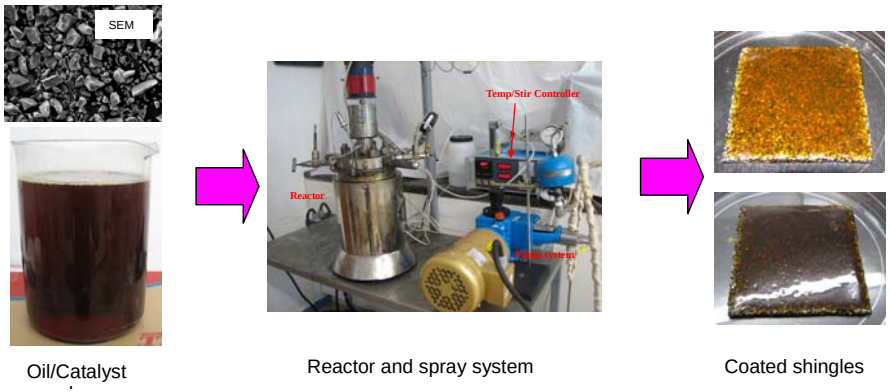
Project Objective:

To develop and demonstrate a waste cooking oil based thermochromic smart roof coating technology that can autonomously respond to temperature changes by adjusting the light transmission.

- Renewable and agriculture product
- Cost reduction
- Environmentally friendly
- Roof enhancement
- Energy savings
- Easy to implement



Bio-based roof coating process

Scope of Work:

• Scale up the coating production system to pilot scale;

• Evaluate the coating durability under accelerated exposure conditions, including UV treatment, thermal ageing, and thermal cycling;

• Study the effects of different oils sources on coating properties – waste cooking oils, waste corn oil, waste fish oil, algae oil, canola oil, and soybean oil;

• Demonstrate the coating technology for natural weather exposure at a weathering facility;

• Conduct field testing of the smart roof coating using prepared gable shed structures;

• Conduct an economic analysis.

Project Funding Supports:

DOE: $999,988 (SBIR)

Accomplishment:

200 L/batch reactor

1000 L/batch reactor

<u>Coating process scale up:</u> Two coating reactors have been built and successfully put into operation:

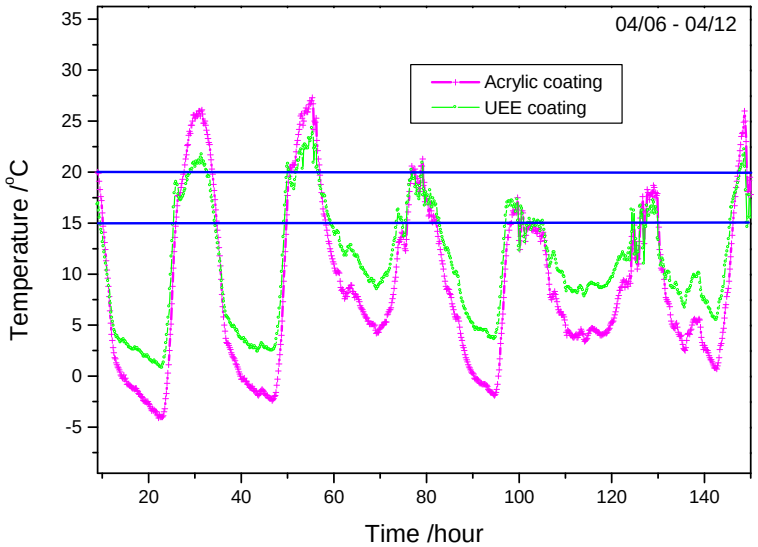
- 200 liters/batch reactor, and
- 1,000 liters/batch reactor

<u>Severe accelerated ageing test:</u> the accelerated ageing did not change the reflectances at both high and low temperatures of the coating - the coating had excellent resistance to thermal aging and UV degradation.

Temperature range: 20 – 90 ^{o}C; UV intensity: 21,700 microwatts/cm^2

<u>Coating using other types of renewable oils:</u> waste cooking oils, corn oil, and soybean oil are ideal for coating production

Accomplishment:



Field testing: The temperatures insides the insulated gable sheds were measured and monitored over time; the results indicated that the UEE coating had better temperature performance than acrylic coating, especially at low temperatures; the commercial white acrylic roof coating (*Ultra-Roof 1000*) had mini-cracks developed over time while no cracks were observed for UEE coating.

Next steps:

1) conduct an economic analysis and develop detailed business plan; 2) develop coating product specifications; 3) work with commercial partners to commercialize this technology.

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