Wettability Properties of 3D Printable Polymers and 3D Printed Structures for Engineering Applications

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Main Objective

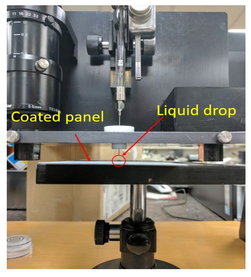
This project will develop a new bio-mimic functionally graded lattice composites to actively locate, capture and mitigate the corrosive water and other contaminants in pipeline, with specific tasks:

- ***To fabricate 3-D composite structures***
- ***To characterize and optimize the chemical activities***
- ***To characterize the long-term durability and reliability***

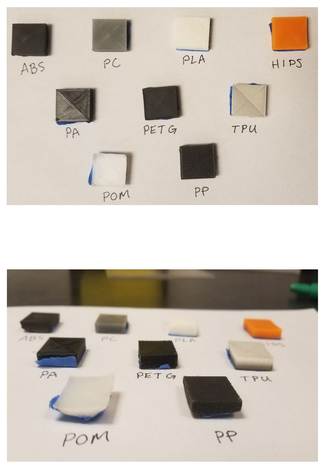
Project Approach/Scope

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

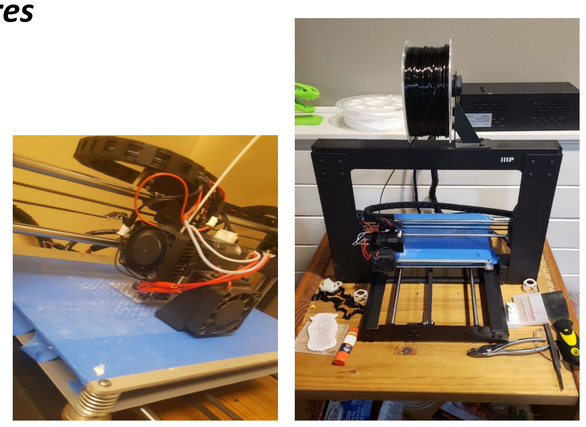
- ***Screening pools of 3-D printable polymers***
- ***Characterizing the wettability***
- ***Characterizing the surface treatment***
- ***Characterizing the 3-D lattice structures***



Characterization



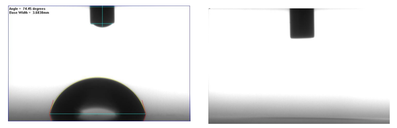
Material selection



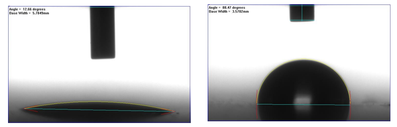
Designing the test specimen

Results to Date

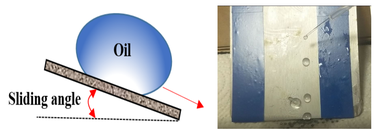
Nine different polymers were tested for water and oil contact angles to determine their theorized effectiveness in the proposed lattice system. In summary, the conventional 3-D printed polymeric materials had no favorable hydrophilic-oleophobic properties:



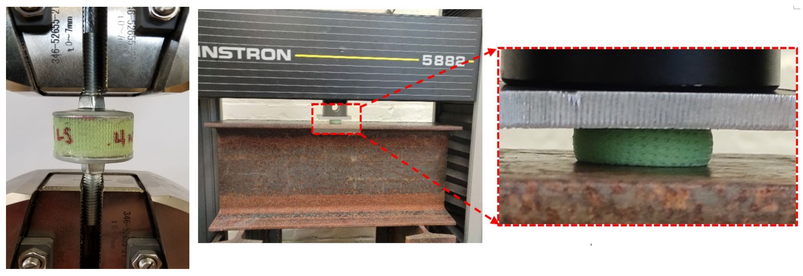
(a) Water (b) Hexadecane Before treatment



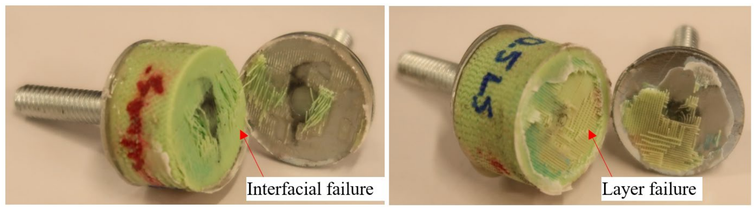
(a) Water (b) Hexadecane after treatment

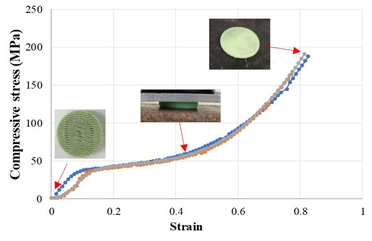


Sliding angle



Mechanical properties of the 3D printing lattice structures were evaluated in terms of tensile and compressive strength.





-Enhance the surface treatments that can better physically and/or chemically integrate with the lattice surface.

Acknowledgments

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Public Project Page

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