

2016 UDOT RESEARCH PROBLEM STATEMENT

*** Problem statement deadline is March 14, 2016. Submit statements to Tom Hales at tahales@utah.gov. ***

Title: Efficiency of NO_x air pollution reduction with TiO₂ coatings

No. (office use): 16.04.02

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Select One Subject Area

Materials/Pavements

Maintenance

Traffic Mgmt/Safety

Preconstruction

Planning

Public Transportation

1. Describe the problem to be addressed.

The harmful air pollutant NO_x is formed from vehicle exhaust and can be high in hot summer days or cold inversion days across the state of Utah. A wide variety of paints and spray-on coatings have been developed and advertised as “self-cleaning” and contain TiO₂ nanoparticles said to effectively react and break down NO_x, SO_x, VOCs. Not all of these coatings actually reduce or are sustainable for reducing the air pollution.

2. Explain why this research is important.

Various manufactured coatings have been attempted to be sprayed on transportation infrastructure, particularly because it is near the source of the NO_x from vehicle emissions. This research is to aid UDOT in classifying which types of coatings are efficient at cleaning the harmful NO and NO₂ pollutants from the air. Previous research or field studies indicated that only a few TiO₂ products can be highly effective and efficient at removing such NO_x, yet other types of TiO₂ coatings claimed to be self-cleaning are not able to reduce NO_x nor are some long-lasting. If these spray-on coatings are to be used to clean up the air in Utah, it is crucial that UDOT implement the effective sustainable versions of these coatings.

3. List the research objective(s):

1. Quantify and compare the NO_x reduction efficiency of various TiO₂-coatings (e.g., PureTi, Drywired, LumActiv) applied to different constructed materials (e.g., galvanized steel, concrete, asphalt).

4. List the major tasks:

1. Obtain different materials (TiO₂ coatings)
2. Cut samples of constructed materials to fit in photocatalytic reactor (1ftx1ft square)
3. Run analyzer to measure NO_x efficiency for each combination of coating and constructed material backing
4. Analyze data and write report

5. List the expected results:

1. Create a database of TiO₂ coatings used now or could potentially be used by UDOT. For those tested, we would have the NO_x reduction efficiency range known.
2. Create a report of results and possible UDOT annual conference presentation

6. Describe how this research will be implemented.

After a selected type of TiO₂ is made, UDOT maintenance personnel can apply the selected TiO₂ coating materials to infrastructure. Future research or air pollution monitoring, such as through DAQ, will indicate the overall impact that the TiO₂ coatings can have with reducing the total NO_x pollutants in the regions across the state of Utah.

7. Requested from UDOT: \$60,000

Other/Matching Funds: \$

Total Cost: \$

(or UTA for Public Transportation)

8. Outline the proposed schedule, including start and major event dates.

Estimated start time August 2016. The plan is to monitor the TiO₂ efficiency initially and for 1.5 to 2 years of exposure to check for initial sustainability, in particular, longevity of the different coatings.