



THE UNIVERSITY OF
MAINE

Process Development Center

University/Industry Research Partnerships

**Michigan Biomaterials Initiative:
The role of education, research, and technology**

October 3, 2013

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University of Maine
Director, Process Development Center

Outline

- Overview
 - Process Development Center
 - Partnerships
 - Operations
- Examples of Public/Private Partnerships
 - Leveraging Resources
 - Cellulose Nanofiber Technology
 - Technology Transfer

UMaine Process Development Center

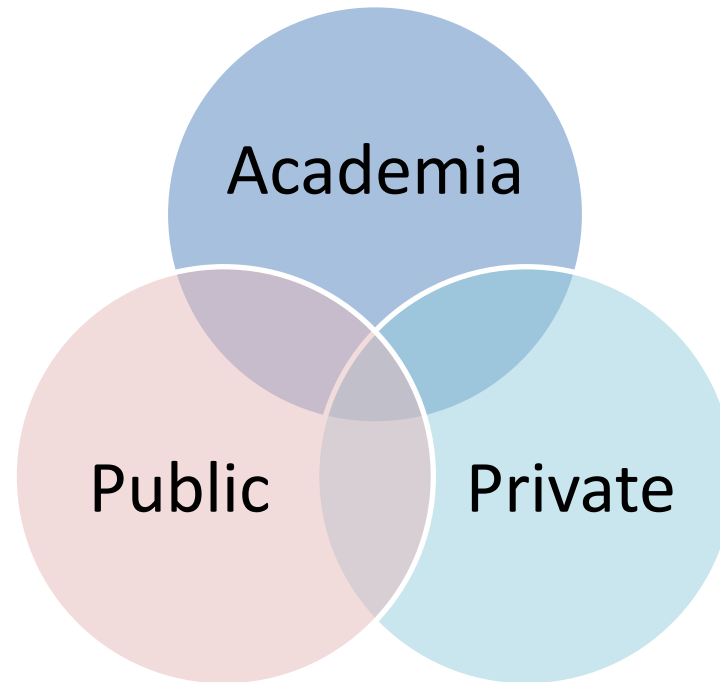
Serving the Needs of Industry Since 1987

- Department of Chemical and Biological Engineering
- Professional Staff
- Self Supporting
- Not-for-Profit Contract Research Group

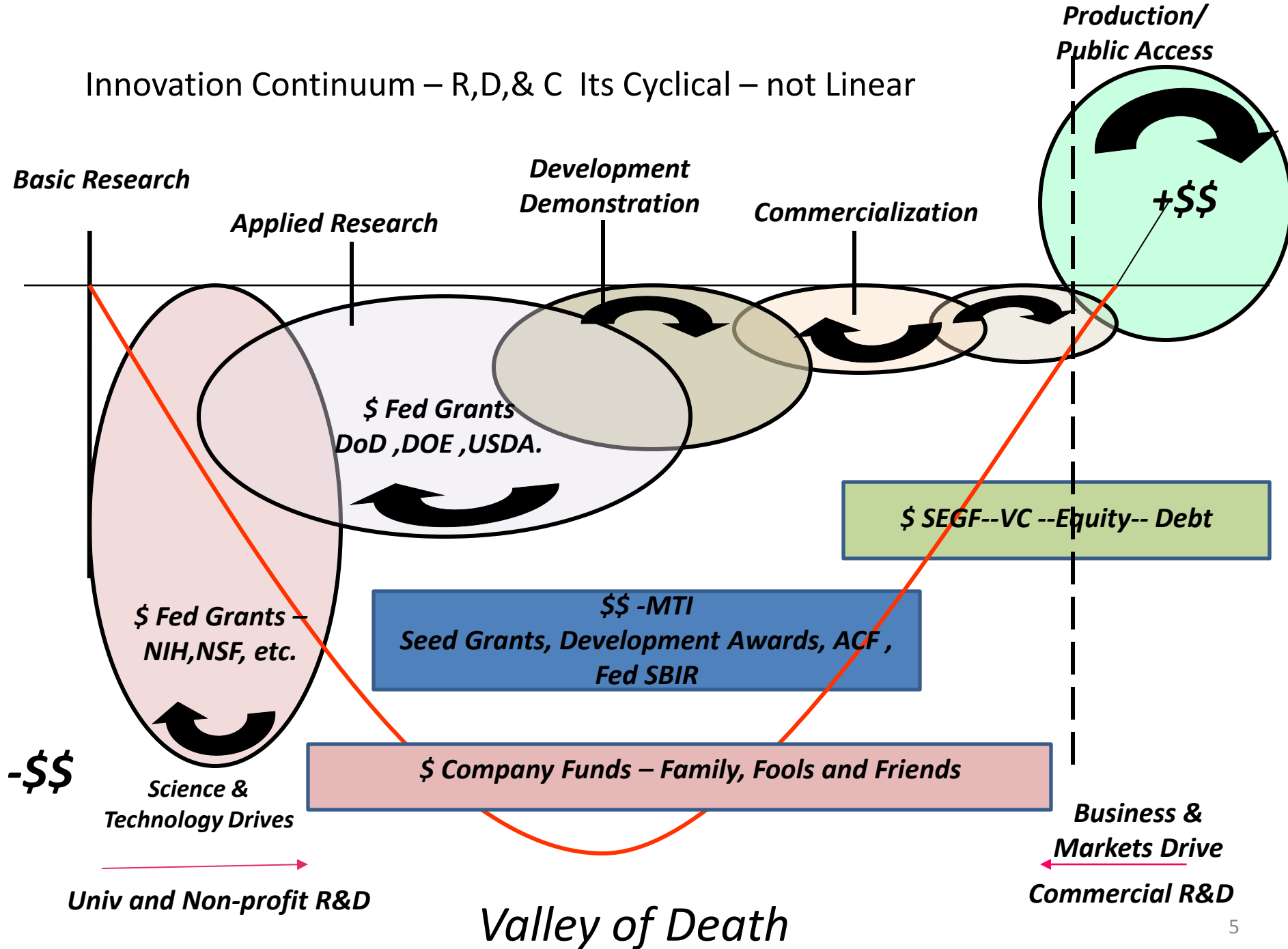


Operating Model

- Partner with Industry
- Collaboration with other Institutions & Agencies
- Example - J/V with USDA Forest Products Laboratory

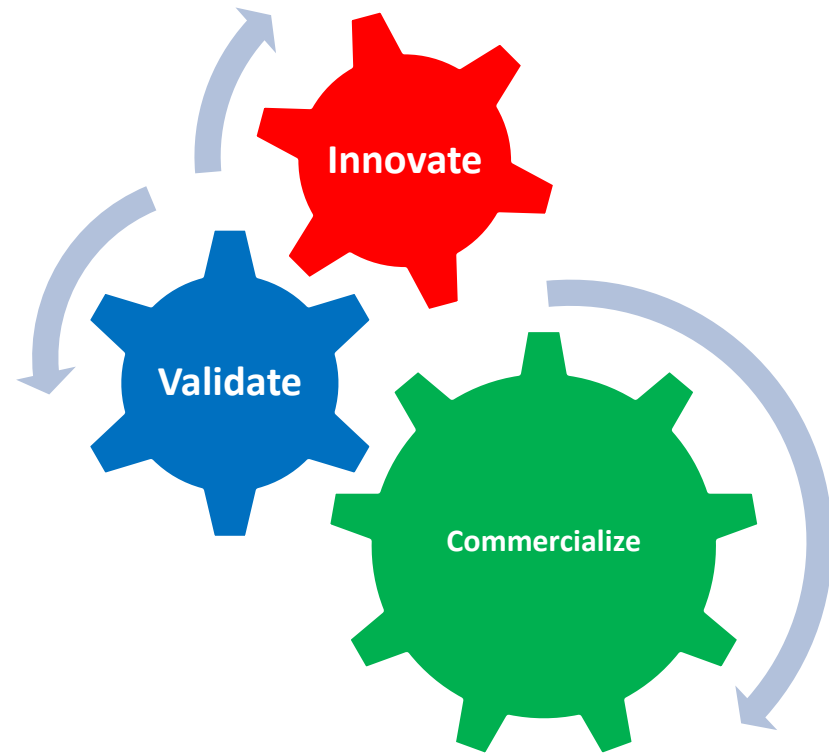


Innovation Continuum – R,D,& C Its Cyclical – not Linear



Focus

- Awarded five US patents in last three years
- All have industrial co-inventor(s)
- All are licensed or in the licensing process



UMaine Process Development Center



Pilot paper machine with advanced control systems

Web coater with laminating station



Example of Private-Public Partnership

High Speed Pilot Coater



Cellulose Nanotechnology Research Consortium

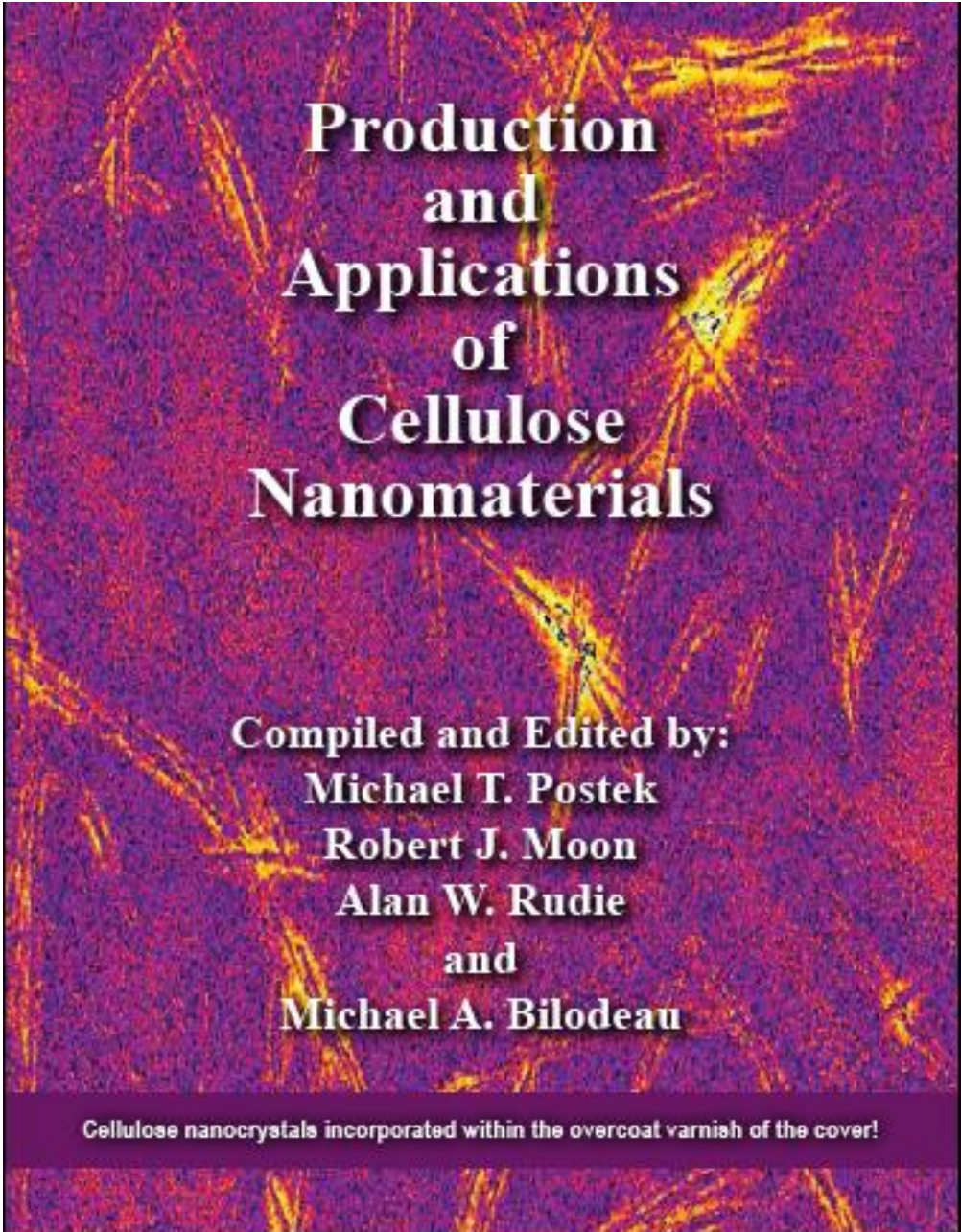
Team



UMaine CNF Pilot Facility

- Capability
 - Refiner CNF
 - Pre-treatment
 - Mass Colloider Grinder
- Capacity
 - 1 ton/day
 - Slurry form (3% solids)



The background of the cover is a microscopic image of cellulose nanocrystals, showing a dense network of yellow and orange fibers against a dark purple background. The text is centered and overlaid on this image.

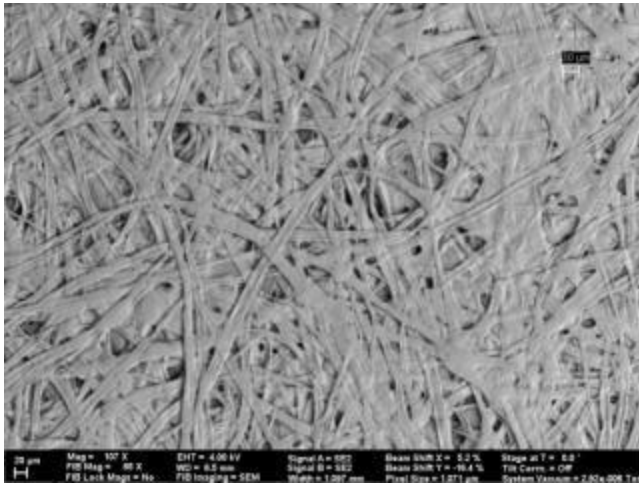
Production and Applications of Cellulose Nanomaterials

**Compiled and Edited by:
Michael T. Postek
Robert J. Moon
Alan W. Rudie
and
Michael A. Bilodeau**

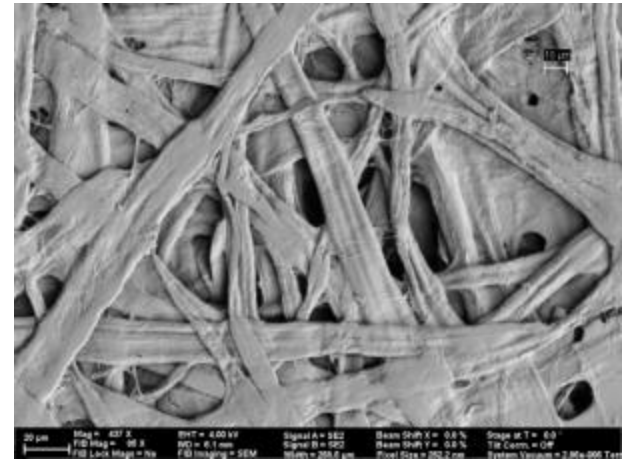
Cellulose nanocrystals incorporated within the overcoat varnish of the cover!

SEMs of the Paper Surface

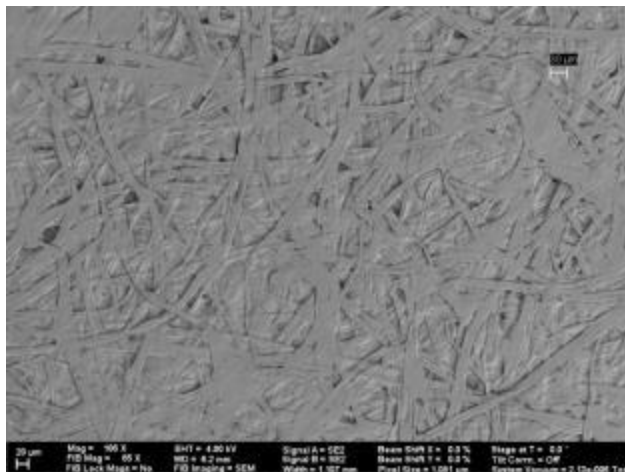
105 X



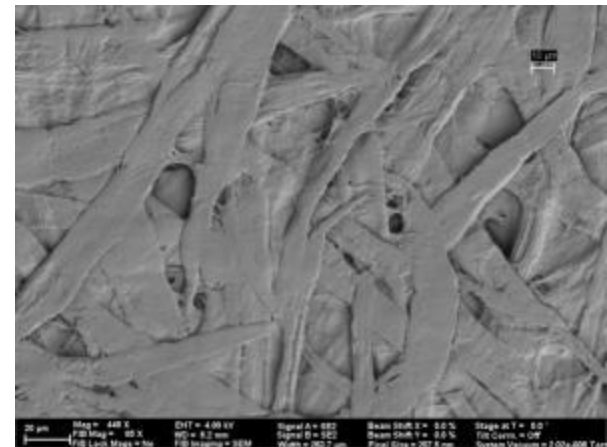
440 X



Glassine
Refining Level
(Control)



CN 200 at
UFS Refining
Level



Stain Results

Surface Treated & Si Coated



**B. Control Base
Starch/PVOH
Size Press**



**C. CN 200 Base
Starch/PVOH
Size Press**

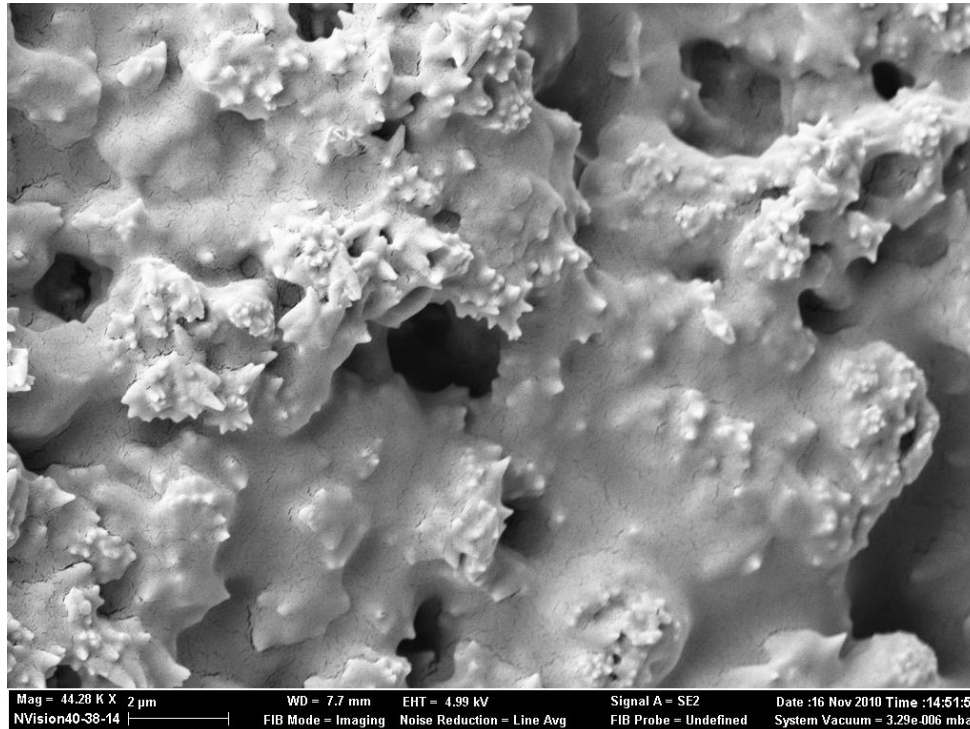


**D. CN 200 Base
Novel Size Press**

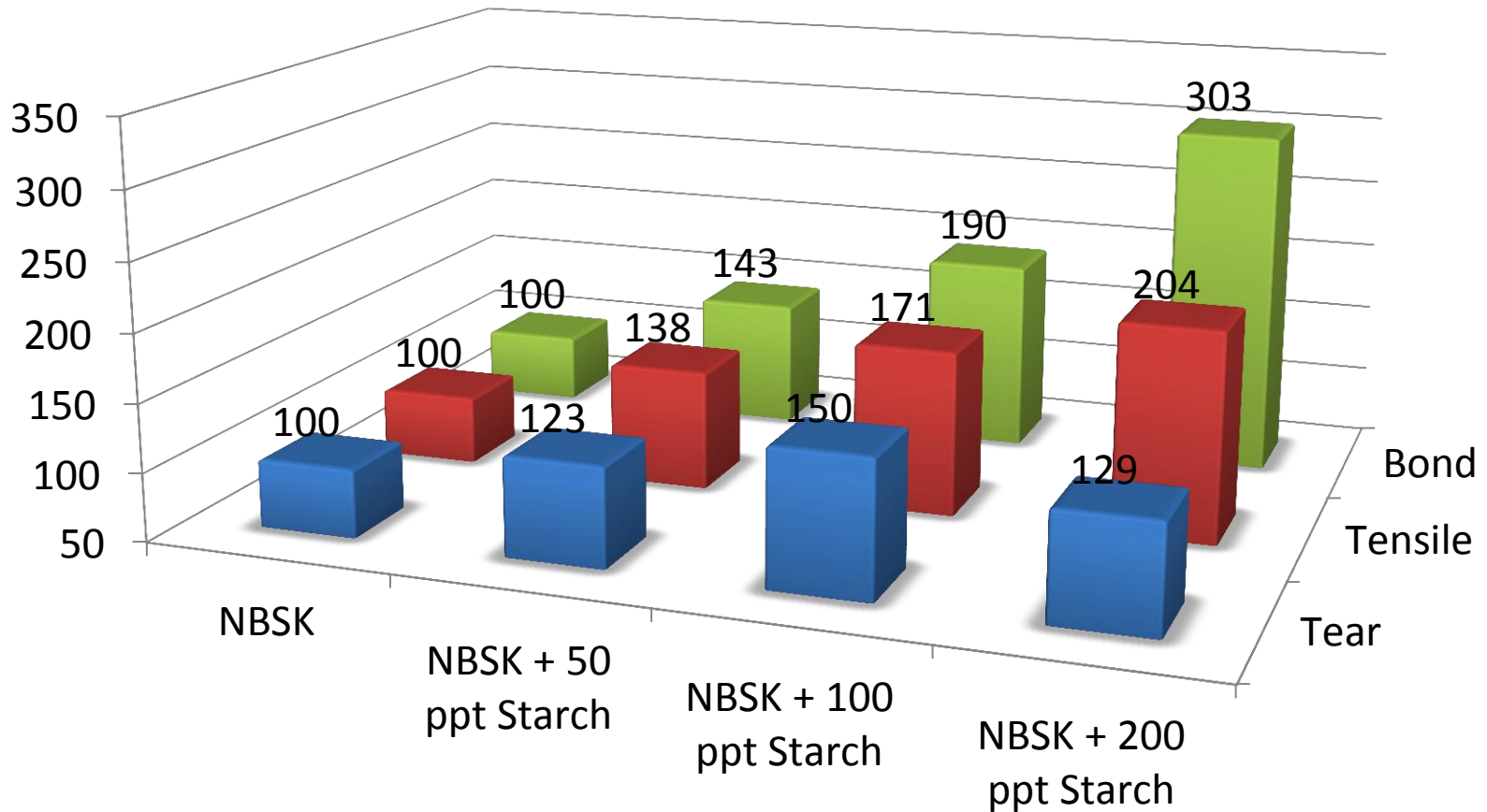
Strength Additive Technology

**A novel, starch encapsulation technology for paper
and paperboard.**

Cerecarb[®] - Cerefiber[®]



Cerefiber[®] - Strength Development



Handsheet study

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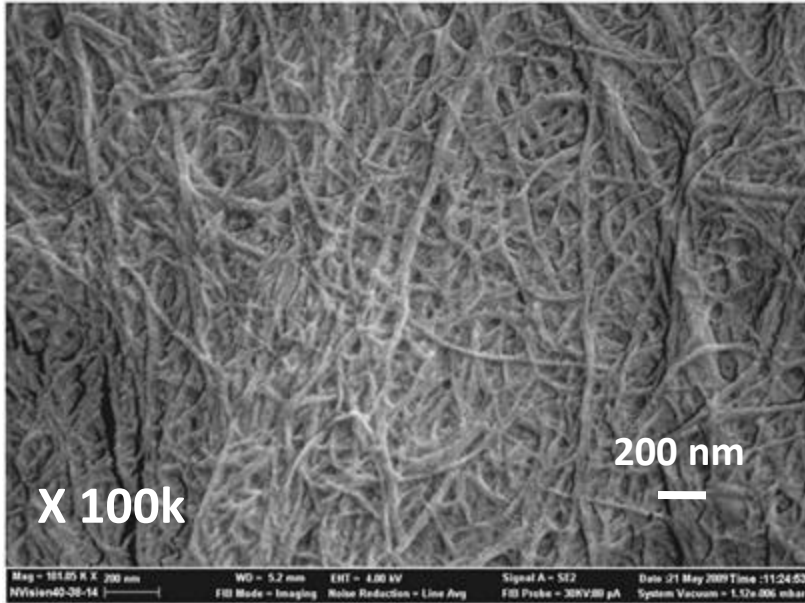


www.umaine.edu/pdc

University of Maine Proprietary Cellulose Nanofiber Process

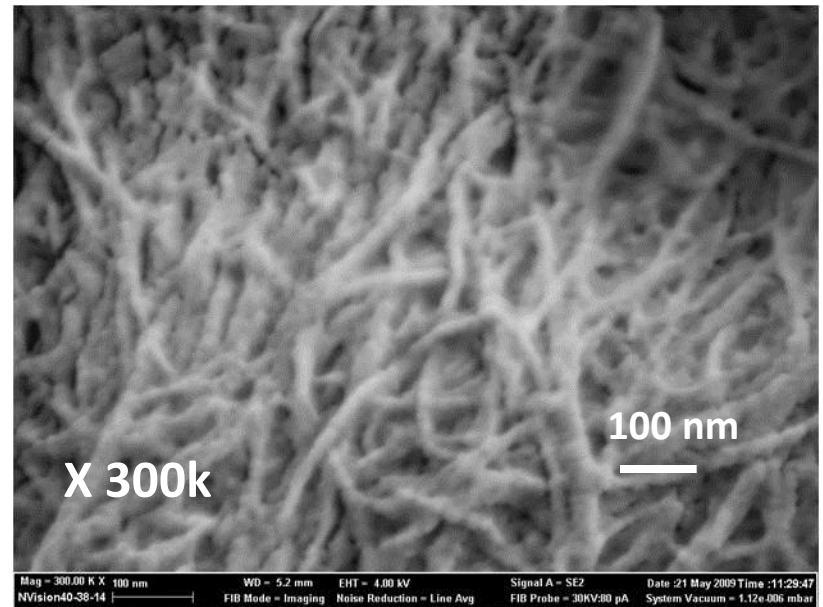
- Novel method to produce CNF
- Commercially scalable
- Low cost
- Patent pending technology
- High performance additive
 - Wide range of applications

Cellulose Nanofibers

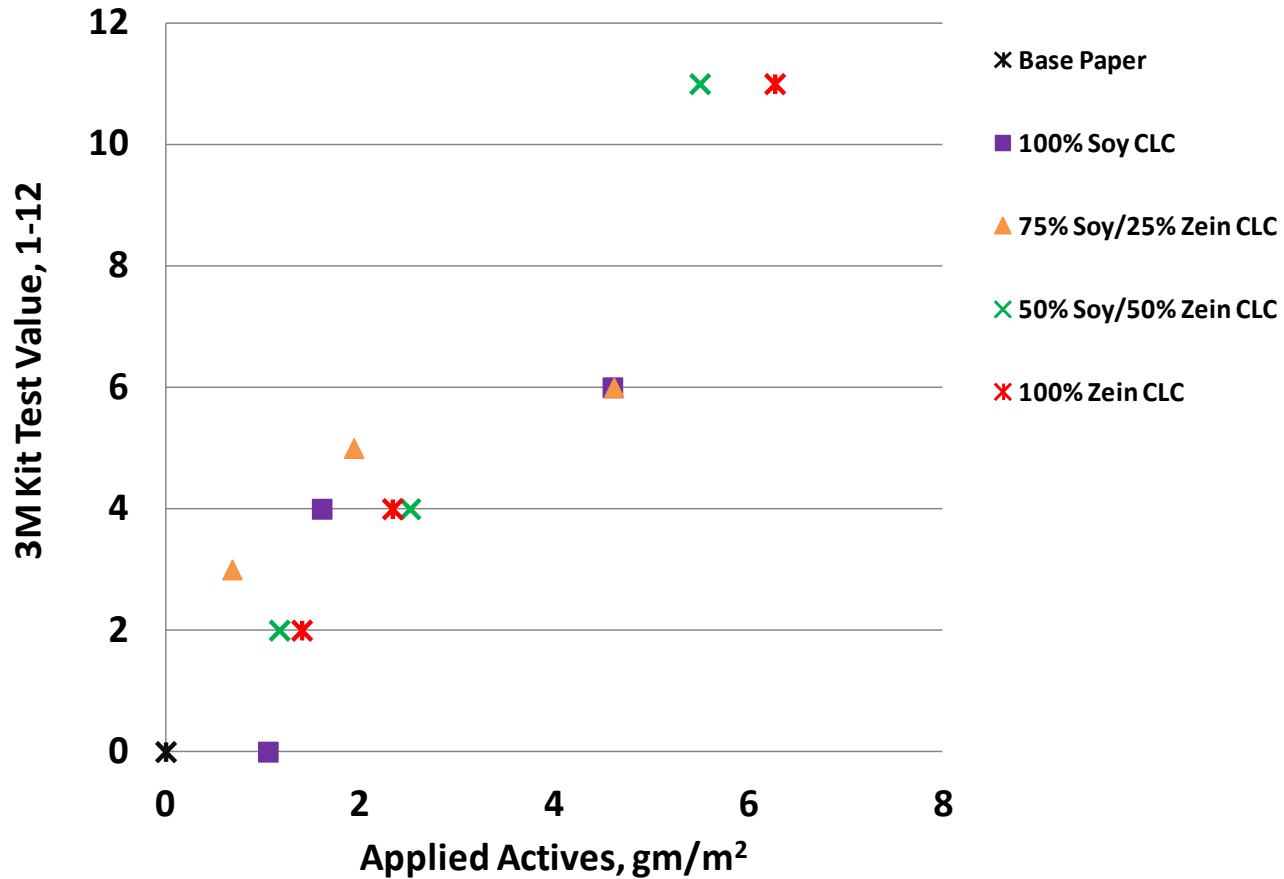


FE-SEM images of UMaine CNF

CNF fiber width ~20 nm



Bio-Based Barrier Coatings



UMaine CNF Pilot Facility



Stock preparation and refining loop



CNF pilot plant

