PROGRESS AND PLANS OF NATIONAL NANOTECHNOLOGY INITIATIVE (NNI) AGENCIES

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U.S. Department of Agriculture (USDA)

Forest Service (FS)

Summary

Forest Service nanotechnology research fulfills the agency's mission-related priorities of creating new revenue for landowners, creating economic opportunities for rural communities, and incentivizing forest operations to improve forest health and fire prevention. The primary focus of Forest Service nanotechnology research is on producing cellulose nanomaterials from wood, and developing the science and technology for the application of cellulose nanomaterials in a broad range of industrial applications such as lightweight paper, strength-enhancing agents for concrete, rheology modifiers, improved packaging, and polymeric composites. Other nanotechnology research in the Forest Service includes improving understanding of the nanostructure of wood and wood properties and transportation phenomena in wood using nanotechnology techniques.

Key Technical Accomplishments by NNI Goal

Goal 1. Advance a World-Class Nanotechnology Research and Development Program

The USDA Forest Service is the leading organization in cellulose nanomaterials research in the United States. Many Forest Service cellulose nanomaterials research projects are conducted in partnership with the public private partnership P³Nano,[1] academic researchers, and private-sector companies. Several projects, such as developing a concrete strength enhancer (partners working on mixing), a green packaging material (working on thermal properties for processing), and an aerogel for oil-spill cleanup (validated in laboratory), are in various stages of completion. Dr. Joseph Jakes of the USDA Forest Service Forest Products Laboratory won the 2017 Forest Products Society Wood Engineering Achievement Award-Engineering Innovation in recognition of his work in understanding wood properties at the nanoscale, leading to improvements in wood adhesion and development of new high-performance wood composite materials.

Goal 2. Foster the Transfer of New Technologies into Products for Commercial and Public Benefit

To accelerate technology transfer, Forest Service R&D has partnered with P³Nano, industry, and academia on cellulose nanomaterials research projects. To ensure that the research projects are relevant to industrial partners, P³Nano facilitates industry input in project selection and project review. The Forest Service and academic partners are currently working on a demonstration project with engineers of Siskiyou County California to adopt the use of cellulose nanomaterials as a strength reinforcement in a concrete bridge. Forest Service experts are also actively involved in cellulose nanomaterials international standards

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[1] http://www.usendowment.org/p3nano.html

development in International Organization for Standardization (ISO) Technical Committee (TC) 6 (Pulp, Paper, and Board) and ISO TC 229 (Nanotechnologies).

Goal 4. Support Responsible Development of Nanotechnology

The Forest Service does not have expertise in nanotechnology-related environmental, health, and safety research, but supports ongoing industry projects to inform regulatory approval of cellulose nanomaterials.

Plans and Priorities by Program Component Area (PCA)

PCA 1. Nanotechnology Signature Initiatives and Grand Challenges

Most Forest Service nanotechnology R&D investments are in cellulose nanomaterials. The priorities are in manufacturing technologies for different types of cellulose nanomaterials and developing the science and technologies to facilitate new product development from different types of cellulose nanomaterials.

PCA 2. Foundational Research

Some Forest Service nanotechnology R&D investments are aimed at understanding wood properties at the nanoscale. This effort will lead to improved wood adhesives and development of high-performance wood-based composite materials.