CAAP Quarterly Report

Date of Report: *Jull 11, 2016*

Contract Number: *DTPH5615HCAP07*

Prepared for: *DOT*

Project Title: *Electromagnetic Strategies for Locatable Plastic Pipe*

Prepared by: *The University of Tulsa*

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For quarterly period ending: *June 31, 2016*

Business and Activity Section

(a) Generated Commitments –

Supplies	Cost
Plastic Pellets	59.06
Lab supplies	41.72

Students working on project: Laura Waldman (MS 2018) – Material compounding and testing
Jordan Trewitt (MS 2018) – Electronic modeling and detection
Ravi Venkata OSU Student – Assistance on extrusion and molding

(b) Status Update of Past Quarter Activities

In the past quarter, we have completed the following research planning activities

1. Formally appointed all students.
2. Begun some initial compounding studies with metal flake for the embossing approach.
3. Began screening approaches for potential self-healing agents
4. Rescheduled in-person kick off for later this year.

Initial Compounding Studies

We bagan working on compression molding some initial polyethylene and aluminum flake samples to characterize the conductivity vs. wt% of the material. We are using compression molding as that allows us to rapidly make and characterize material samples. An image of two of the specimens ready for conductivity testing is shown in Figure 1. These samples will be testing using a four-point conductivity setup in our lab. We will use this information to develop some initial material parameters for the embossing approach. The high concentration is approximately 10 wt% of aluminum flake. So far this has been extremely easy to incorporate using a melt approach. We will add microcapsules to the PE using this approach based on these initial studies.

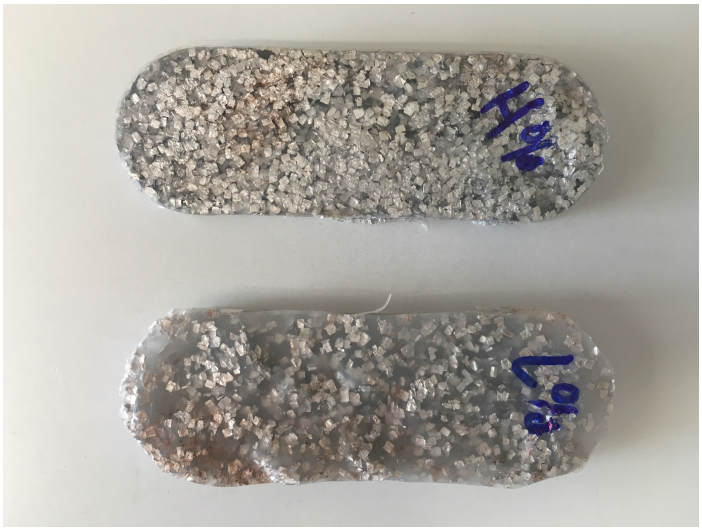

Figure 1: High and low concentration aluminum flake-loaded polyethylene samples.

Self-Healing Screening

In addition to the metal flake studies, we have been investigating potential healing chemistries to enable self-helaing PE pipe. We are currently adopting a solvent-based healing approach and have done some initial swelling screenings. Previous research on epoxies have shown that the ability of a solvent to swell a polymer is directly correlated to the ability to promote self-healing. For our initial studies we chose three solvents, chlorobenzene, hexanes, and toluene. These were chosen based on our established ability to microencapsulate these materials. We are continuing these studies with solvents that have higher boiling points ($T_b > 200^{\circ}C$). Based on previous experience, the results in Figure 2 indicate that chlorobenzene is a potential candidate as a healing agent.

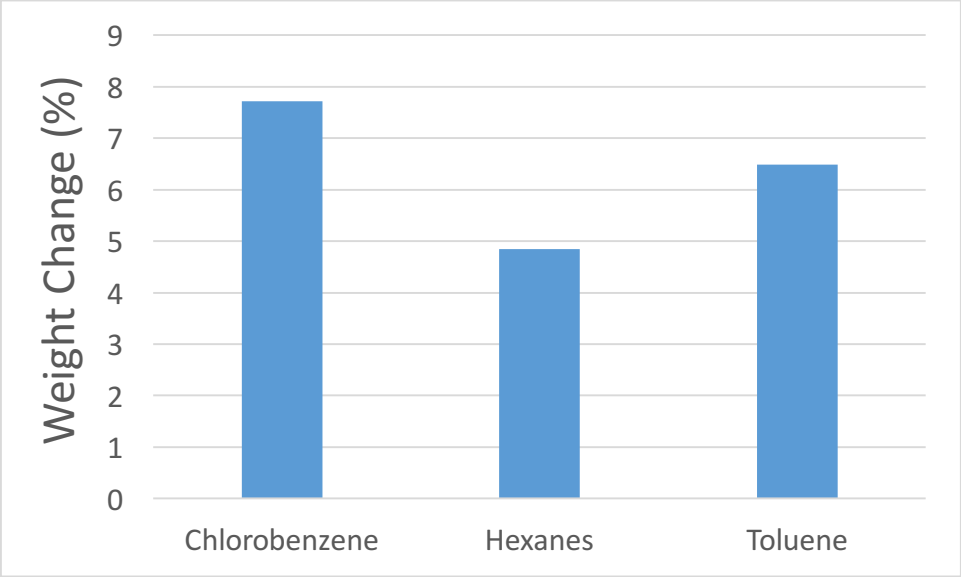

Figure 2: Weight change for three candidate solvents for self-healing.

(c) Description of any Problems/Challenges –

During this past quarter there were no significant challenges as we have just initiated the research project. Our EE student was not able to start in the lab until mid-July, so we expect the computation study of the RFID to start this quarter.

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

Planned activities for the next quarter include the following

1. Continue initial materials compounding
2. Initialization of analytical and computation study of RFID designs for pipe.
3. In-person Kick-off meeting will occur during June.