

Cellulose Nanomaterials – A Versatile Material with Multiple Benefits

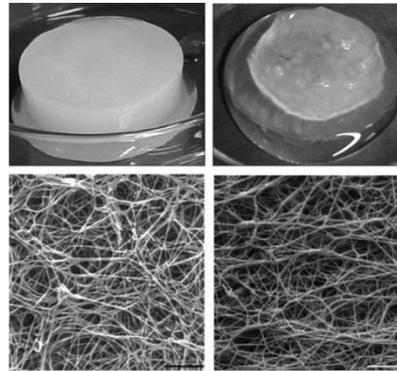
Dr. Cynthia West
Associate Deputy Chief
Forest Service R&D



Discoveries Leads to New Applications



Electronics



Hydrogel

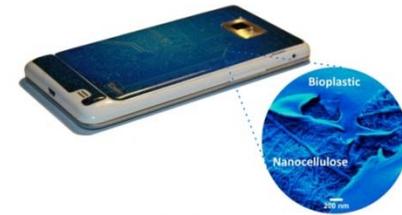
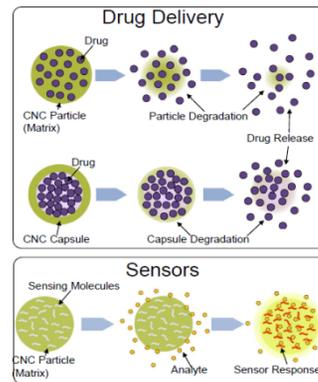


Illustration of a foreseen nano-composite for protection of smart phones. Photo: Gary Chinga-Carrasco, PFI.

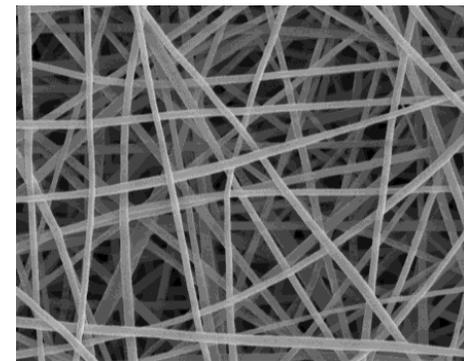
Bioplastic



Building Material



Core-Shell



New Fiber



There are 751 million acres of forest in the U.S. (33%)

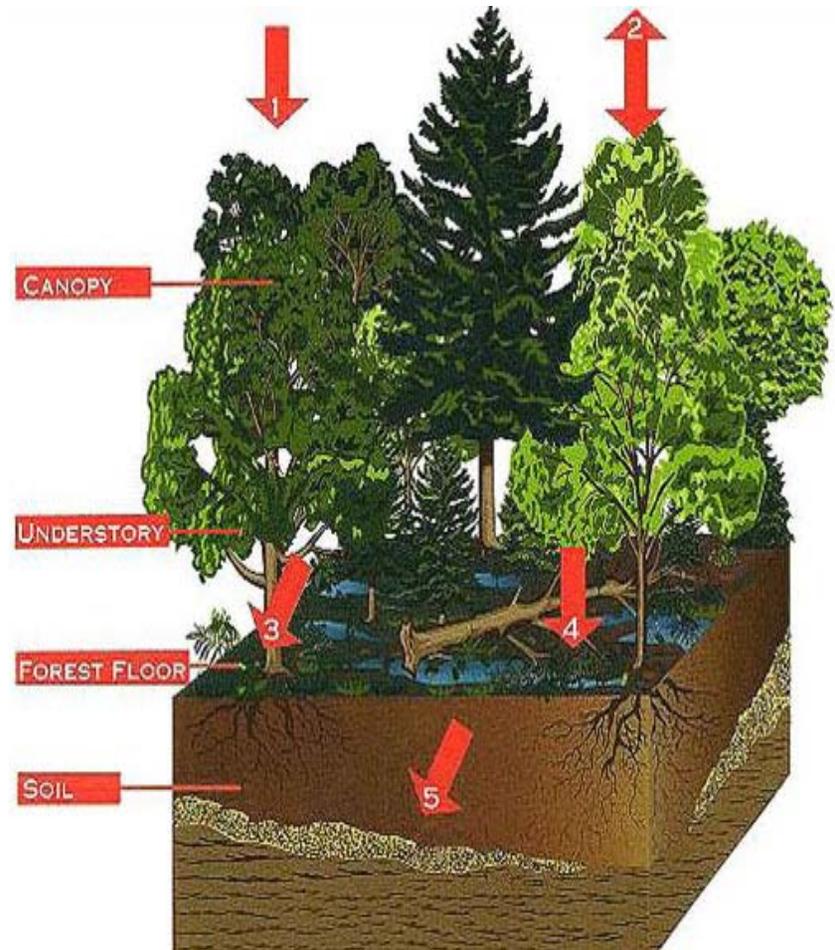


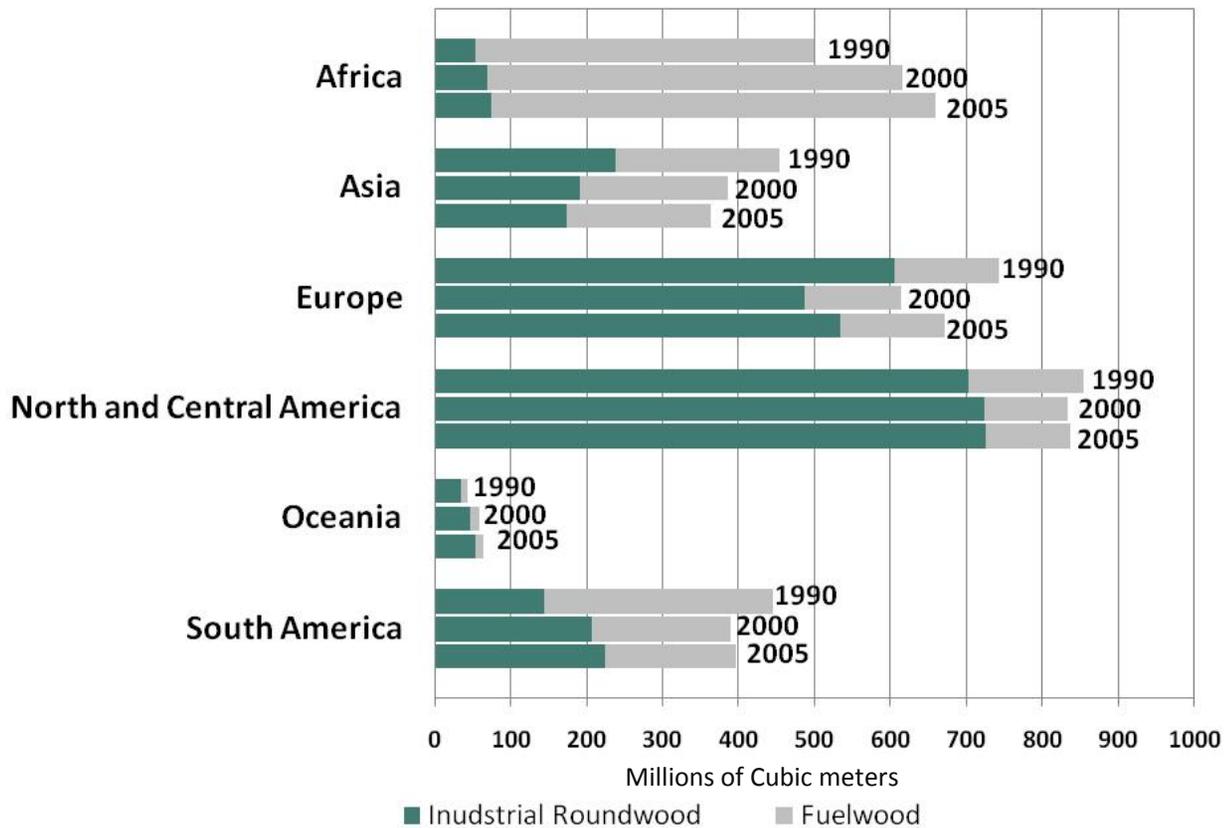
- 514 million acres are timberland that produce timber.
- More than 50% of the forest land is privately owned. Half of this is owned by individuals and families.
- About 44% of the forest land is controlled by federal, state and local governments.



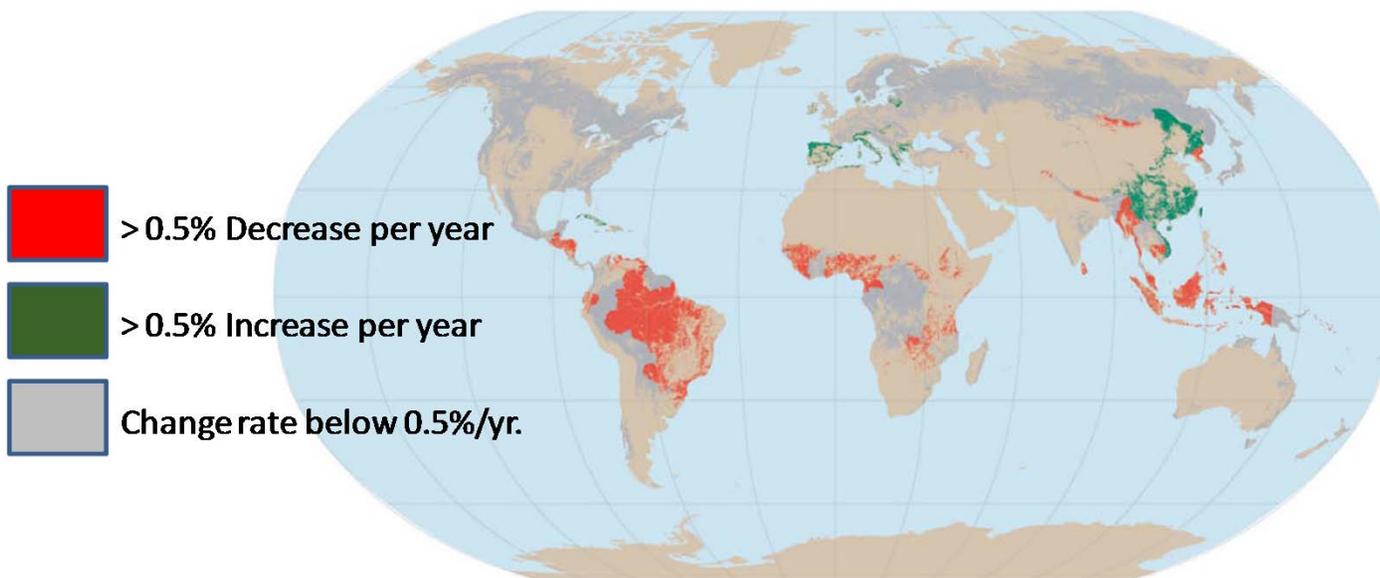
Forests are Essential to Life on Earth

- Climate control
- Soil water conservation
- Clean water
- Habitat for wildlife
- Recreation
- Produces oxygen, takes in carbon dioxide
- Supply timber and non-timber forest products
- Contributes to economic growth and create jobs

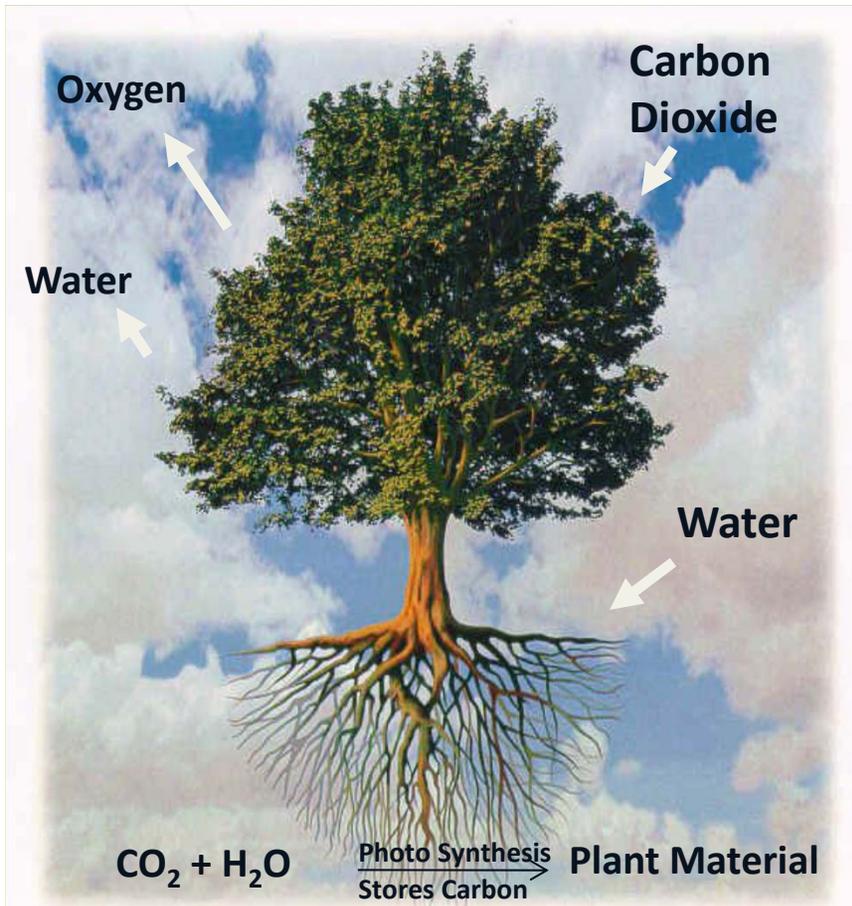




Countries with Highest Industrial use of wood have the most stable forest base



Forest Based Materials are Green and Renewable



- Photosynthesis produces plant materials from atmospheric carbon dioxide and water with solar energy.
- Atmospheric carbon is stored in trees and wood-based products.
- Wood-based nanomaterials are recyclable.
- Net zero carbon emission on a human time scale.
- Wood-based nanomaterials can replace petroleum-based materials to lower carbon footprint.

Forest Service is an NNI-Participating Agency

- Forest Service has participated in the NNI since 2005.
- Forest Service is one of the 29 NNI participating agencies.
- Cellulose Nanomaterials is on the thrusts of the Sustainable Nanomanufacturing Signature Initiative.



The NNCO
Is the coordination office of the NNI

The National Nanotechnology Coordination Office (NNCO) was established in 2001 to provide technical and administrative support to the NSET Subcommittee, serve as a central point of contact for Federal nanotechnology R&D activities, and perform public outreach on behalf of the National Nanotechnology Initiative.

The National Nanotechnology Initiative

Leading to a revolution in technology and industry that benefits society

Contact the NNCO

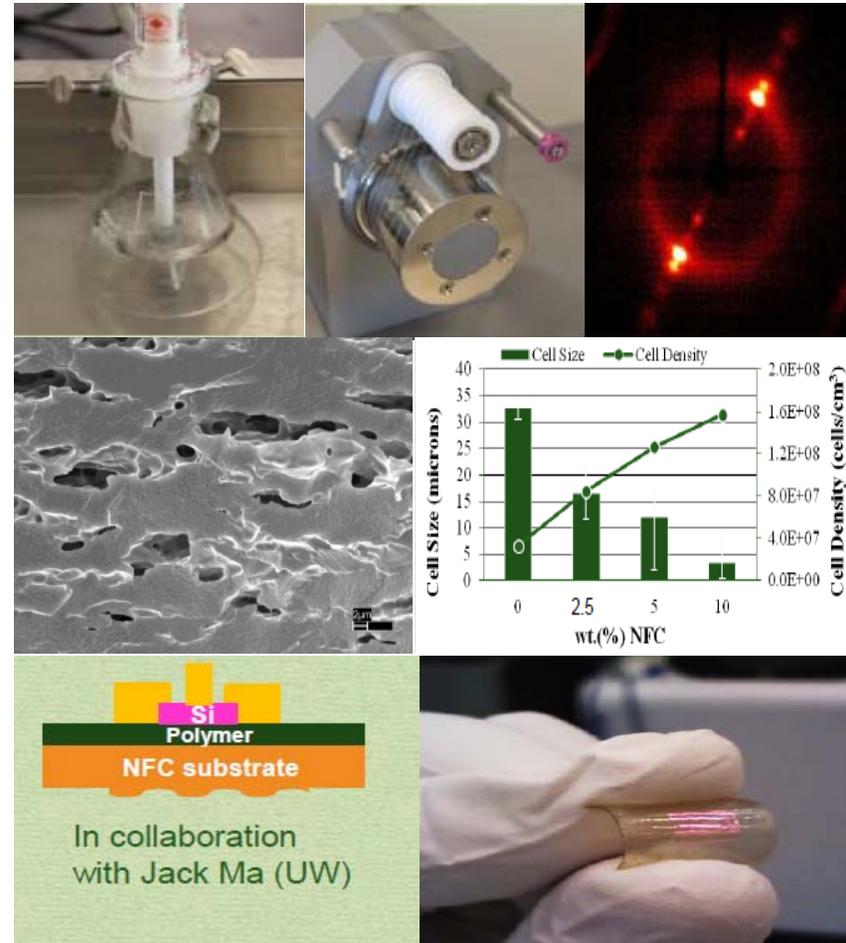
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Cover image: credit Oak Ridge National Laboratory

The NANO.gov logo, featuring a stylized sunburst icon to the left of the text 'NANO.gov'.

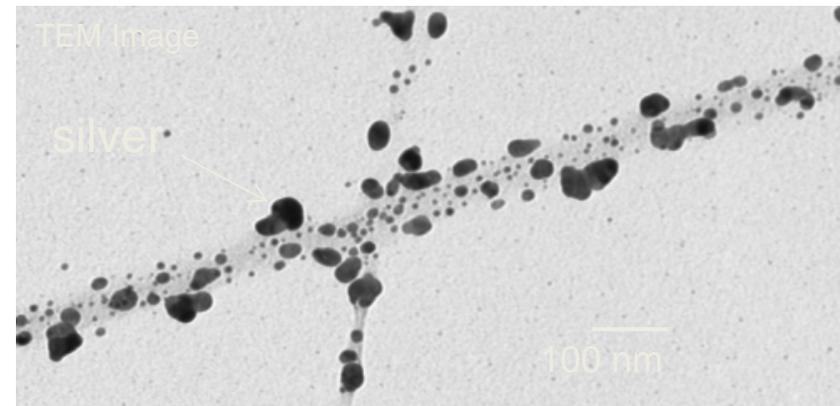
Forest Service Nanotechnology R&D

- Forest Service leads nanotechnology R&D in the following areas.
 - Understanding the nano-scale structure of wood.
 - Production, characterization and application of forest-based nanomaterials such as cellulose nanomaterials.
 - Application of nanotechnology in forestry and forest products (example wood preservatives).
 - International standards development.

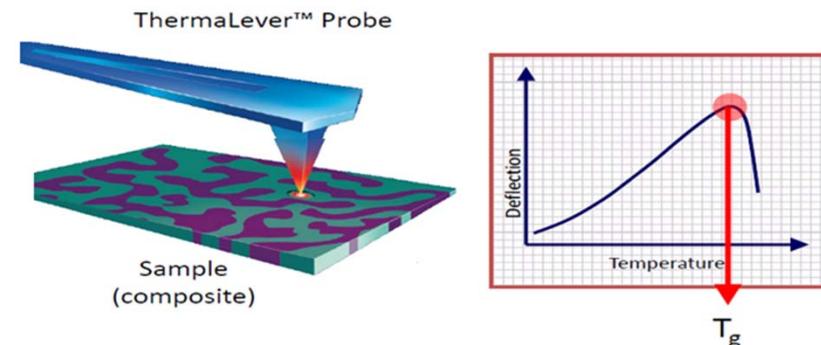


Forest Service – Academia Collaborations in Cellulose Nanomaterials

- Forest Service-Purdue Birck Nanotechnology Center since 2007.
- Forest Service- Institute of Paper Science and Technology (IPST) at Georgia Tech beginning in 2013.
- Collaborative research with NCSU, UTK, UMN, OSU, UME.



Nano Thermal Analysis

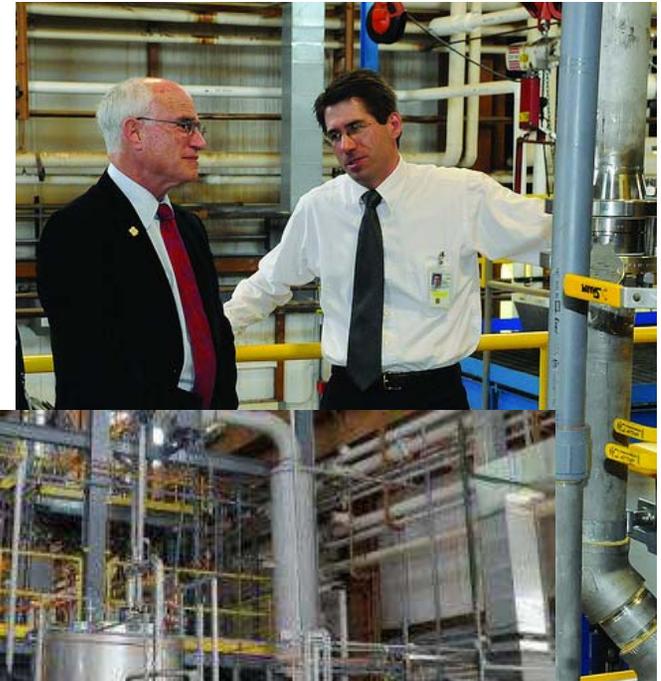


Figures courtesy of Anasys Instruments



Forest Service Cellulose Nanocrystals Research Pilot Plants

- Forest Service owns and operates a cellulose nanocrystals pilot plant.
- Produces cellulose nanocrystals by acid hydrolysis.
- Provides cellulose nanomaterial for R&D.
- U ME operates cellulose nanofibril pilot plant established with Forest Service funds.



Public Private Partnership in Cellulose Nanomaterials R&D

- Forest Service and the U.S. Endowment for Forests and Communities formed the P3Nano to advance cellulose nanomaterials R&D.
- This was announced by Secretary Vilsack in December 2013.



NEWS RELEASE

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Secretary Vilsack Announces Partnership to Advance Commercial Potential of Cellulosic Nanomaterial from Wood

WASHINGTON, Dec. 11, 2013 – U.S. Department of Agriculture (USDA) Secretary Tom Vilsack today announced a public-private partnership to rapidly advance the development of the first U.S. commercial facility producing cellulosic nanomaterial, a wood fiber broken down to the nanoscale. The partnership is between the U.S. Endowment for Forestry and Communities (Endowment) and the U.S. Forest Service.

"We believe in the potential of wood-based nanotechnology to strengthen rural America by creating sustainable jobs and adding timber value while also creating conservation opportunities in working forests," said Vilsack. "This public-private partnership will develop high-tech outputs from the forest products sector, and promote the invention of renewable products that have substantial environmental benefits."

Cellulose nanomaterials – A Major Contributor to Local Economy

- Wisconsin and Maine are the largest and second largest paper making states.
- Paper industry salary is usually higher than per capita income.
- Adds capacity to downstream manufacturers.
- Manufacturing mills are usually the biggest contributor to local taxes.
- Mill are usually big employers.



Cellulose Nanomaterials a Potential Topic for NNMI

- Innovative technology developed by Federal Laboratory and private sector partner (P3Nano) and academic collaborators.
- Technology that will benefit multiple industrial sectors
- Can take advantage of existing manufacturing infrastructure/distressed facilities
- Contribute to long-term regional economic development
- Potential for both universities and technical colleges in work force training



Cellulose Nanomaterials Benefit Landowners and Multiple Industries

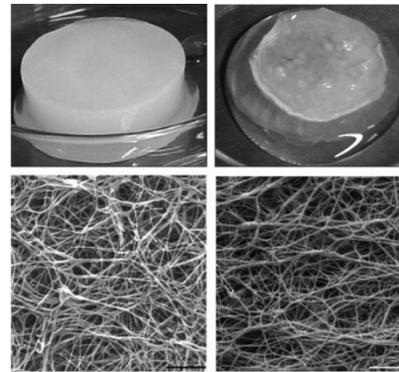
- Cellulose nanomaterials benefit landowners by creating new use of wood.
- Cellulose nanomaterials is a new technology developed by collaboratively by government labs, PPP and joint projects with academic institution.
- Production of cellulose nanomaterials products will be a major economic stimulators in rural communities.
- Supports USDA goals and National initiatives



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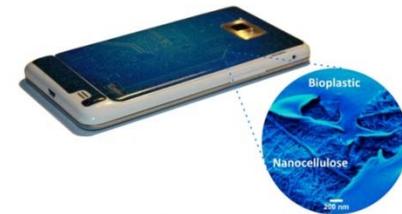
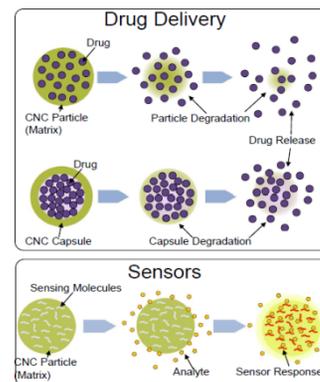


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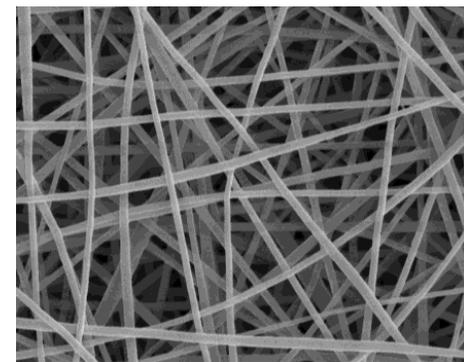
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