An Inorganic Composite Coating for Pipeline Rehabilitation and Corrosion Protection

Milad Salemi, Graduate student, Hao Wang*, Assistant Professor, and P.N. Balaguru, Distinguished Professor

*hwang.cee@rutgers.edu; Department of Civil and Environmental Engineering

Rutgers, The State University of New Jersey, New Brunswick, NJ

Main Objective

Pipelines are susceptible to corrosion, mechanical damage, and stress corrosion cracking (SCC) that could increase maintenance cost and cause safety hazards. The aging and degradation of pipeline system induces the need of cost-effective repair techniques with ease of installation.

The proposed project aims to address the need for an inorganic coating composite for corrosion protection and rehabilitation of pipeline in aggressive environments. We propose to use nanomodification and fiber reinforcement to improve the performance of coating composite as corrosion barrier and strengthening system for pipeline.

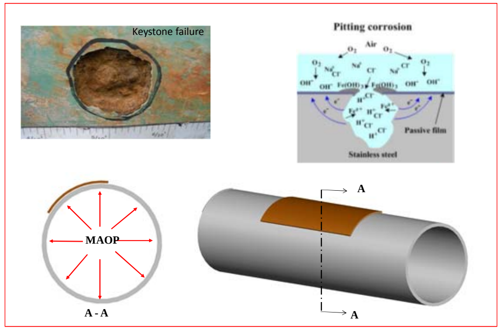

Figure 1. Pipeline Corrosion Failure and Repair.

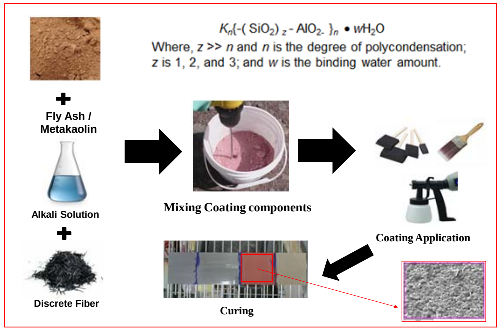

Figure 2. Inorganic Coating Composite.

Project Approach/Scope

- Development of Inorganic Coating Formulations
- Corrosion Testing of Coating with Electrochemical Measurements
- Durability and Adhesion Testing of Coating
- Strength Testing of Fiber-Reinforced Coating Composite
- Analytical Study of Pipeline Strengthening System

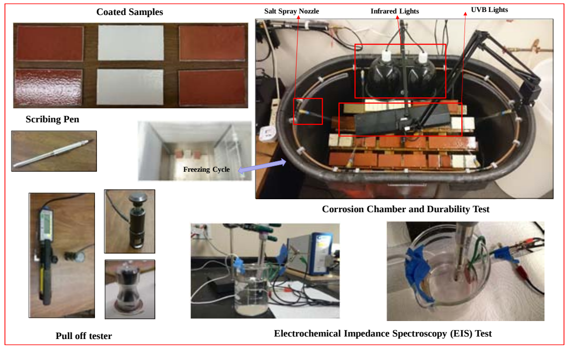

Figure 3. Electrochemical Measurements and Pull-Off Strength Test after Accelerated Corrosion

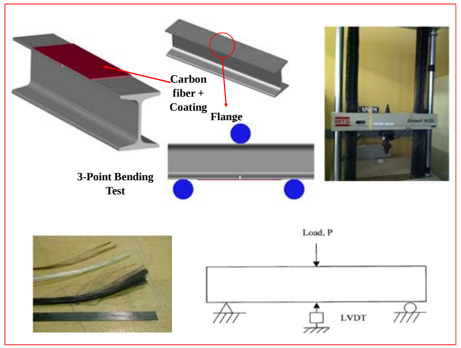

Figure 4. Laboratory Testing of Fiber-Reinforced Composite for Repair.

Expected Results and Results to Date

- The coating is in the class of geopolymer with least impact on generation of CO_2 emission.
- The coating can provide protection against corrosion where the pipelines are exposed to moisture and chemicals that cause corrosion.
- The coating can maintain good adhesion with fiber-reinforcement and pipeline surface to strengthen the pipeline structural integrity.
- The coating has high mechanical strength and abrasion resistance and hence surface damage due to occasional impact or soil movement is protected.

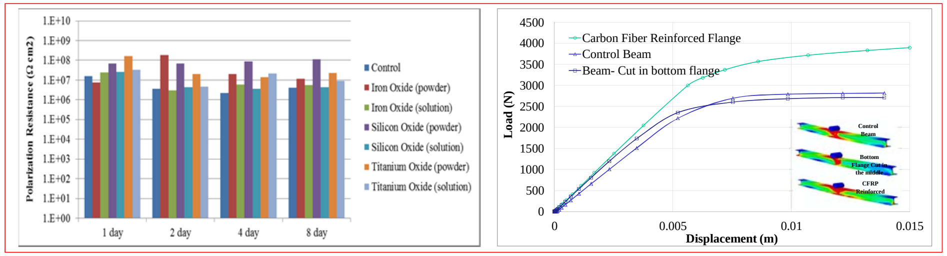

Figure 5. Left: Polarization Resistance from EIS Test and Right: Simulation of Composite Repair.

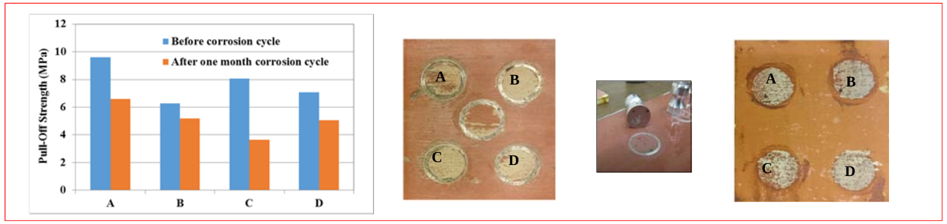

Figure 7. Adhesion Strength Test Results.

Acknowledgments

This project is funded by DOT/PHMSA's Competitive Academic Agreement Program. The authors would like to acknowledge Dr. Ning Xie and Mr. Yujun Liang (student) at Montana State University for conducting EIS testing.

References

ASME (2006) Repair of pressure equipment and piping, ASME PCC-2–2006, New York.

Zaarei, D. et al. (2008) Structure, properties and corrosion resistivity of polymeric nanocomposite coatings based on layered silicates, J. Coat. Technol. Res., 5, 241-249.

Balaguru, P. N. and K.W. Lee. (2001) Effectiveness of High Strength Composites as Structural and Protective Coating for Structural Elements, Final Report NETCR 28.

Public Project Page

Please visit the below URL for much more information:

https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=635