

Nanotechnology Thrust

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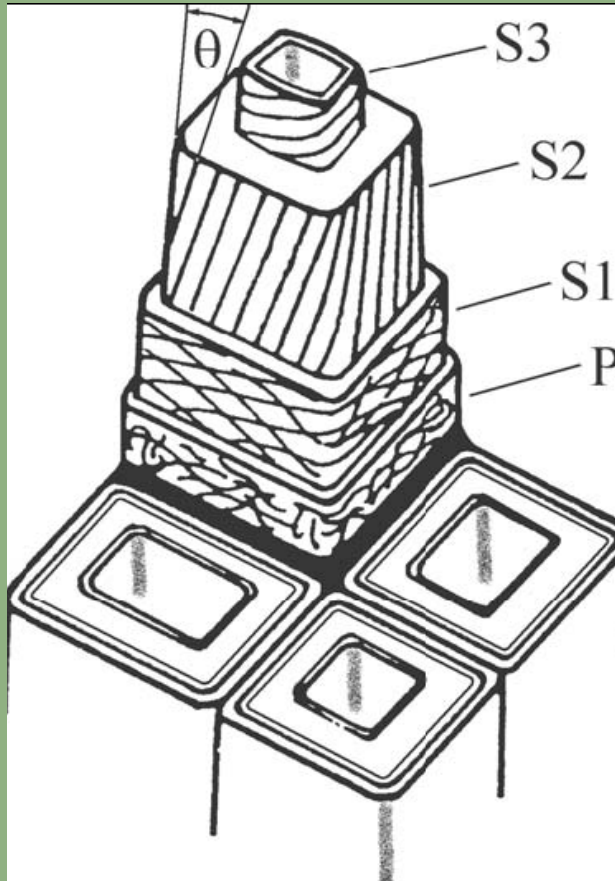
Goal

- To generate a nanometer-scale fibrils from wood that can be used in some commercial application and future research.

Issues

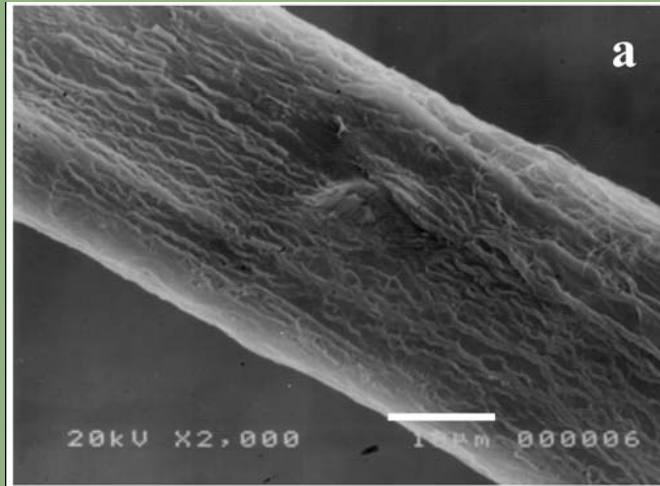
- Cost/benefit
- Energy and cost to produce. Want high yields.
- Stability and ability to use after fibrils are produced.
- Compatibility of fibrils with other materials.

Wood Fibers – composed of nano-fibrils

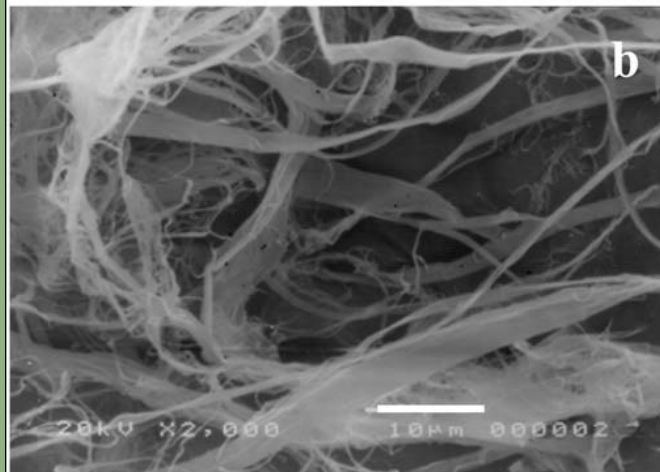


Why not take
advantage of what
is naturally there?

Concept



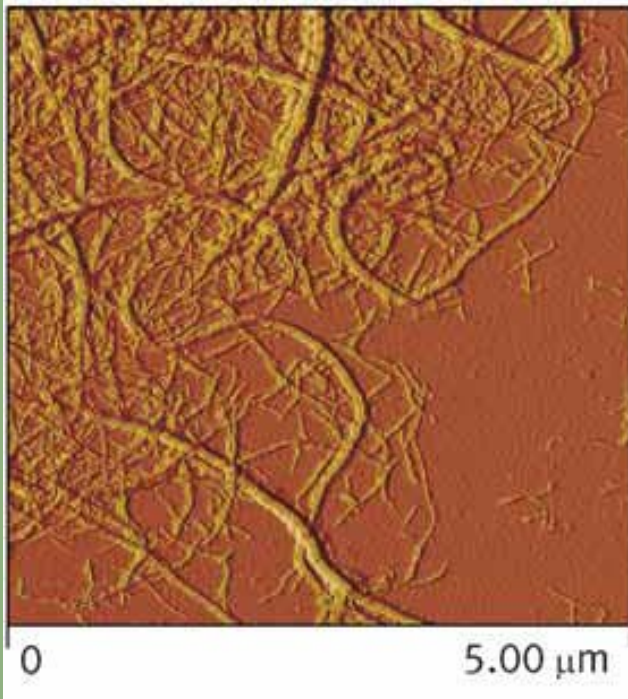
Original fibers



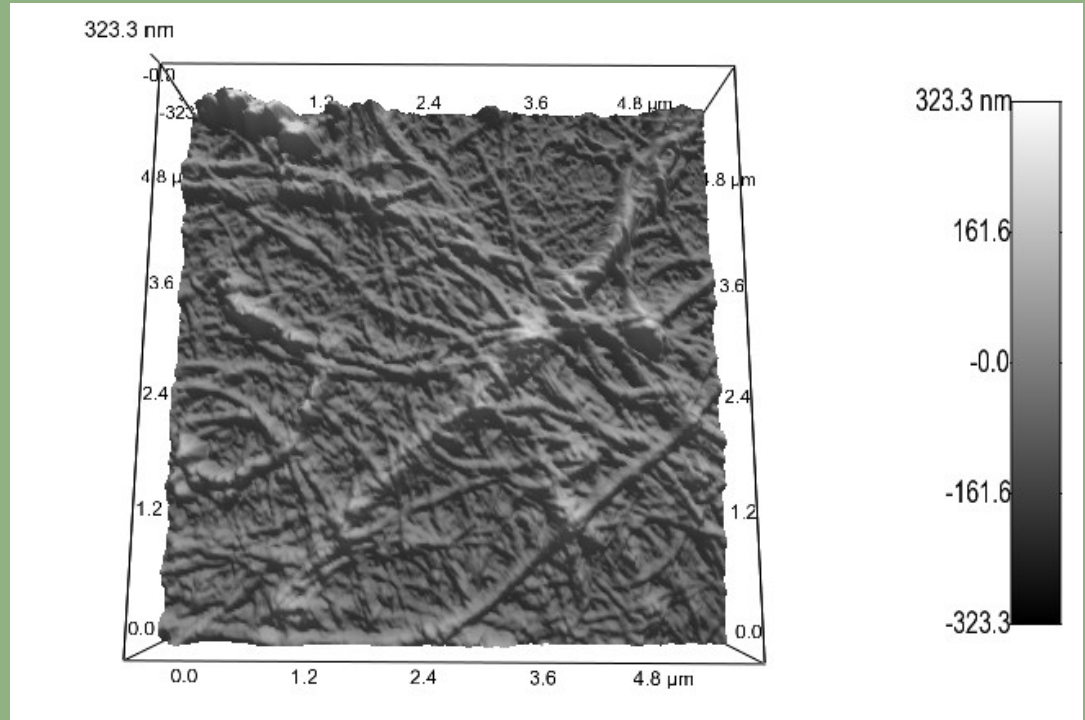
After refining and
Fourteen times through a
homogenizer

Bar = 10 µm

We can now generate fibrils!



STFI



Maine

Some results



Original fibers



Cell wall peeling
After shear treatment

Some results



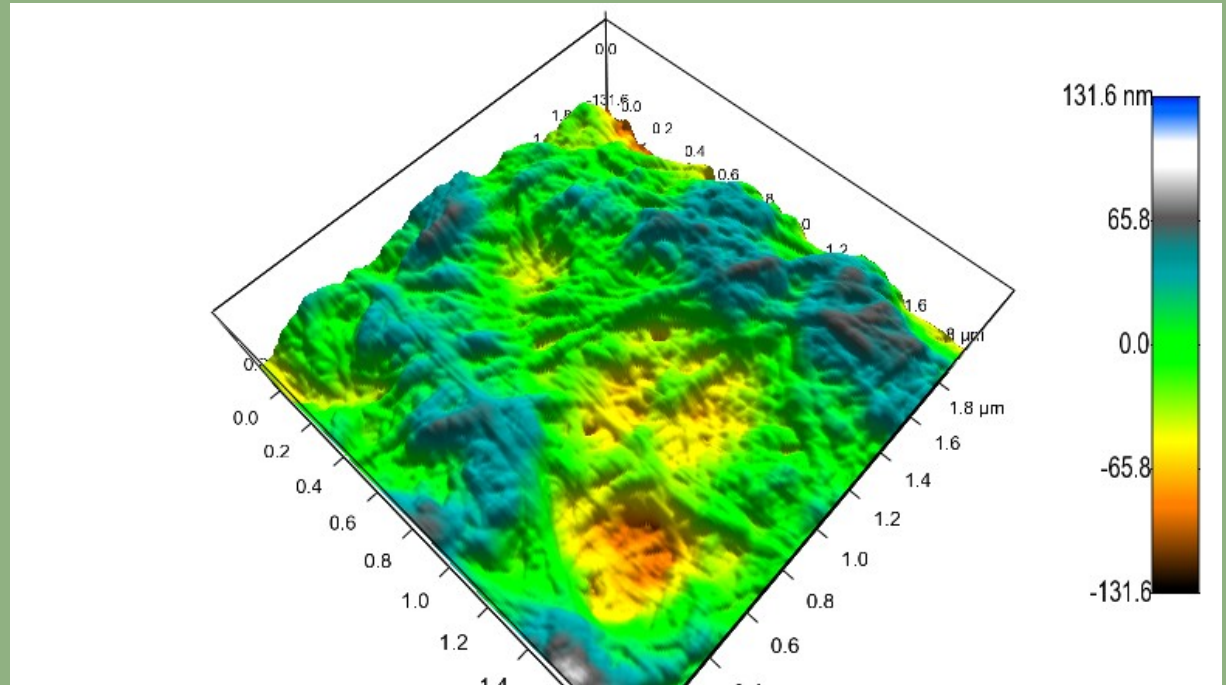
Simple shear



Shear with edges

Results

Enzyme pretreatment seems to lower the needed homogenizer Energy demand.

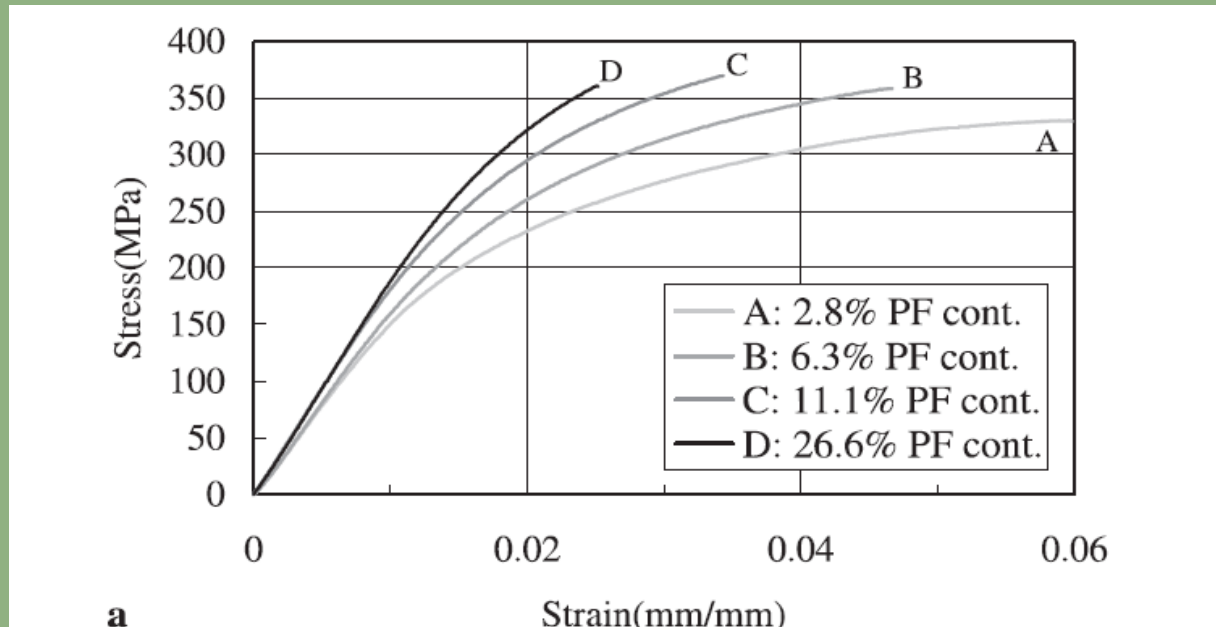


Other routes are possible

- Use Micro-crystalline cellulose with acid hydrolysis to obtain cellulose “whiskers”.
- Dissolve cellulose in special solvents and re-crystallize.
- Bacteria

Potential Use

- Add to polymer to reinforce.



From applied
Physics A
2005

Additive to varnishes, coatings, paints to add toughness and control rheology.

Key Tools being used

- Homogenizer (NSF –EPSCOR)
- Atomic Force Microscope (NSF-EPSCOR)
- Optical microscope
- Environmental Scanning Electron Microscope
- Kady mill

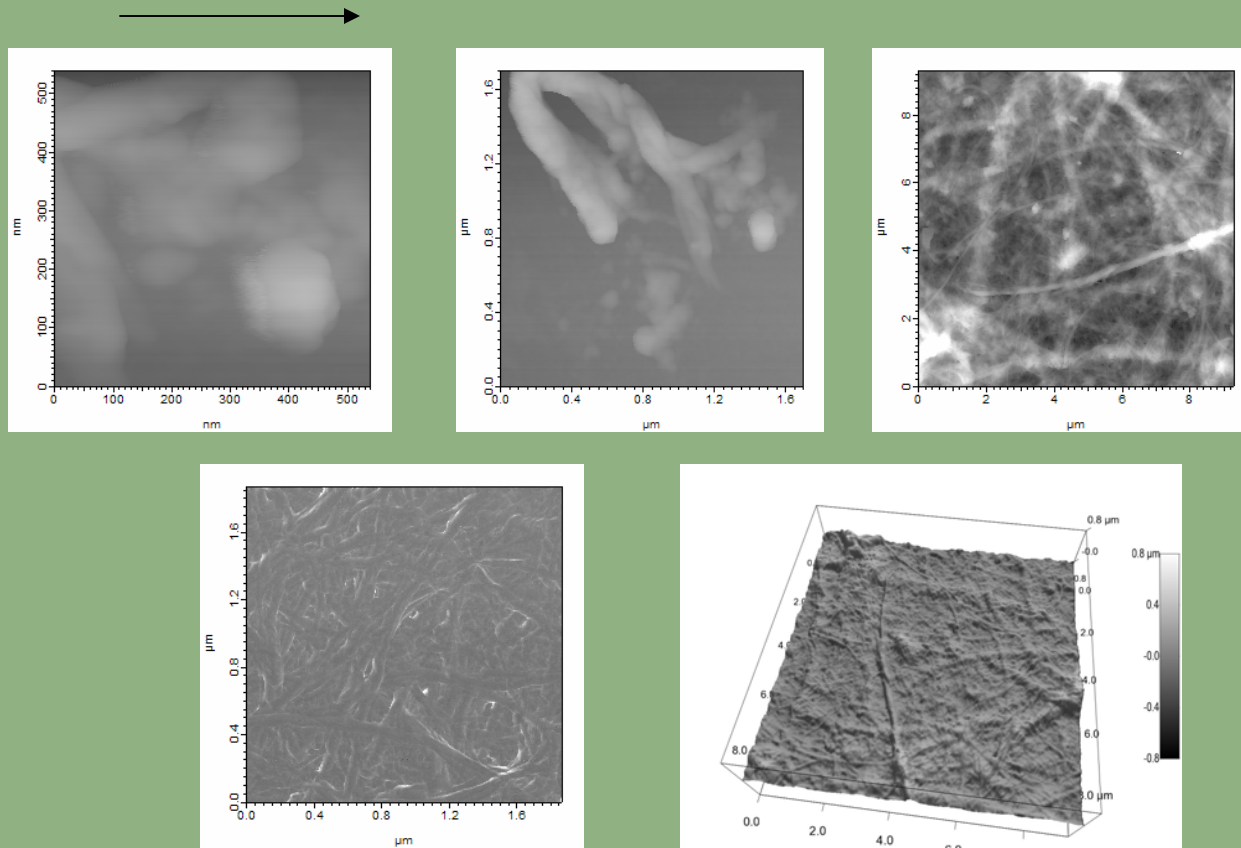
Interactions

- RPI Nanotechnology center – Trip in July. Cooperation planned.
- Southern Maine – John Wise – toxicology study.
- Ongoing – Chemistry, Wood Science, Biology, Chemical and Biological Engineering

Future work

- Try different enzymes to enhance fibril release
- Test toxicity of fibrils
- Test mechanical properties of polymer films
- Look at modifications and other applications.

Undergraduate student experience



- “My friends do not understand that you just don’t plop in the sample and get the image back.” Ryan