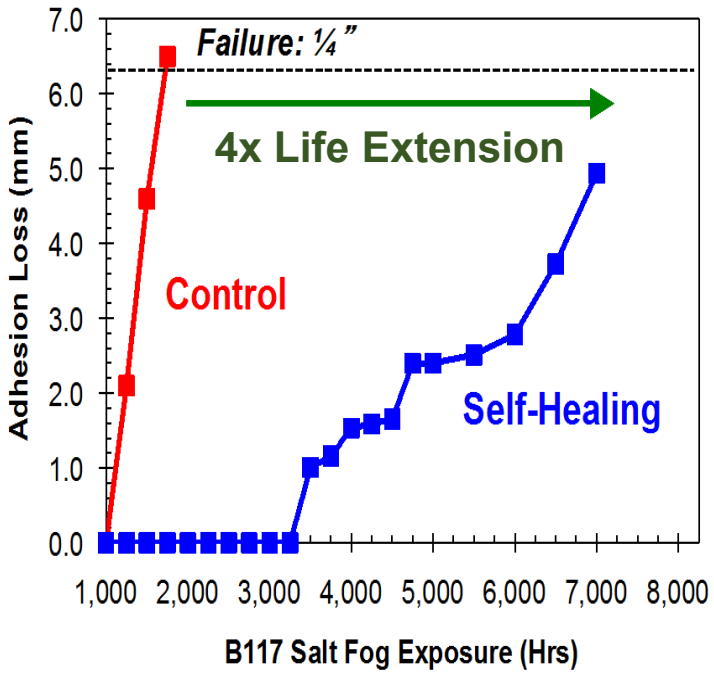
Enabling significant ROI to Asset-Owners through lower labor costs and less downtime

4X LIFE EXTENSION DEMONSTRATED IN COMMERCIAL SELF-HEALING COATING*



Accelerated Exposure

SIGNIFICANT REDUCTION OF OFFSHORE OIL RIG MAINTENANCE COST**

> $10M Cost Savings Over Life of Asset with 2X Improvement in Coating Performance

***** Source: NACE***

Summary of Our Results on Steel Substrates

Autonomic Materials

Over 32 systems evaluated with an an average life extension of 150%

Commercially Available Liquid Epoxy Coating

With “AMI Inside”

Commercially Available Powder Coating

With “AMI Inside”

Liquid Epoxy-Based Coatings

System	Average Creep	Corrosion Rating	Life Extension
Controls	11.5	2	
With ”AMI” Inside	3.3	5	150%

Powder Coatings and Fusion-Bonded Epoxies

System	Average Creep	Corrosion Rating	Life Extension
Controls	14.4	1	
With ”AMI” Inside	4.7	5	400%

Summary of Our Results on Steel Substrates

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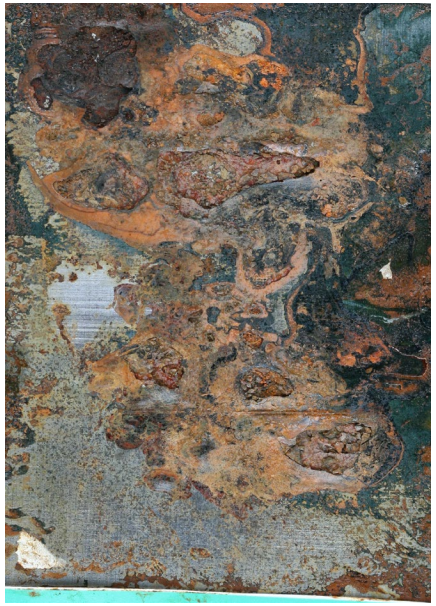
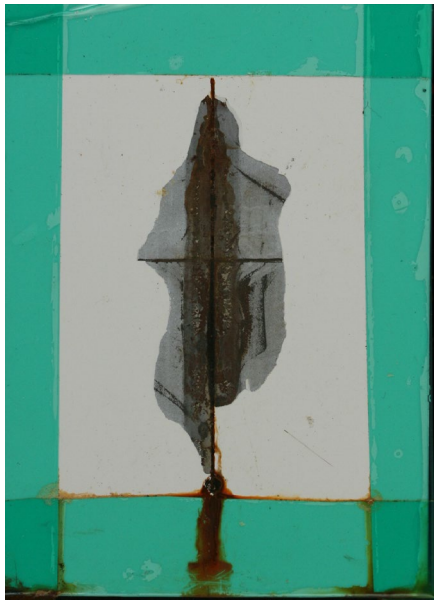
Over 32 systems evaluated with an an average life extension of 150%

Commercially Available Silicone Coating



With "AMI Inside"

Commercially Available Acrylic Coating



With "AMI Inside"

Liquid Non-Epoxy Coatings

System	Average Creep	Corrosion Rating	Life Extension
Controls	13.7	1	
With "AMI" Inside	1.6	7	600%

Water-Borne Coatings

System	Average Creep	Corrosion Rating	Life Extension
Controls	14.2	1	
With "AMI" Inside	2.1	6	500%

Deliver Reporting Capability Along with Healing Capability

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Reporting Mechanism

VISUAL

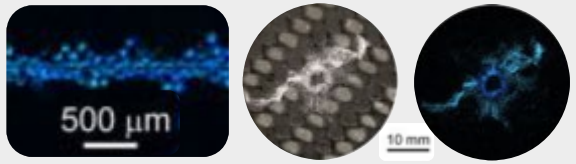
FLUORESCENCE

VISIBLE COLOR CHANGE

- Functionality by Chemical Reaction

DETECTABLE COLOR CHANGE

Coating and Composite Damage



- Rapid Release of UV Absorbing Agent

VISIBLE COLOR CHANGE

- Capsules Respond to pH Change
- Color Change by Released Indicator

DETECTABLE COLOR CHANGE

- Capsules Respond to pH Change
- Released Indicator Excited by UV light

MECHANICAL DAMAGE
Instant Detection

CORROSION
pH Responsive

Trigger Mechanism

Deliver Fouling Release and Antifouling Functionality

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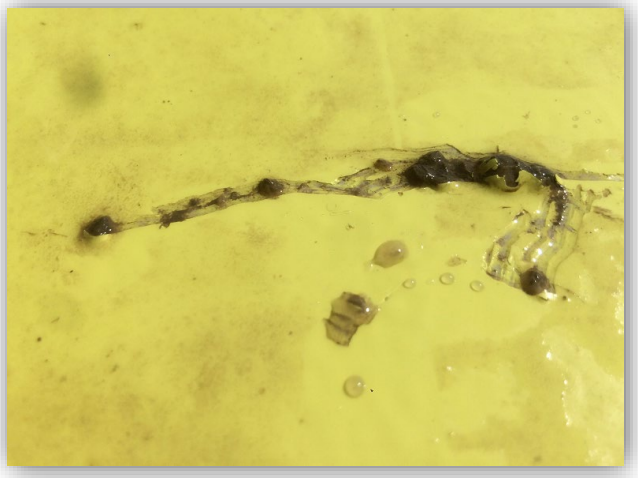
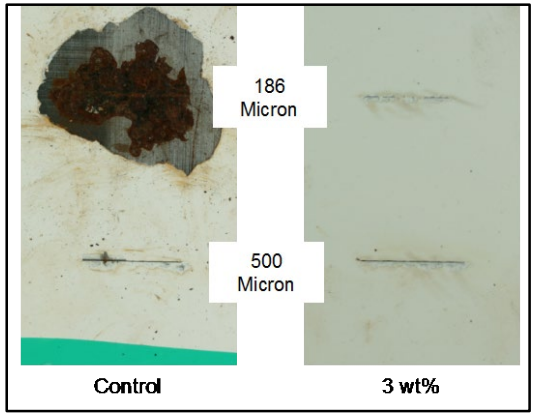
Current fouling release coatings are easily damaged allowing biomatter to take hold. Self-Healing functionality combined with biocidal activity can mitigate fouling.

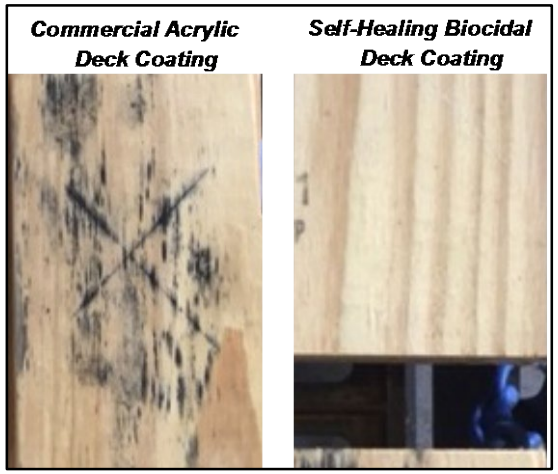


Damaged Coating Allows Barnacle to Adhere to Substrate

Solution: Healing & Antifouling



Healing and Maintenance of Adhesion to Steel in Silicone Coatings



Localized Biocidal Activity at Damage Site

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