Instrumentation for Research on Nanotechnology-Based Infrastructure

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Disclaimer Statement

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16. Abstract Instrumentation is requested which will lead to the ultimate objective of promoting Rutgers as a leader in the study of sustainable transportation infrastructure. In recent years, nanotechnology has brought revolutions to engineering materials. The "bottom-up" concept behind nano-modification of materials has the potential to open up new uses and classes of infrastructure materials. Carbon nanotubes (CNTs) are inherently multifunctional and can serve as a structural reinforcement as well as a platform for sensing and healing due to their novel mechanical, electrical, and thermal properties. A research effort is planned to provide initial results on the fundamental behavior and functional performance of nanotube-modified asphalt material. The requested equipment will leverage additional funding from federal sources (NSF and FHWA). The Research Council award will generate preliminary data that will provide credibility for the junior faculty investigator toward future proposals.			
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Instrumentation for Research on Nanotechnology-Based Infrastructure Material

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1. Overview

Instrumentation is requested which will lead to the ultimate objective of promoting Rutgers as a leader in the study of sustainable transportation infrastructure. In recent years, nanotechnology has brought revolutions to engineering materials. The "bottom-up" concept behind nano-modification of materials has the potential to open up new uses and classes of infrastructure materials. Carbon-based nano-material are inherently multifunctional and can serve as a structural reinforcement as well as a platform for sensing and healing due to their novel mechanical, electrical, and thermal properties. A research effort is planned to provide initial results on the fundamental behavior and functional performance of nano-modified asphalt material. The requested equipment will leverage additional funding from other sources.

2. Project Outcome

An Omni Sonic Ruptor 400 Ultrasonic Homogenizer with processing tips was purchased in this project, which can be used to improve the uniform dispersion of carbon-based nano-additives in the asphalt binder. A software support to Materials Studio was also acquired, which provides a complete modeling and simulation environment designed to allow researchers to predict and understand the relationships of materials' atomic and molecular structure with its properties and behavior.

3. Significance and Potential Impact

The mechanical behavior and durability of infrastructure materials depend to a great extent on structural elements and phenomena which are effective on a micro- and nano-scale. The basic concept behind nano-modification of materials is that of "bottom-up" engineering, starting with engineered modifications to the molecular structure with an aim to affect the bulk properties of the material. This has the potential to open up new uses and classes of infrastructure materials with multifunctional properties. The requested instrumentation will enable preliminary investigation that will address fundamental behavior and functional performance of nanotube-modified asphalt material and catalyze future research directions.