Semi-Annual Progress Report

Project Number and Title: 2.3: Measuring Adhesion Between Binders and Aggregates Using Particle Probe Scanning Force Microscopy at Low Temperatures
Research Area: Thrust 3 Use New Materials and Systems to Build Longer-lasting Bridges and Accelerate Construction
PI: *Ting Tan, University of Vermont*
Co-PI(s): *Co-PIs and home institution(s)*
Reporting Period: *06.01.2019 to 07.31.2019*
Date: *Date*

Overview: (Please answer each question individually)

Overview and summary of activities performed during previous six months

The funded start date of this project is 06.01.2019. The primary activities have been:

1. Fill out the project research team – PI Ting Tan has been working with an undergraduate student Austin Kopec for the binder substrate preparations during the summer of 2019. PI Tan has been working on the fabrication of particle probe scanning force microscopes.

2. For the experimental part, about nine particle probes have been fabricated by the PI, including three calcium carbonate, three alumina and three silica probes. For the modeling part, we have started the literature review of the modeling of adhesion between particle probes and the binder substrates, including the molecule types, the model sizes, the modeling software.

Context as to how these activities are helping achieve the overarching goal of the project

The research objectives of this project are to understand the adhesion between asphalt binders and representative aggregate minerals, including

1. experimental measurements using particle probes

2. modeling to understand the effects of chemical components on binder-aggregate adhesion.

Accomplishments achieved under the project goals

The accomplishments are primarily the results reported above, i.e. the fabrication of different particle probes, the literature review of the adhesion modeling and the modeling set-up efforts.

Opportunities for training/professional development that have been provided

UVM engineering undergraduate Austin Kopec participated in the research effort during the summer 2019.

Activities involving the dissemination of research results

No disseminations based on the research have been collected yet.

Participants and Collaborators:

Faculty participants:

Associate Prof. Ting Tan
Ting.Tan@uvm.edu
Civil and Environmental Engineering Department
University of Vermont
Burlington, VT 05405

Student participants:

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Austin Kopec
Undergraduate Student – graduated
Civil and Environmental Engineering
Role on project: assisted in binder substrate preparation

Organizations have been involved as partners on this project - NA

Other collaborators or contacts:

Vermont Agency of Transportation personnel have provided advice on the potential utility of a positive outcome of the research.

Changes:

Actual or anticipated problems or delays and actions or plans to resolve them

Because the scanning force microscope is broken, we are working dedicatedly to fix it. I propose to apply for a no cost extension of the particle probe project for 6 months. So, I will be more ready to perform the experimental part. Thank you for your consideration. All help is greatly appreciated.

Changes in approach and the reasons for the change: NA

Planned Activities:

Description of future activities over the coming months.

Planning for the research – Experimentally, we will fabricate more micro-cantilevers (5-10) in the next month. For modeling, we will complete the literature review of molecular modeling of adhesion between asphalt binders and particle probes, create Z-matrix molecular models for representative asphalt binders, test different mutual potentials of binder materials and set-up preliminary adhesion models based on representative asphalt binders.