Más Resistente que el Acero

Materiales del 3er Milenio

Construcción Sustentable

CENTRO DE BIOMATERIALES Y NANOTECNOLOGÍA

UNIVERSIDAD DEL BÍO-BÍO

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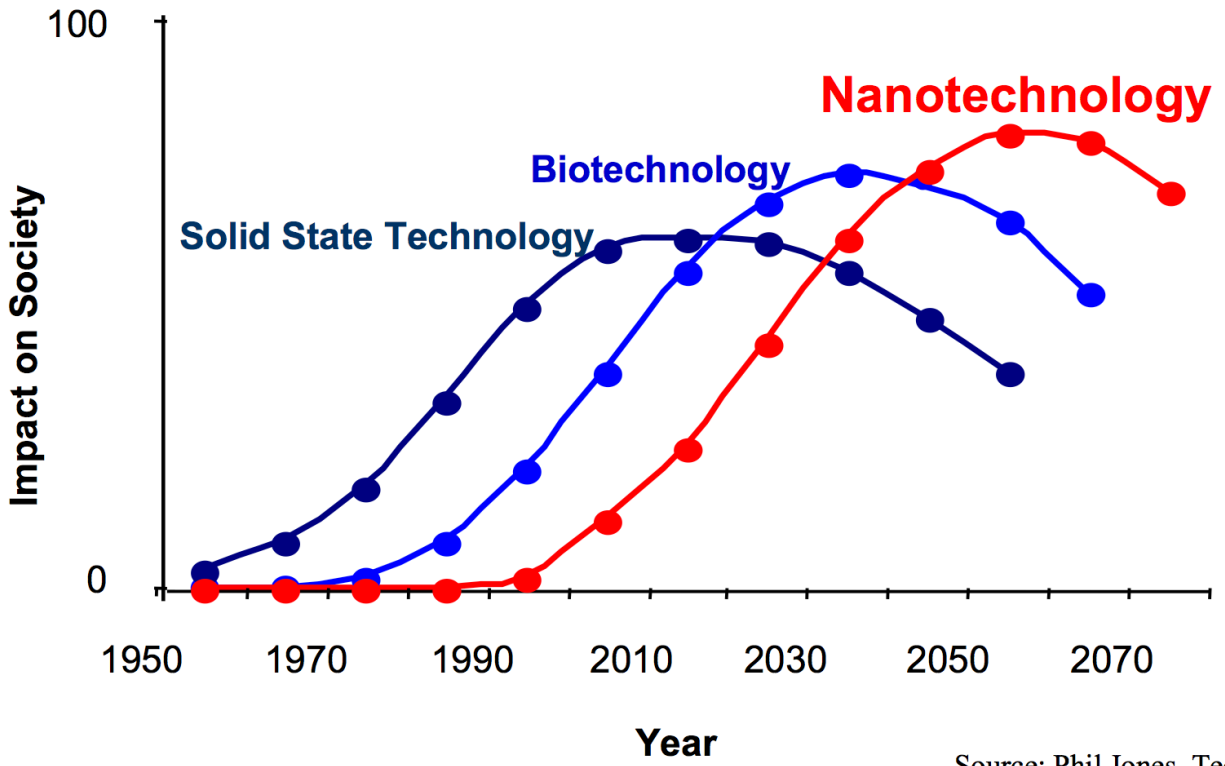
Nanotecnología: La próxima revolución industrial



Source: Phil Jones, Ted Wegner, USDA Nanotechnology Workshop Oct 2004

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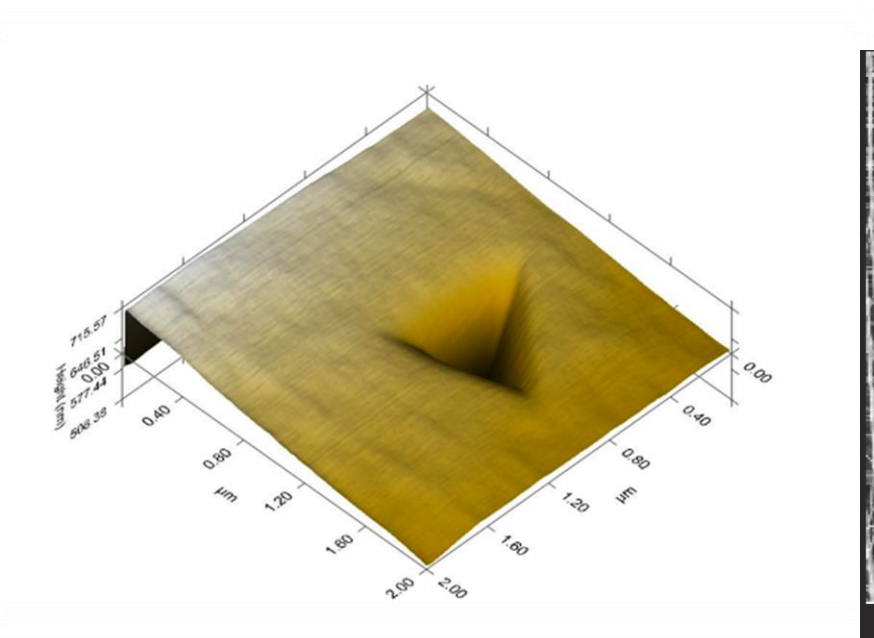
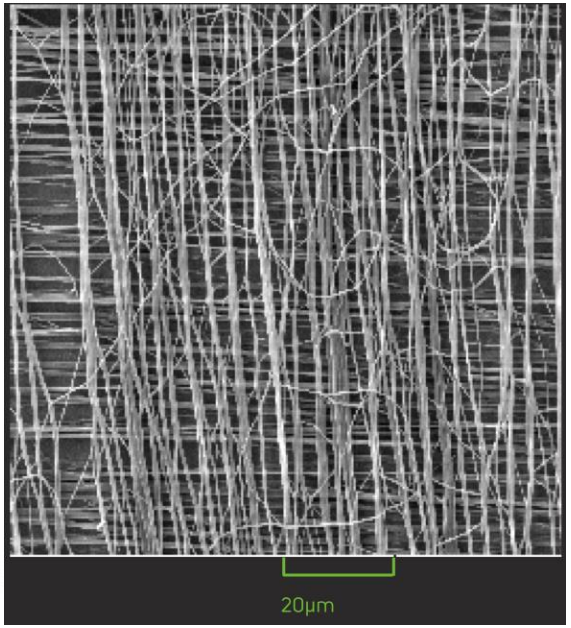
¿Qué es la Nanotecnología?

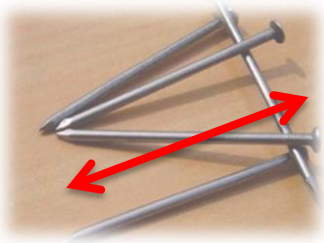
1 nm = 10^{-9}m

Línea 1:
Explotación propiedades a nanoescala

Línea 2:
Nuevos nanomateriales

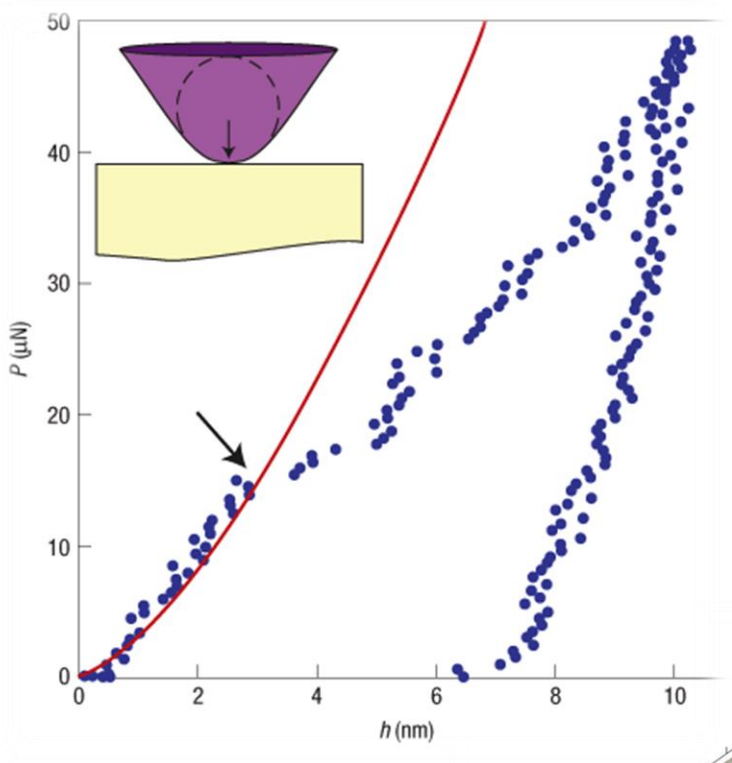




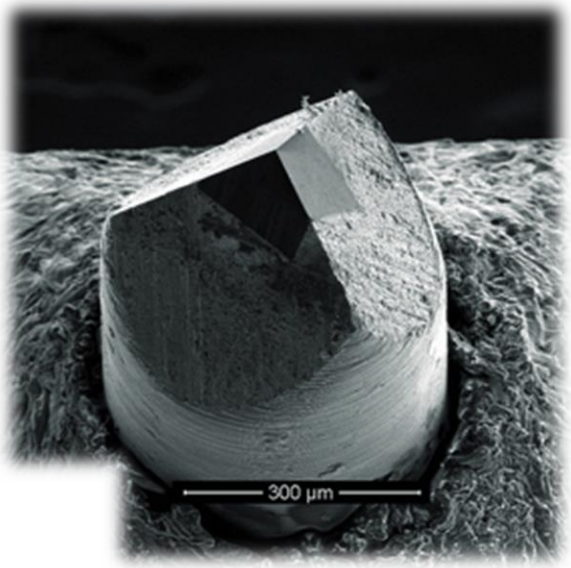


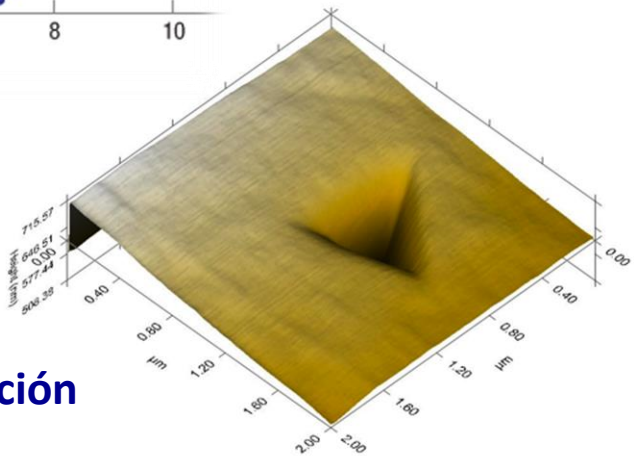
1 nm

Explotación de las propiedades de las fibras



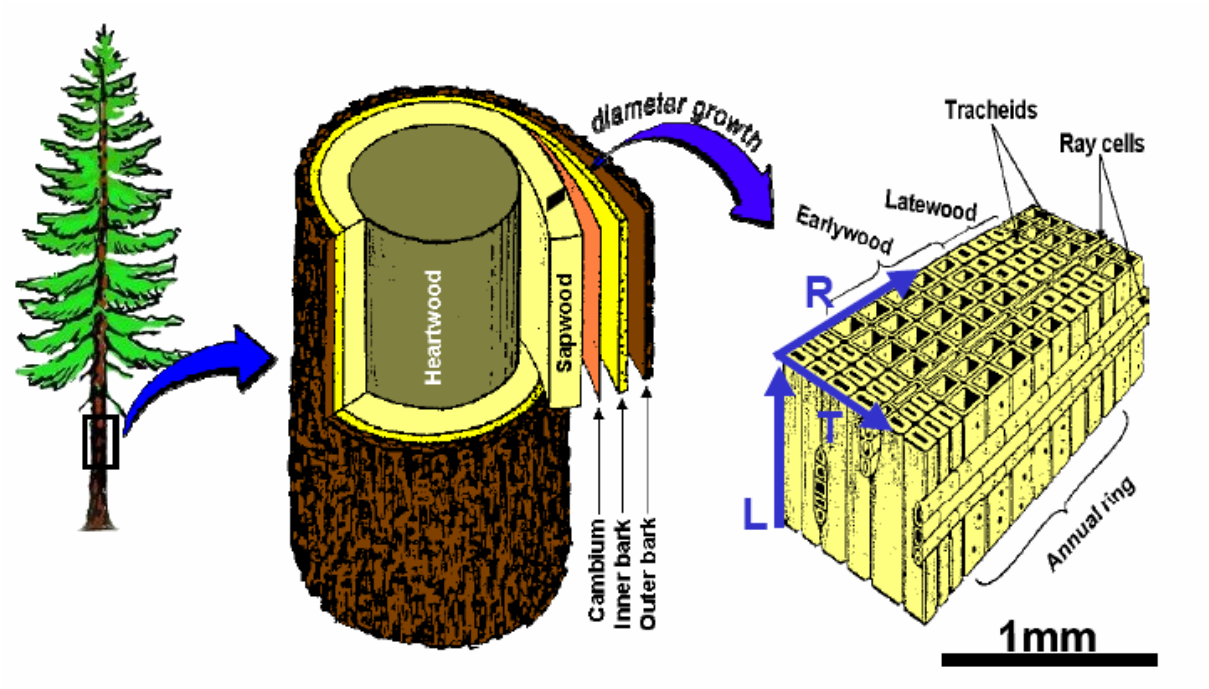
Punta Cube-Corner





Una simple nanoindentación

Microestructura de la Madera



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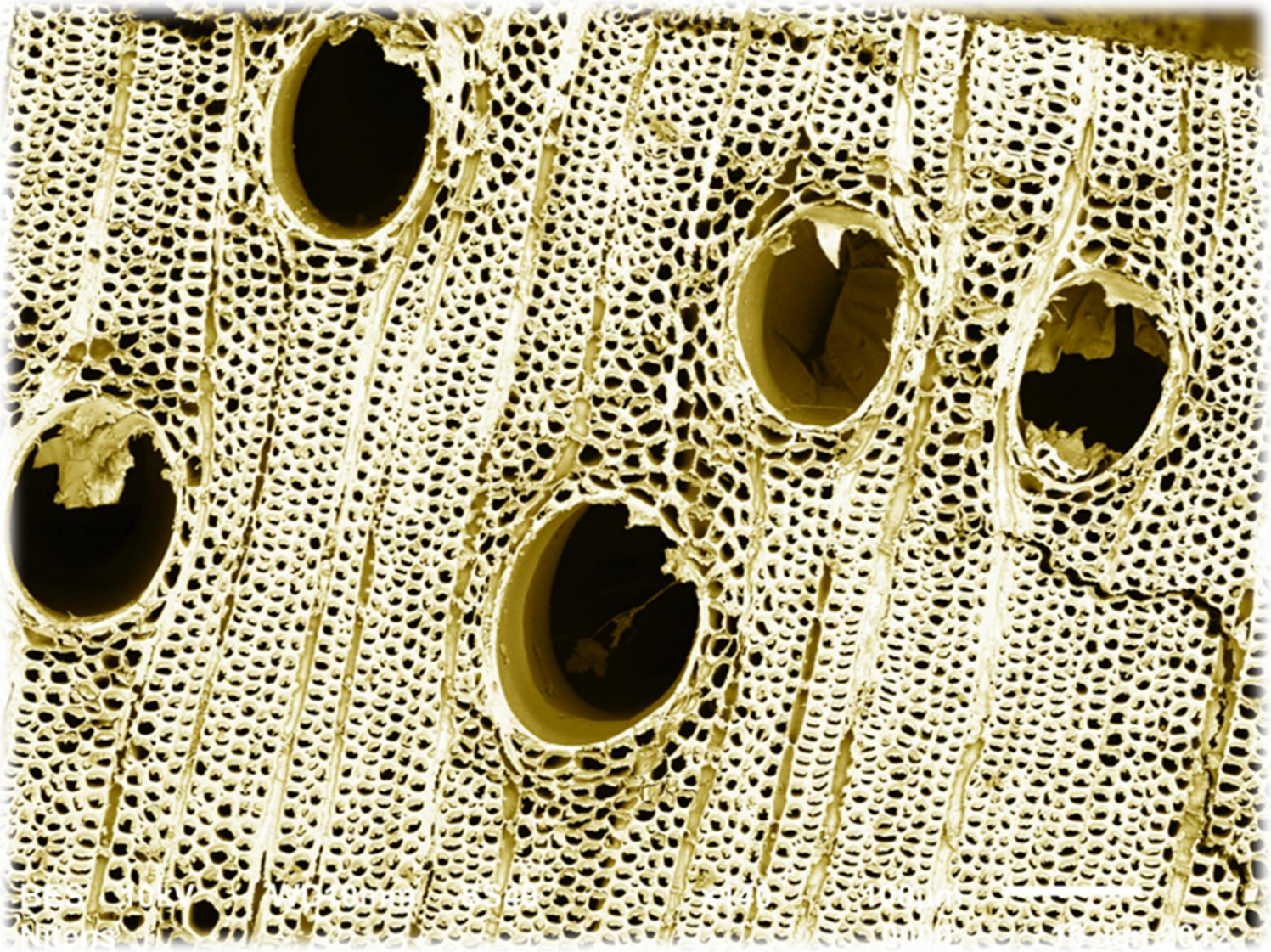
Microestructura de la Madera



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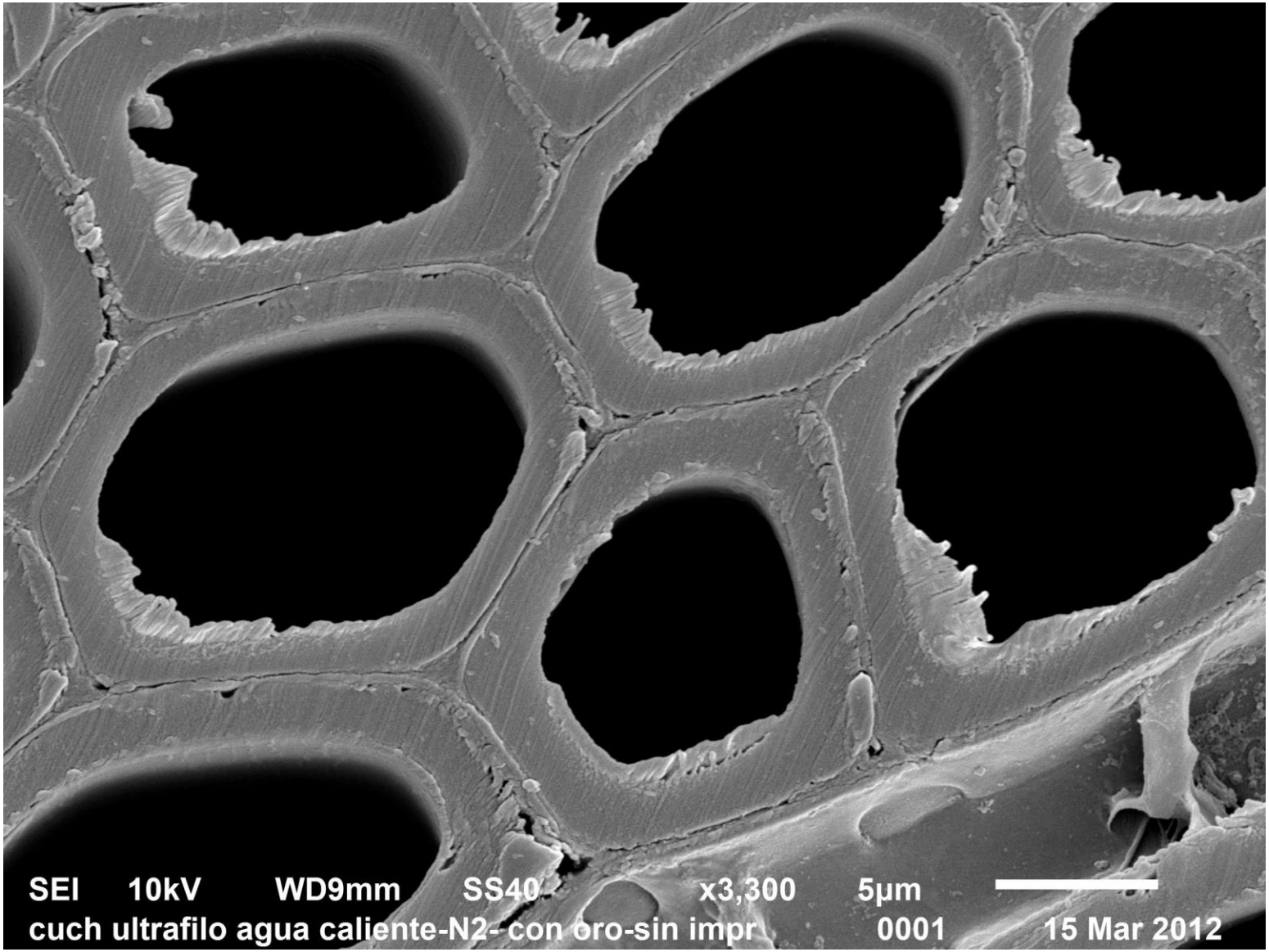
SEM (Scanning Electron Microscopy)



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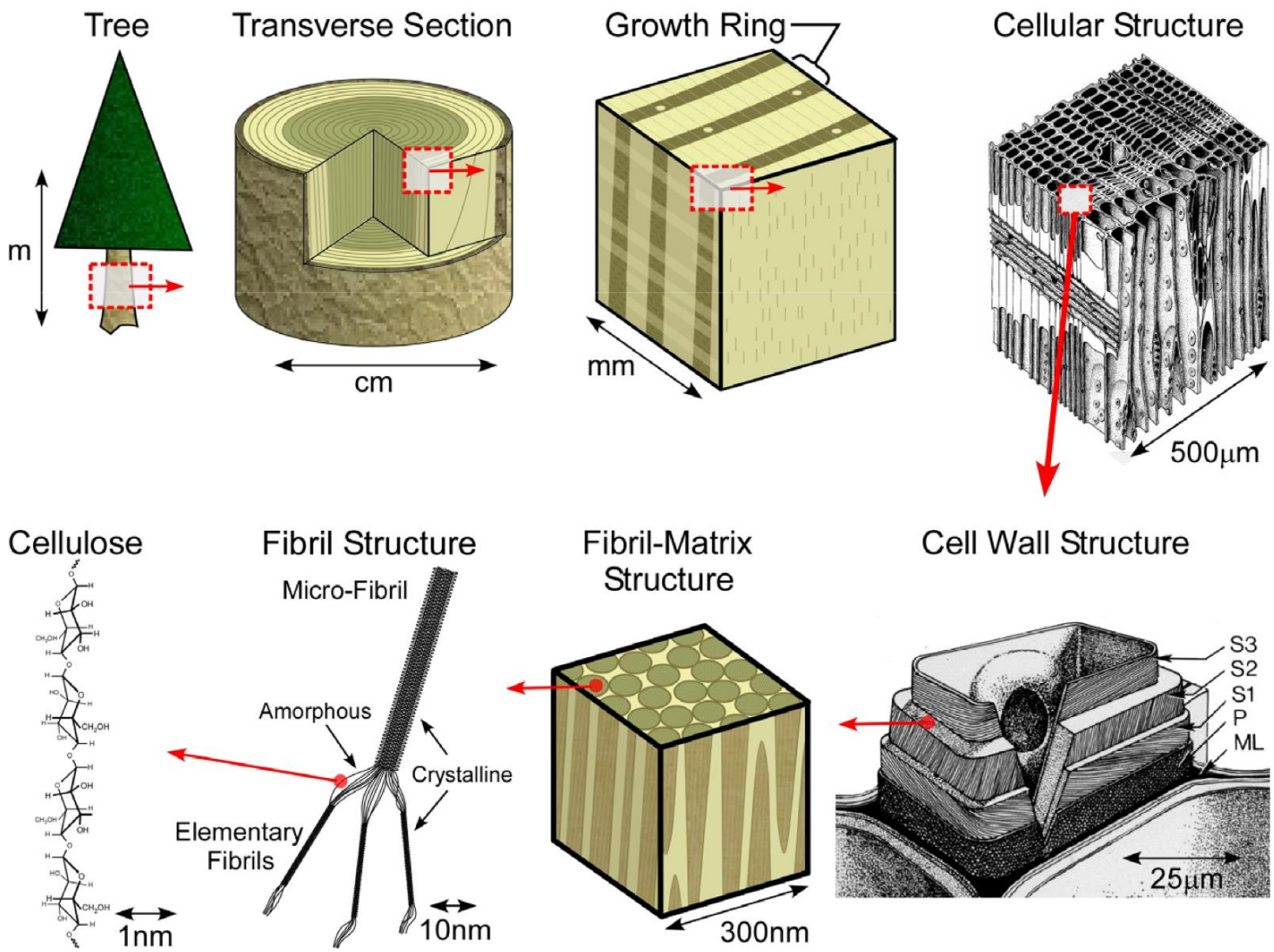
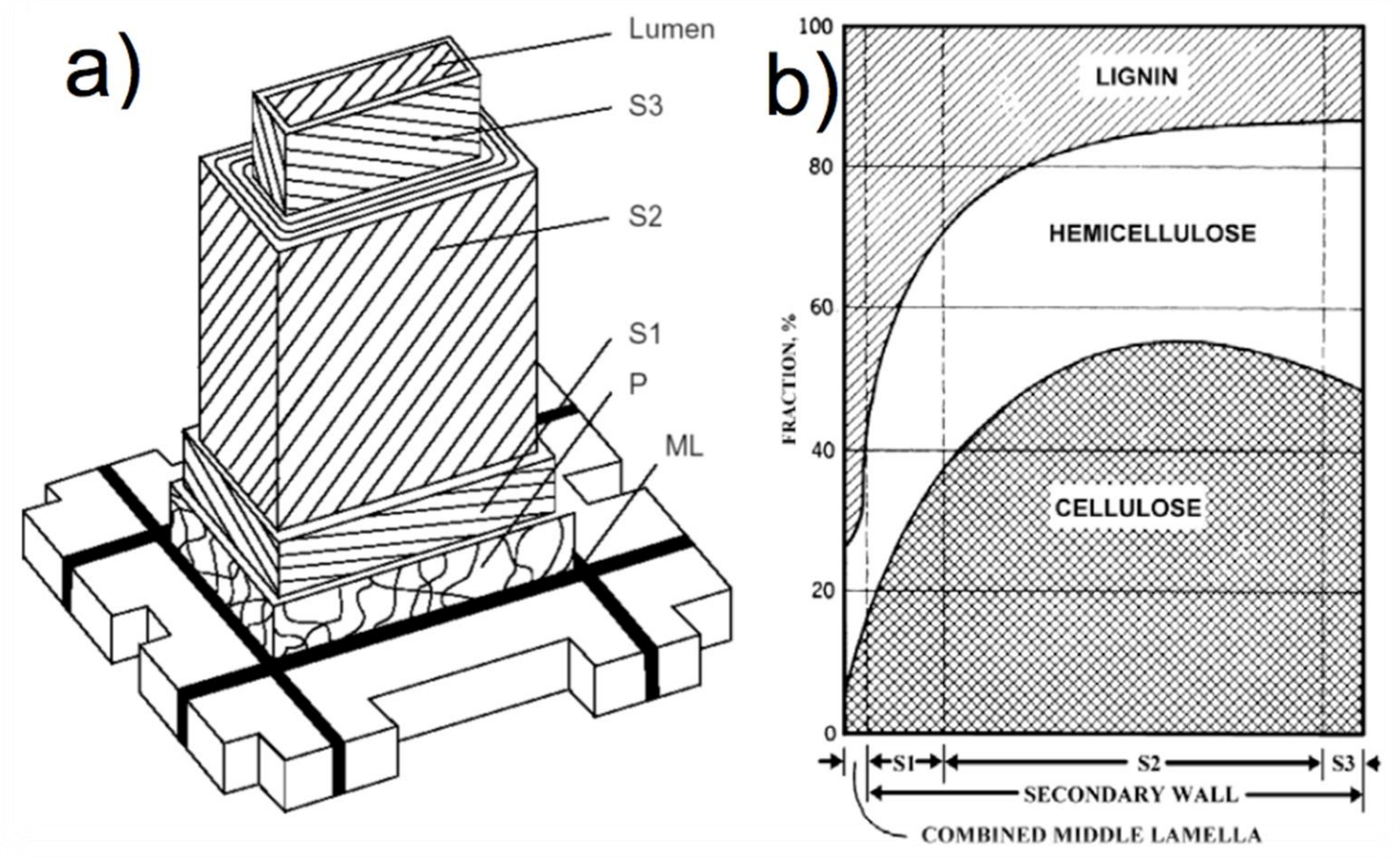
La madera es un Nanomaterial



Ultraestructura de la fibra

$E_{celulosa} \approx 134$ GPa

$E_{Alumnio} \approx 70$ GPa



Retulainen et al. 1998

Jensen 1977

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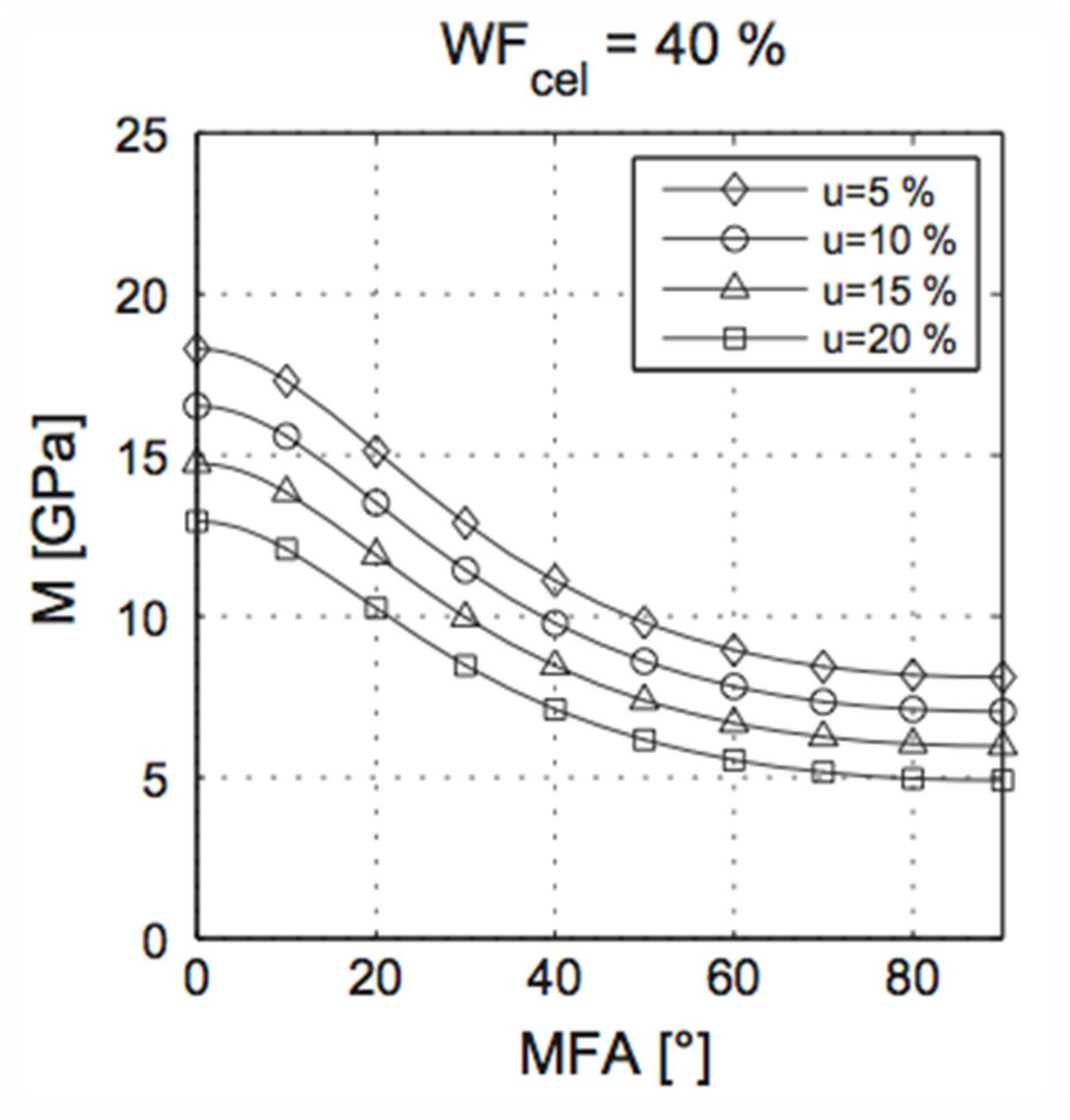
Angulo microfibrilar vs. Prop. Mecánicas de la Fibra



A. Jager et al. –Composites part A 42 (2011) 677-685

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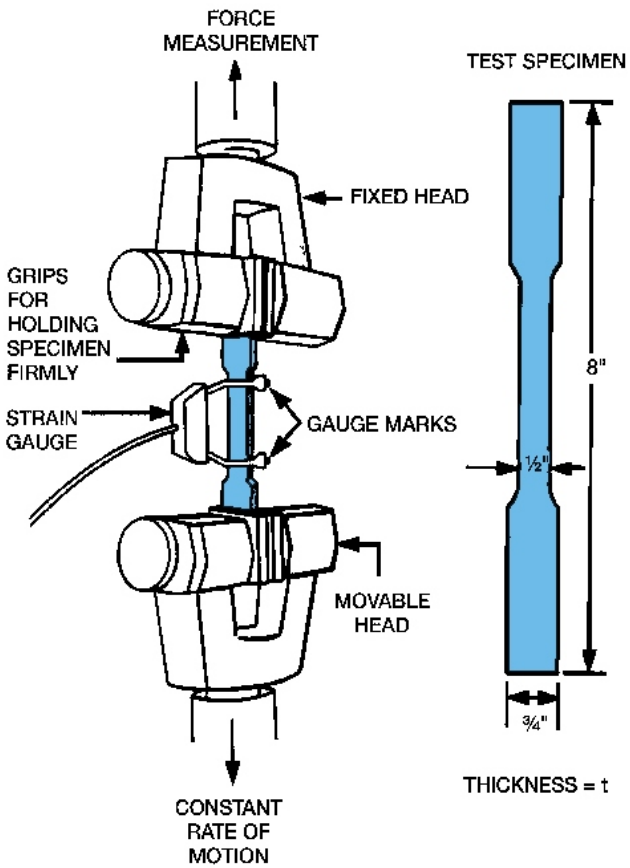
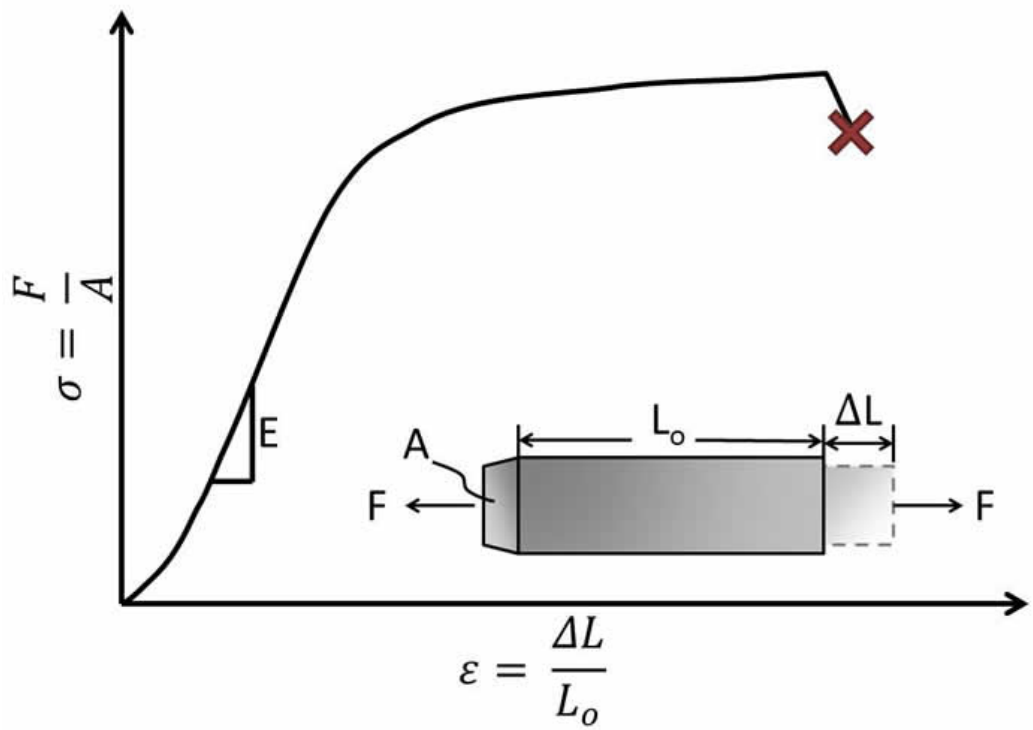
¿Como extraer las propiedades de una fibra?





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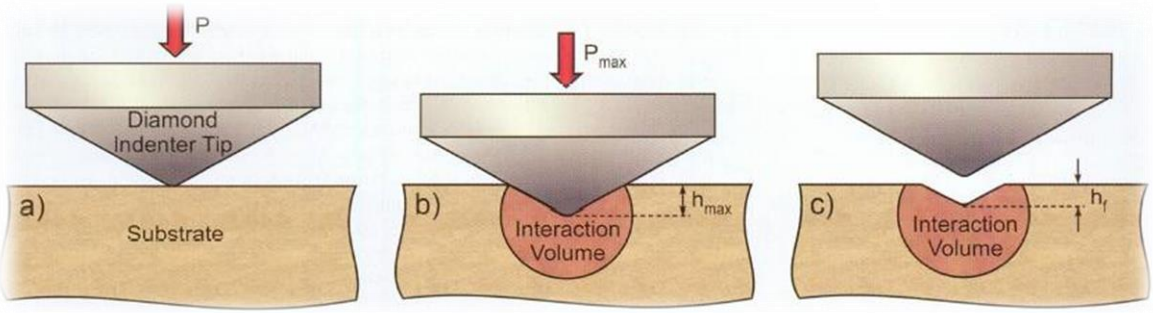
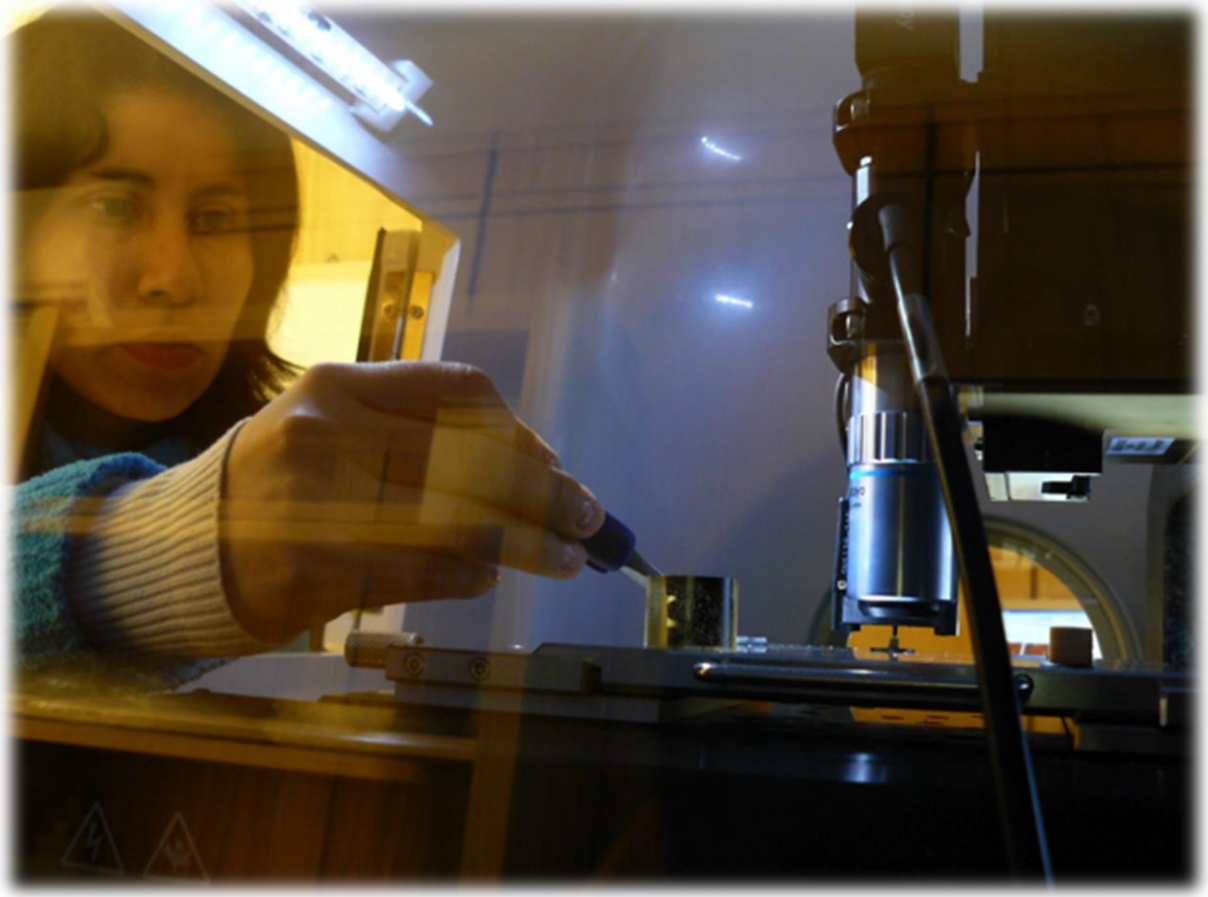
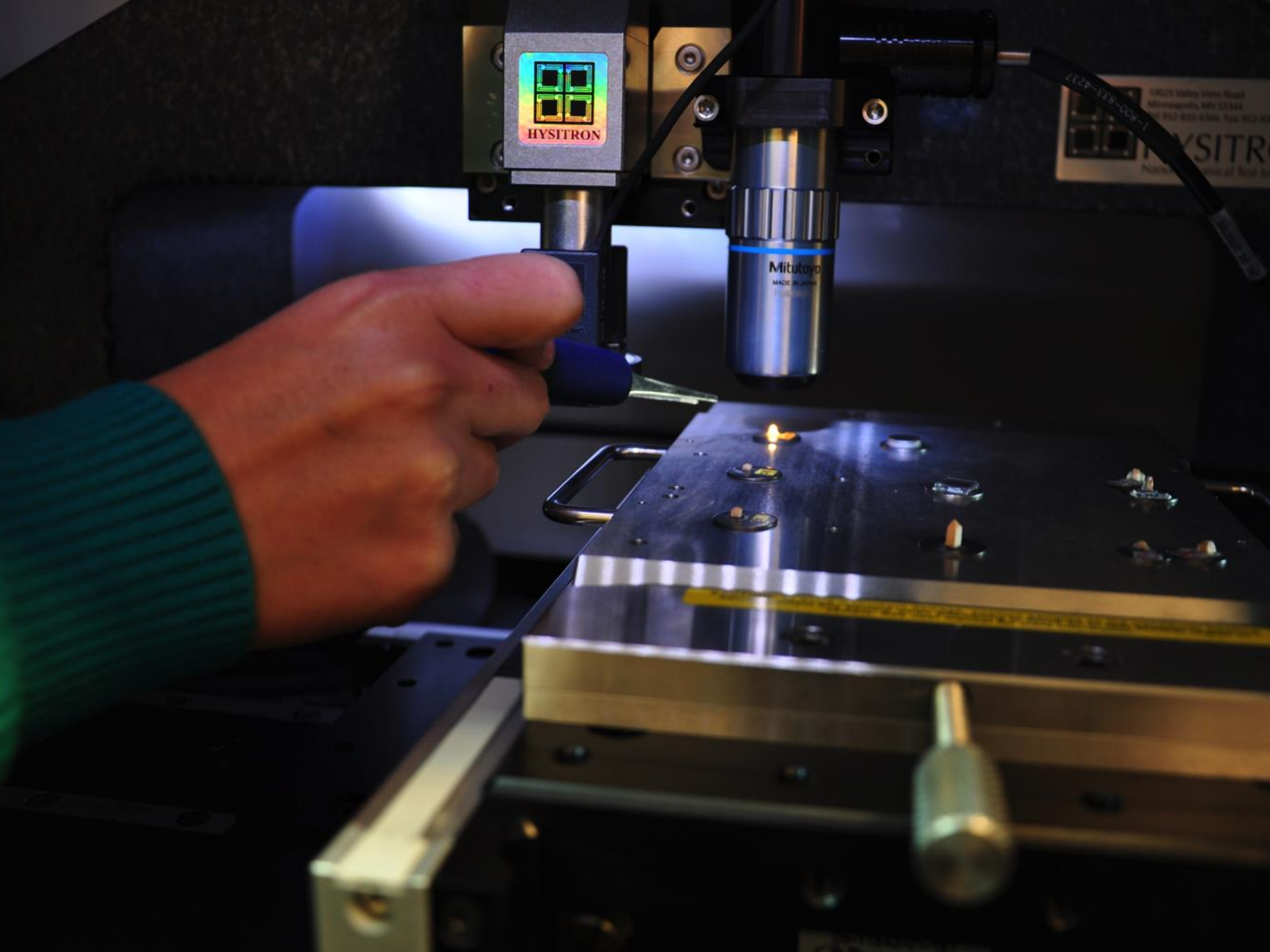
Metodología

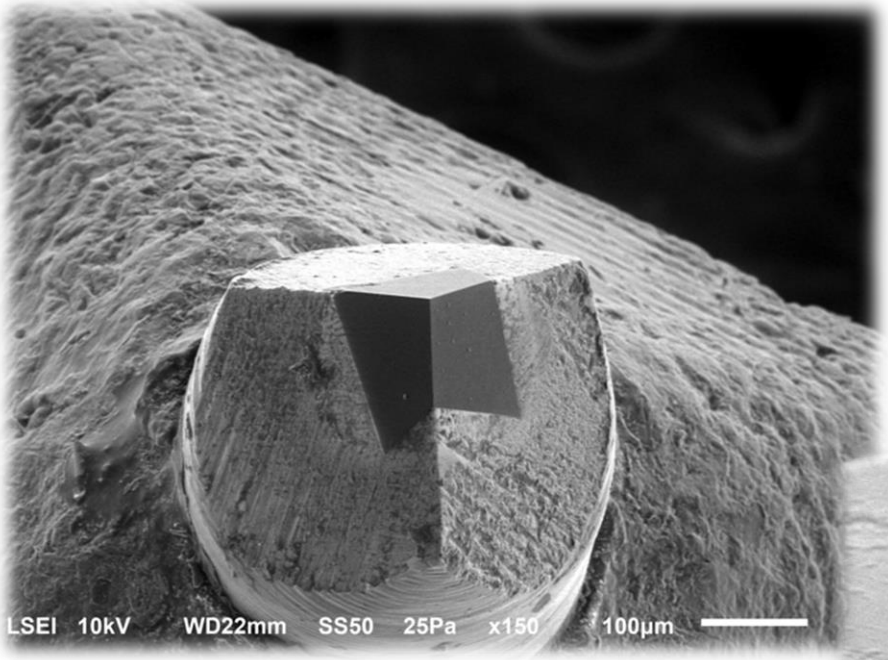


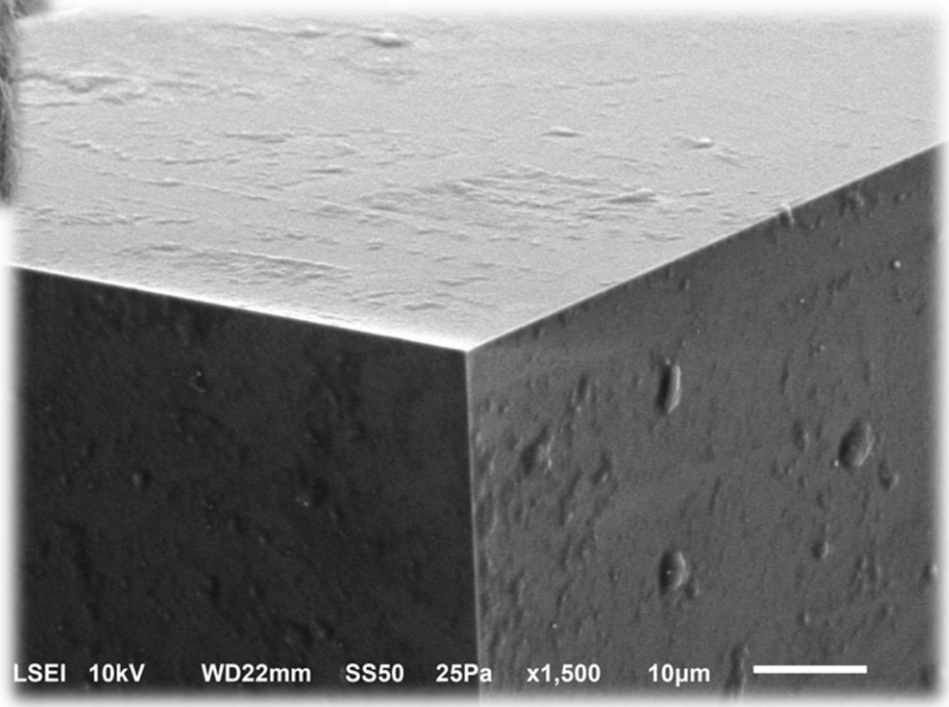


La Nanotecnología y el material Madera


HYSITRON
Mitutoyo
MADE IN JAPAN

Puntas piramidales – Area de Contacto





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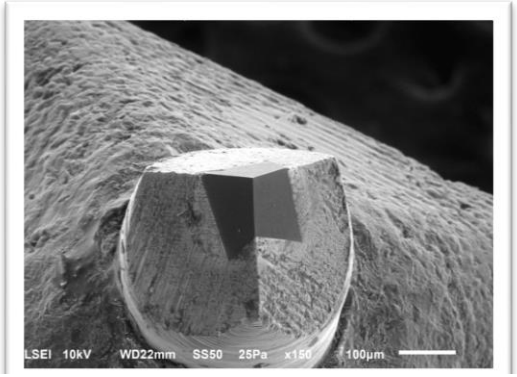
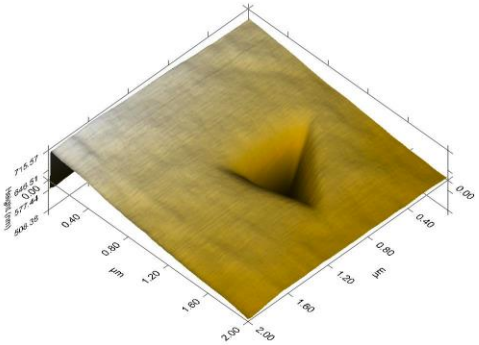
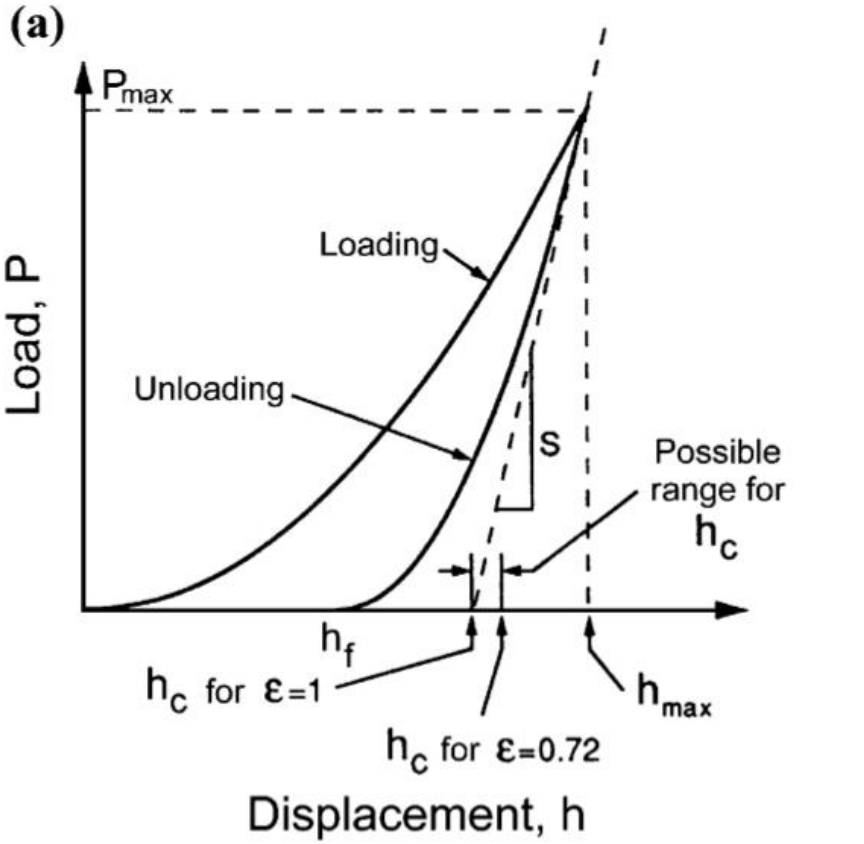
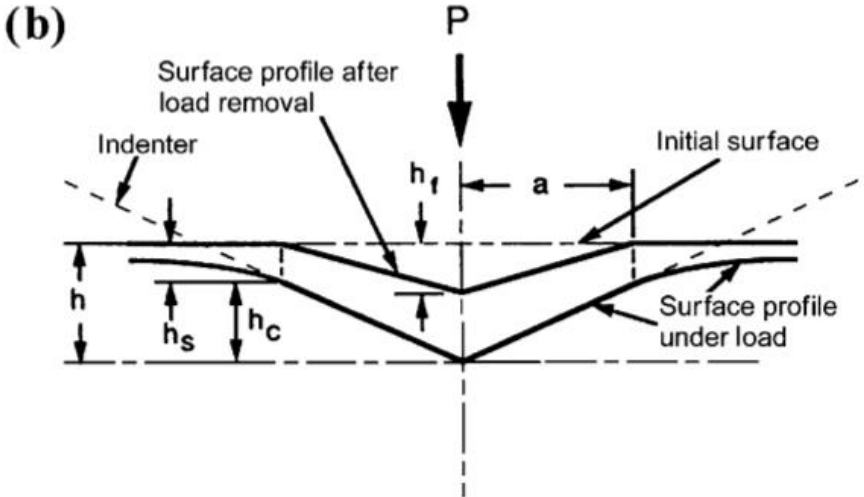
Mecánica de contacto

Variables respuesta: ***E* y *H***









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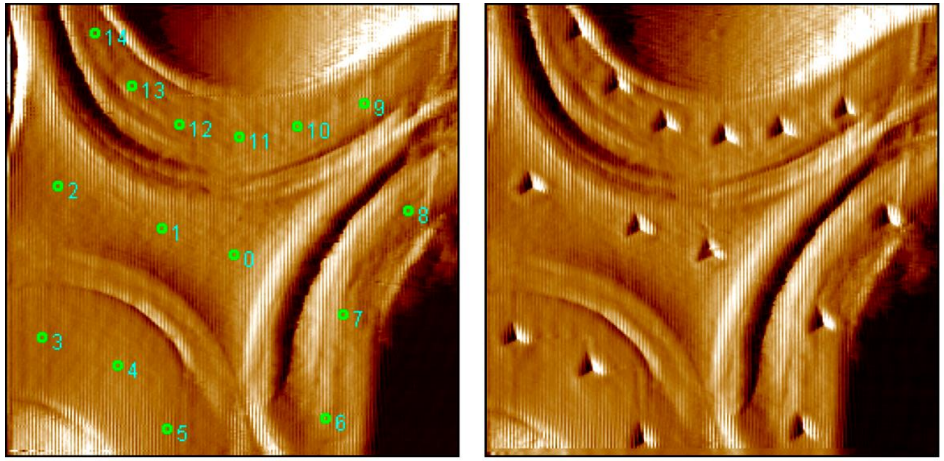
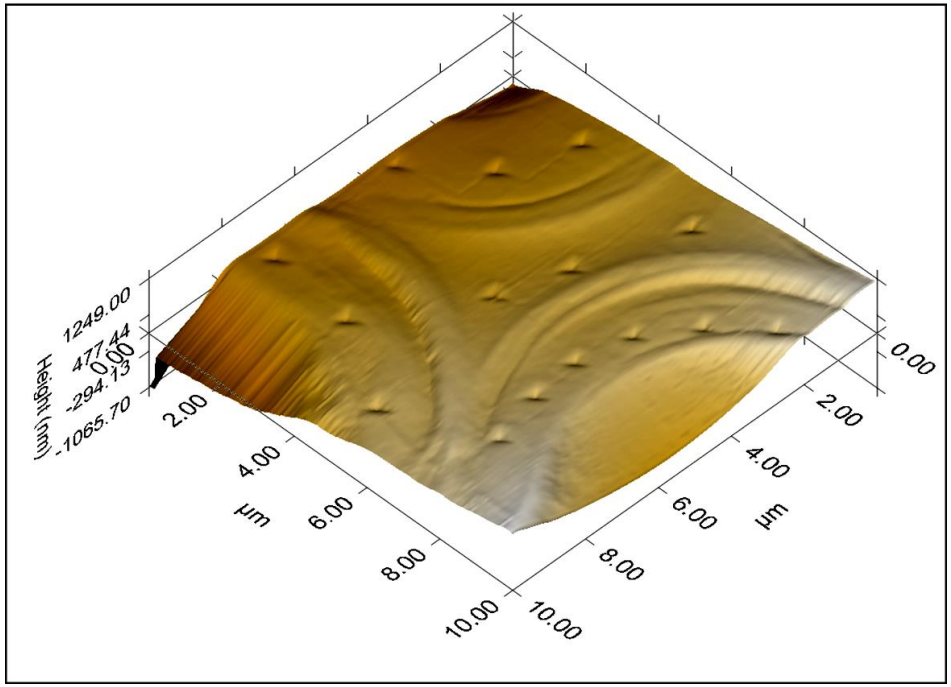
Valores Típicos





Pared celular, S2: 10 – 15 GPa

Lamela media: 4 – 8 GPa

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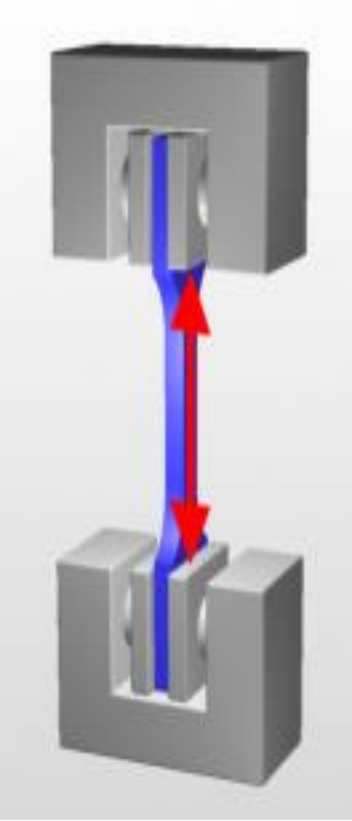
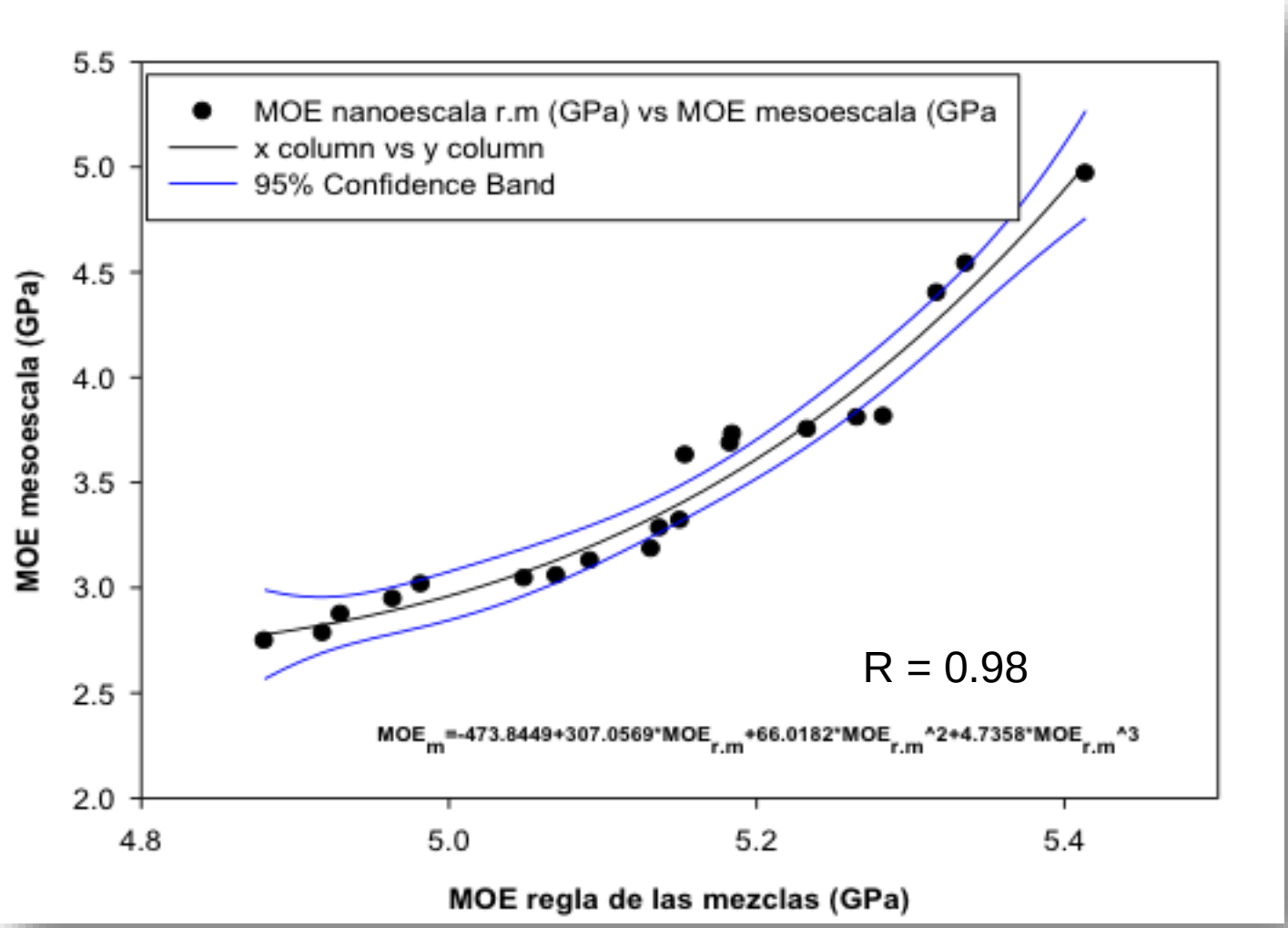
Macro vs. Nano





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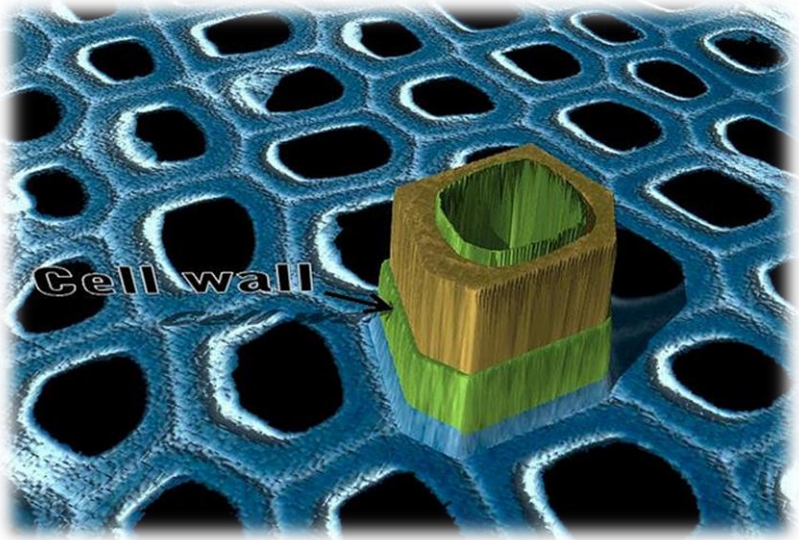
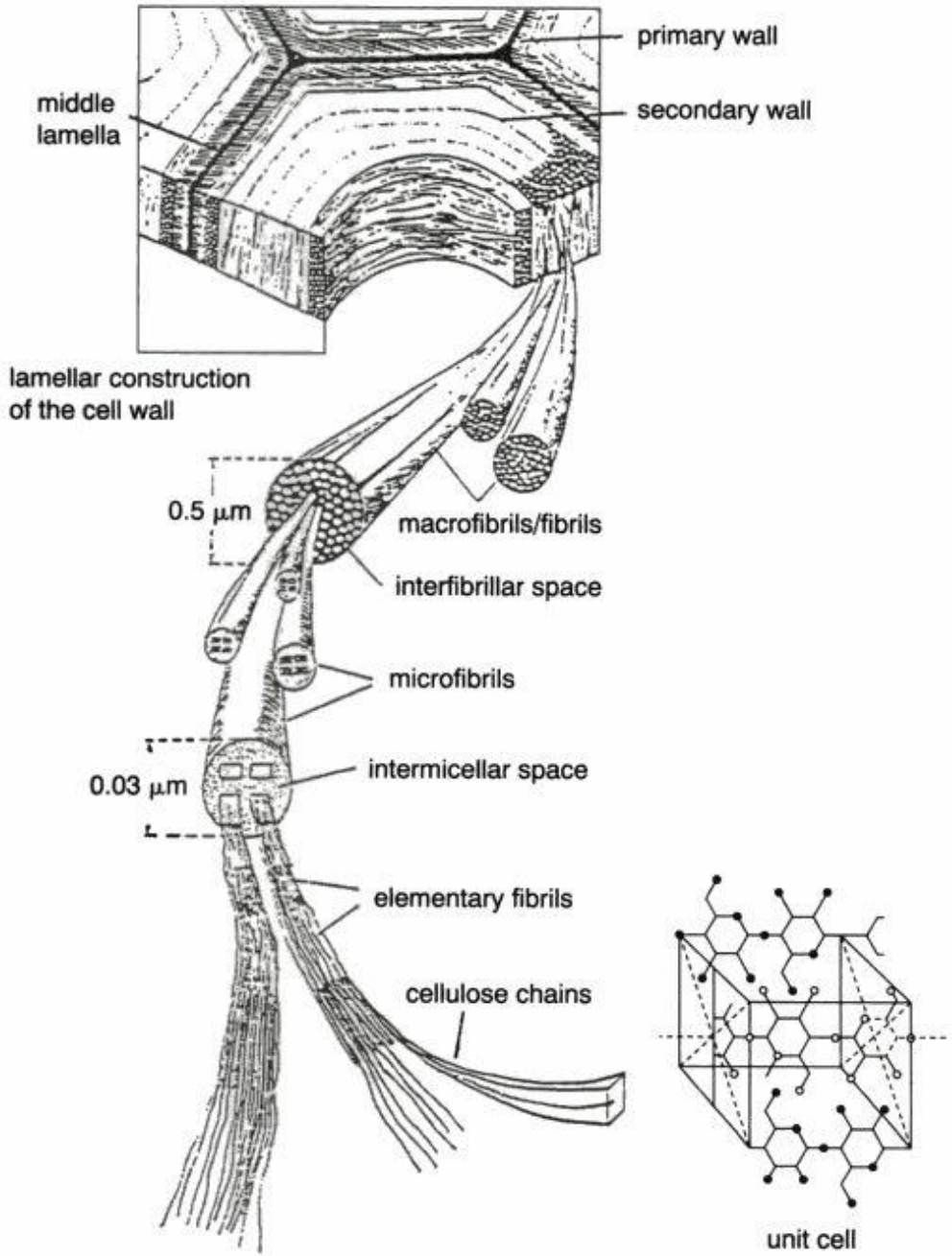
Nanocelulosas

Ultraestructura de la Fibra





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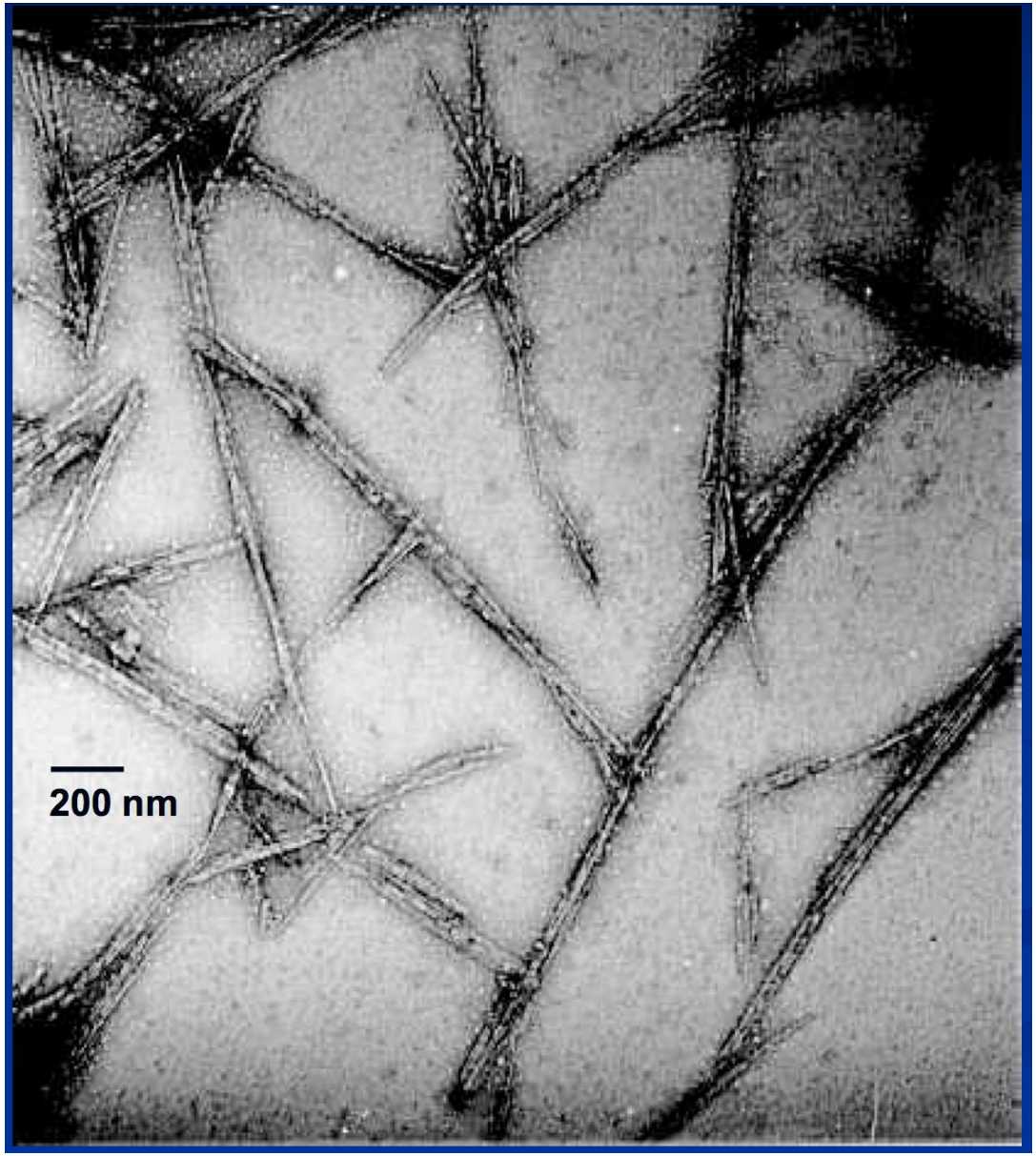
Nanocelulosas



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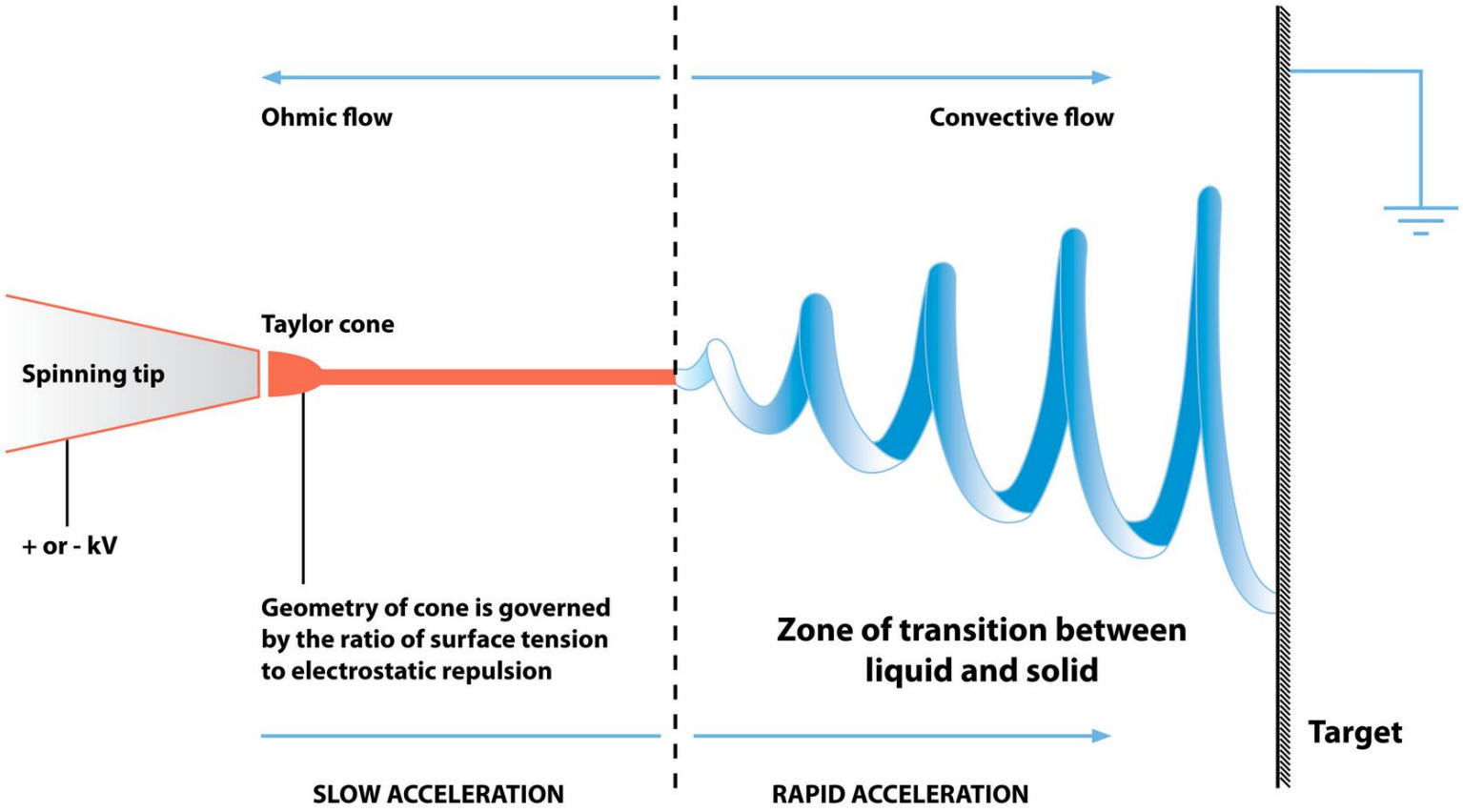
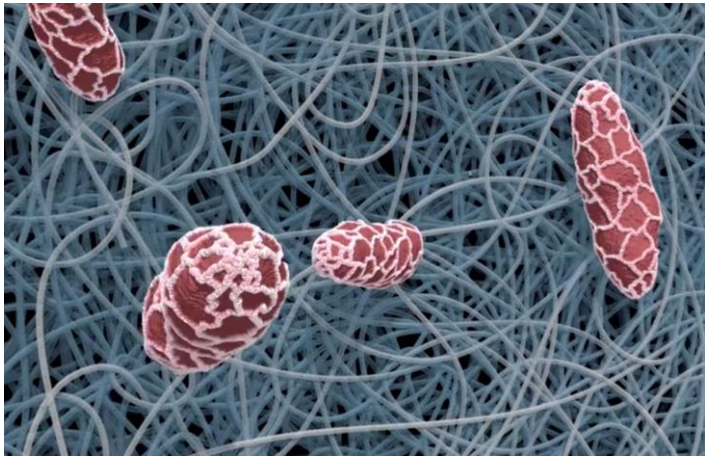
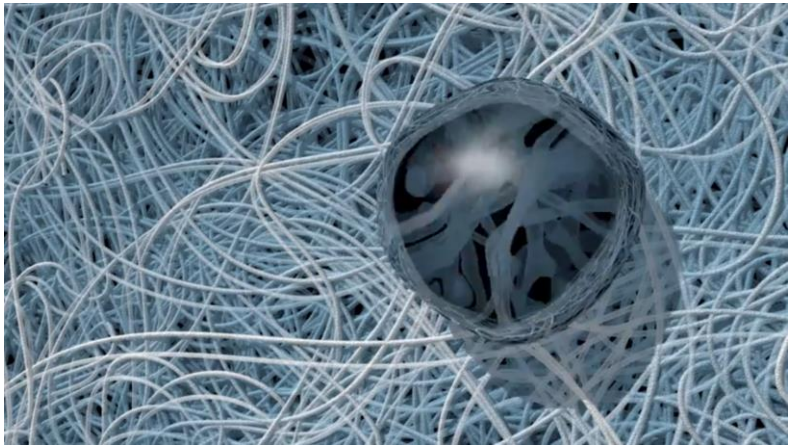
Electrospinning



Aplicaciones de la Nanocelulosa



Anti-bacterias – Barrera de vapor



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En resumen…
Atributos de los nanotejidos

Atributo	Films plásticos	Biotejido de nanocelulosa
Traspaso de aire	No	Si
Traspaso de vapor	No	No
Resistencia mecánica	Baja	Alta
Aislación térmica	Pobre	Buena
Biodegradabilidad	No	Si

Propiedad	Acero (a)	Aluminio (a)	Kevlar 29	Nanocelulosas (b)
Densidad, kg/m^3	7.860	2.800	1.400	1.550
Resistencia a la tensión (MPa)	500	400	2.800	10.000
Módulo de Young (GPa)	200	70	183	130 - 250

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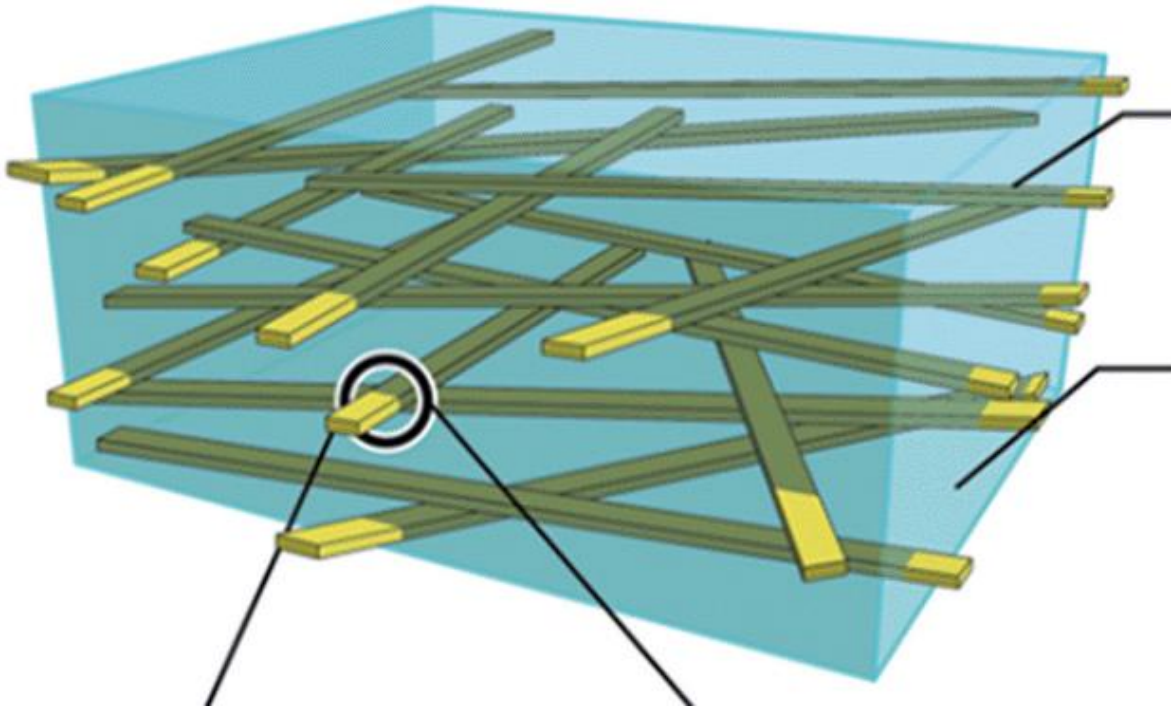
Refuerzo de Matrices



- Prop. mecánicas
- Barrera térmica
- Barrera ruido
- Barrera vapor
- Biodegradable

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Súper material “verde”

- Material de refuerzo en matrices poliméricas como los adhesivos para madera y otros termoplásticos (nanocomposites),
- Refuerzo en pinturas y barnices,
- Material para embalaje de alimentos,
- Material de refuerzo en papeles especiales y
- Como un gel no alergénico (hidrogel) para aplicaciones en medicina u otras aplicaciones en la industria química.

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Tremenda oportunidad

Muchas gracias…!!

Centro de Biomateriales y Nanotecnología
Departamento de Ingeniería en Maderas

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