# CAAP Quarterly Report

Date of Report: *April 5th, 2018*

Contract Number: *693JK31850009CAAP*

Prepared for: *U.S. DOT Pipeline and Hazardous Materials Safety Administration*

Project Title: New Bio-Inspired 3D Printing Functionalized Lattice Composites for Actively Preventing and Mitigating Internal Corrosion

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For quarterly period ending: *April 7th, 2018*

## Business and Activity Section

### (a) Generated Commitments

No changes to the existing agreement

### (b) Status Update of Past Quarter Activities

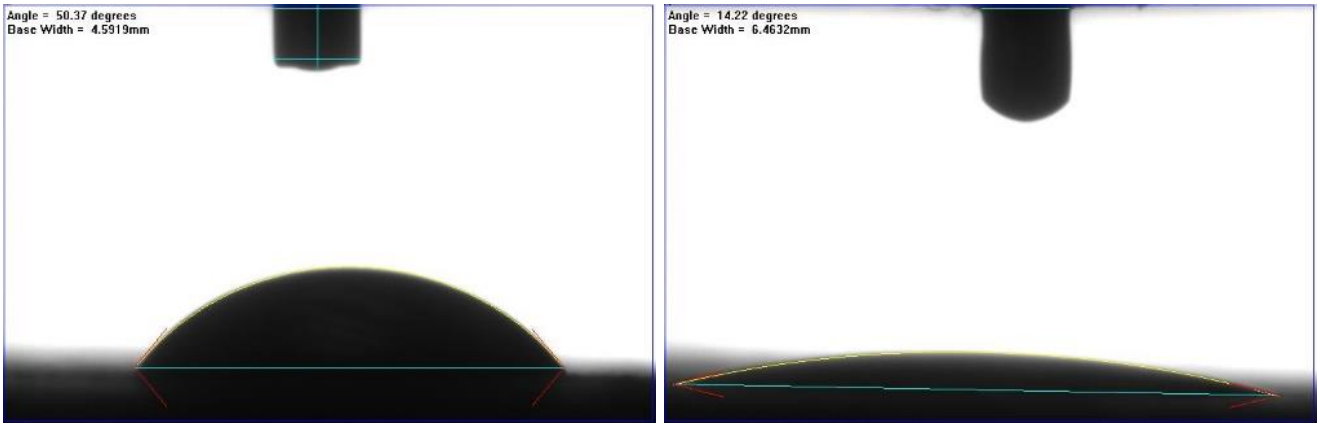
### 2.1 Selection of proper 3-D printable polymers

To achieve the 3-D printing structured architecture for desirable mechanical and chemical properties required in pipeline environments, the research work in this quarter aimed to select proper 3-D printable polymers, and characterize the selected 3-D printed materials.

With the prepared 3-D printed specimens, the characterization was conducted through the contact angle tests for understanding of their properties after the process of the 3-D printing.

ASTM D7334 contact angle test, illustrated in Fig. 1, was used, where the specimen was placed in the test plate and a drop of a specific volume of water (and then hexadecane), and results were typically shown in Fig. 2.

**Fig. 1** Equipment used for contact angle test




(a) Water to the substrate surface (b) Hexadecane to the substrate surface

**Fig. 2** typical contact angle of the 3-D printed specimens.

### 2.2 Synthesis of the materials

The second direction herein was to synthesize the materials that will use as the surface treatment. As stated in section 2, the origin 3-D printed specimens did not exhibit the favorable properties. Thus, this direction was to synthesize the materials with desirable behavior. The results of contact angles and sliding angle were measured as schematically shown in Fig. 3. The findings in this report could assist us to test the concept using the 3-D printed lattice structures in the next report.


(a) Contact angle (b) Sliding angle

**Fig. 3** Contact angle and sliding angle

**(c) Description of any Problems/Challenges**

No problems are experienced during this report period

**(d) Planned Activities for the Next Quarter**

The planned activities for next quarter are listed below:

- First direction will characterize the 3-D printable polymers and,
- Another direction will explore synthesis and optimization of the nano-modified composite.