Development of New Multifunctional Composite Coatings for Preventing and Mitigating Internal Pipeline Corrosion

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Main Objective

This project was awarded to "Dr. Zhibin Lin's Research Group, NDSU" in order to *develop new functionalized high-performance composite coatings that reduce interrelated corrosion-fouling-wear issues, effectively elongate the performance life of metallic pipelines and ultimately protect them under severe corrosive environments.*

Figure 1. Internal corrosion[1]

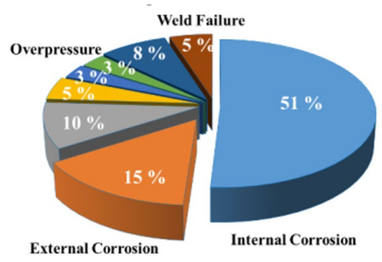

Figure 2. Dominant internal pipe[2]

Project Approach/Scope

As shown in Figure 3, the proposed coating was contributed by the three modifications as listed below: 1) superamphiphobic layer, 2) modified resin, and 3) hybrid nanofiller reinforcement.

The following properties were evaluated for the developed nanocomposite coatings, as these properties play a vital role in the protection a metal substrate.

- *Corrosion resistance*
- *Abrasion resistance*
- *Mechanical strength*
- *Water/oil repellency*

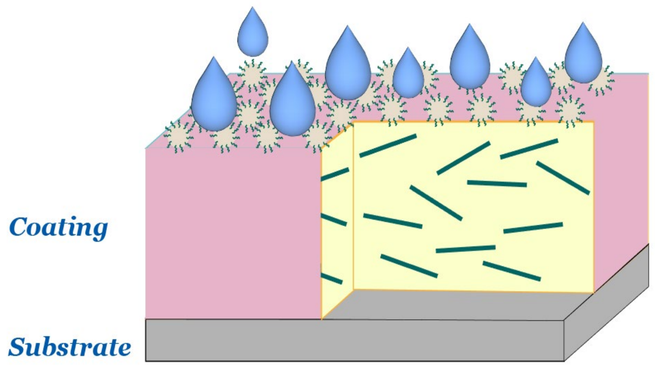

Figure 3. Proposed high-performance multifunctional coating

Results to Date

Strong reinforcement was obtained in the proposed nanocomposite coating. The integration of ani-corrosion, mechanical strength, water & oil repellency, and long-term durability was observed, which is rarely offered by conventional coatings.

Abrasion resistance:
- *reduced mass loss*

Mechanical strength:
- *improved strength*

Corrosion resistance:
- *intact coating film after long-term durability test*

Water/oil repellency:
- *superamphiphobic surface*

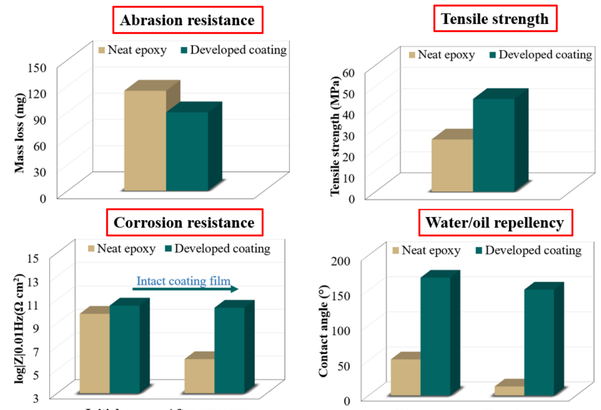

Figure 4. Improved performance obtained in the developed coating

Excellent water repellency:
- *Water droplet was easily detached from the surface and remained on the tip.*

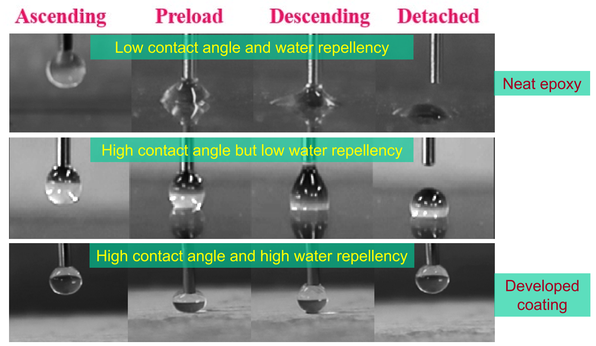

Figure 5. Water droplet ascending and descending of the coating surface

Acknowledgments

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References

[1] Photo from https://c1.staticflickr.com/6/5096/5416927808_82c3fe27d8_b.jpg.
[2]. Nalli, K. "Aovid internal corrosion with glass-reinforced plastic", Pipeline and Gas Journal, Vol. 239, 2012

Public Project Page

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