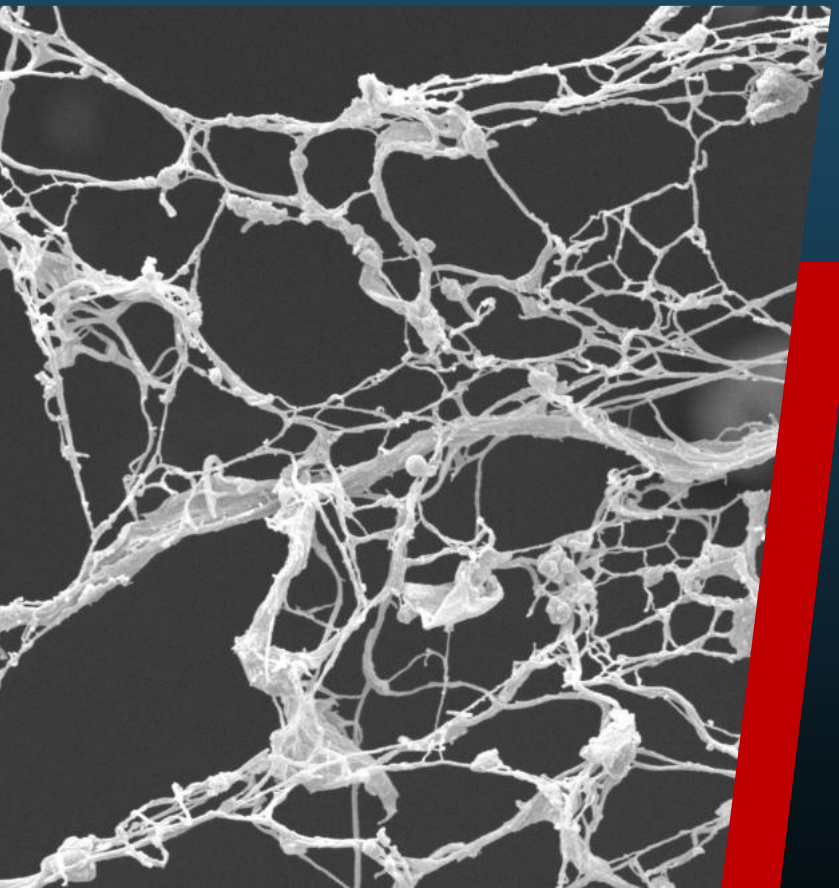


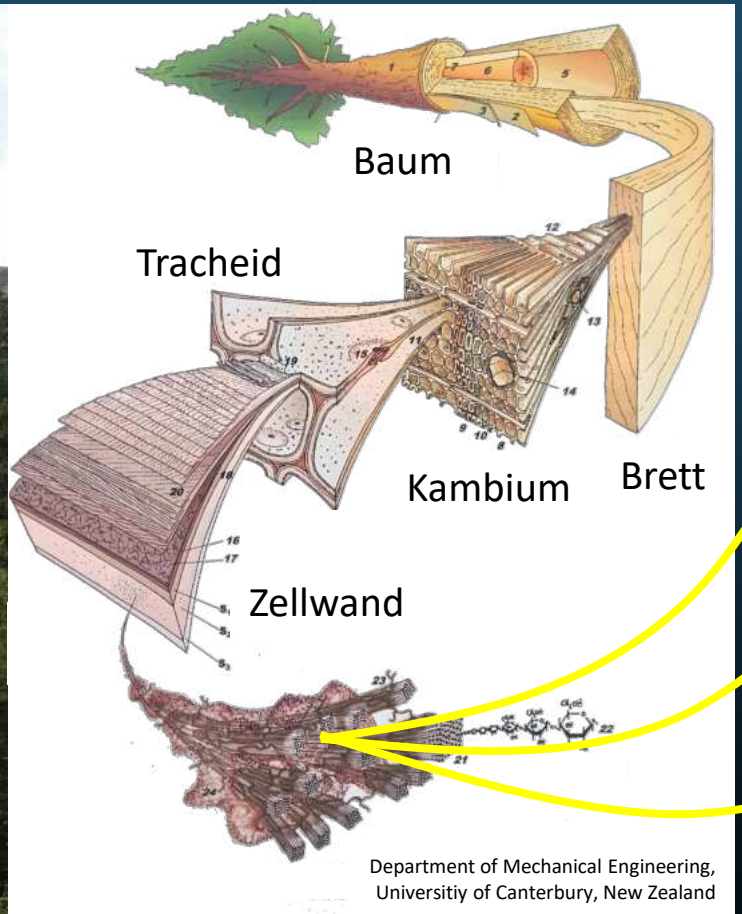
Empa

Materials Science and Technology

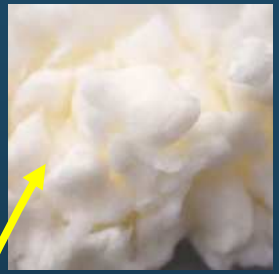
Nanocellulose - Ein Rohstoff mit mannigfaltigen Eigenschaften

Thomas Geiger

Ursprung der Nanocellulosen



Department of Mechanical Engineering,
Universitiy of Canterbury, New Zealand

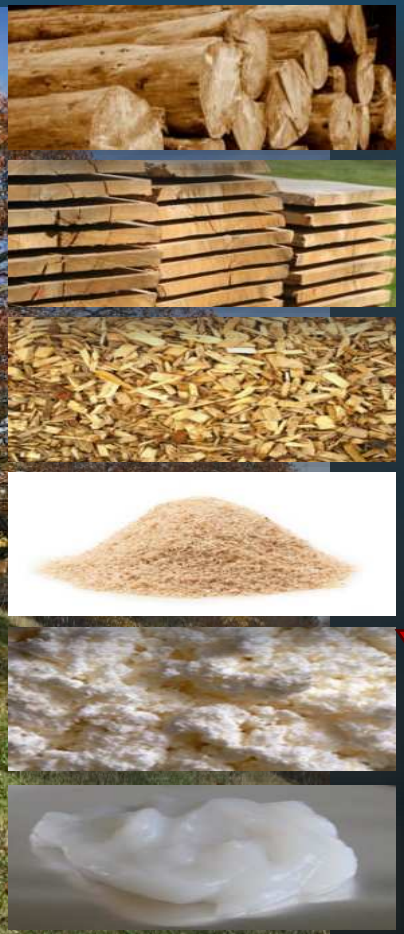


Cellulose

Lignin

Hemicellulose

Ursprung der Nanocellulosen



Makro

Nano

Säge

Häcksler

Refiner

Disperser

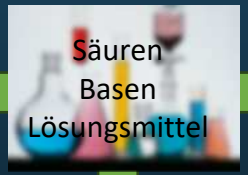
Reibmühle

Kugelmühle

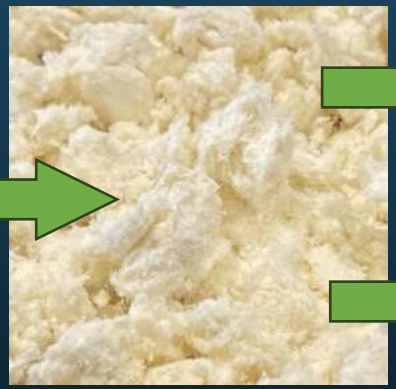
Ursprung der Nanocellulosen

Holzschnitzel

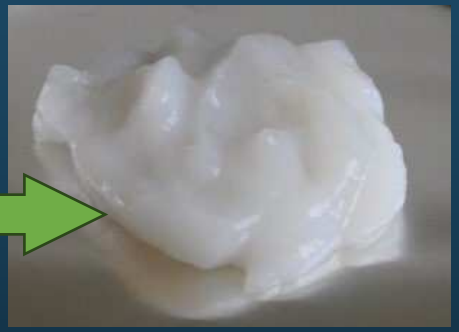
Refiner



Zellstoff
Cellulosefaser



Cellulose Nano-Fibrillen



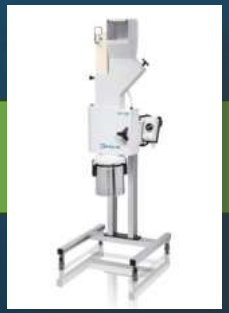
Cellulose Nano-Kristalle

Lignin

Hemicellulose

Herstellung der Cellulose Nano-Fibrillen

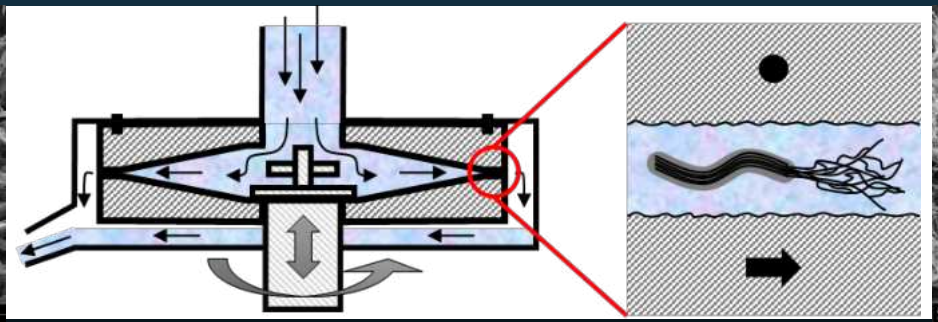
Zellstoff

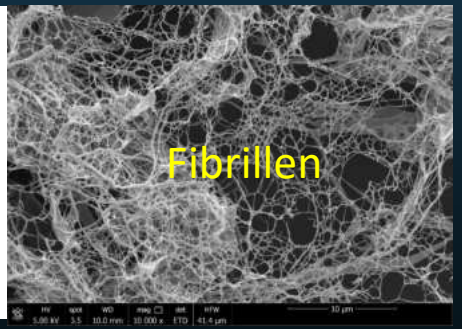


Schneidmühle

ultra-feine Reibmühle
‘‘Supermass-Colloider’’
Masuko Sangyo Co.

Cellulose **N**ano-**F**ibrillen (CNF)
Micro-**F**ibrillierte **C**ellulose (MFC)
Nano-**F**ibrillierte **C**ellulose (NFC)

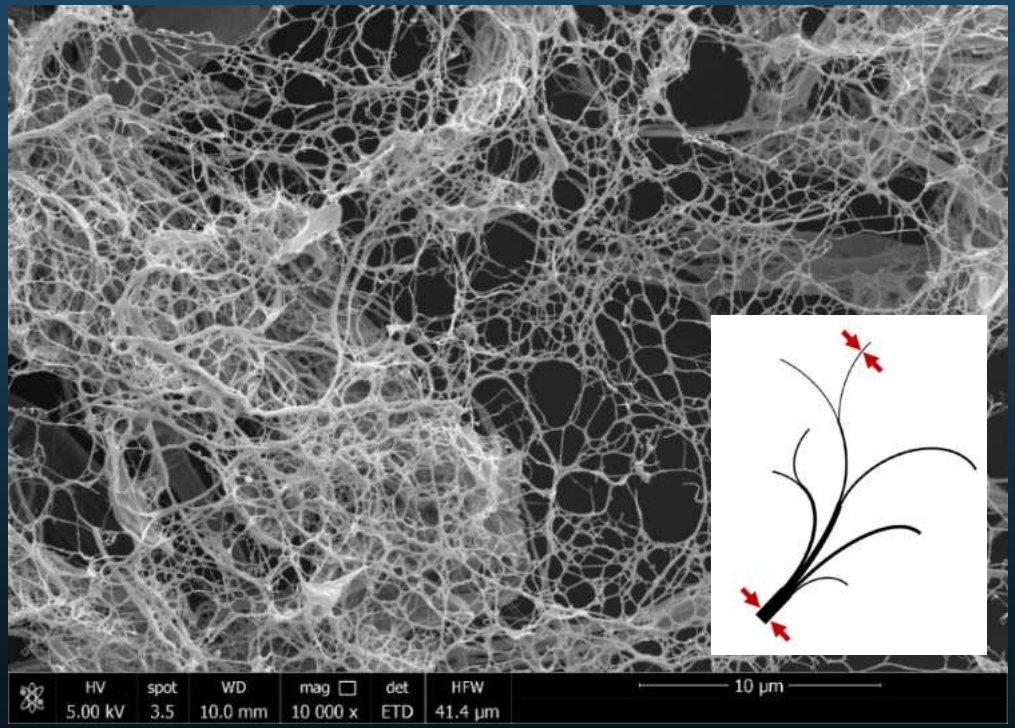




Cellulose Nano-Fibrillen

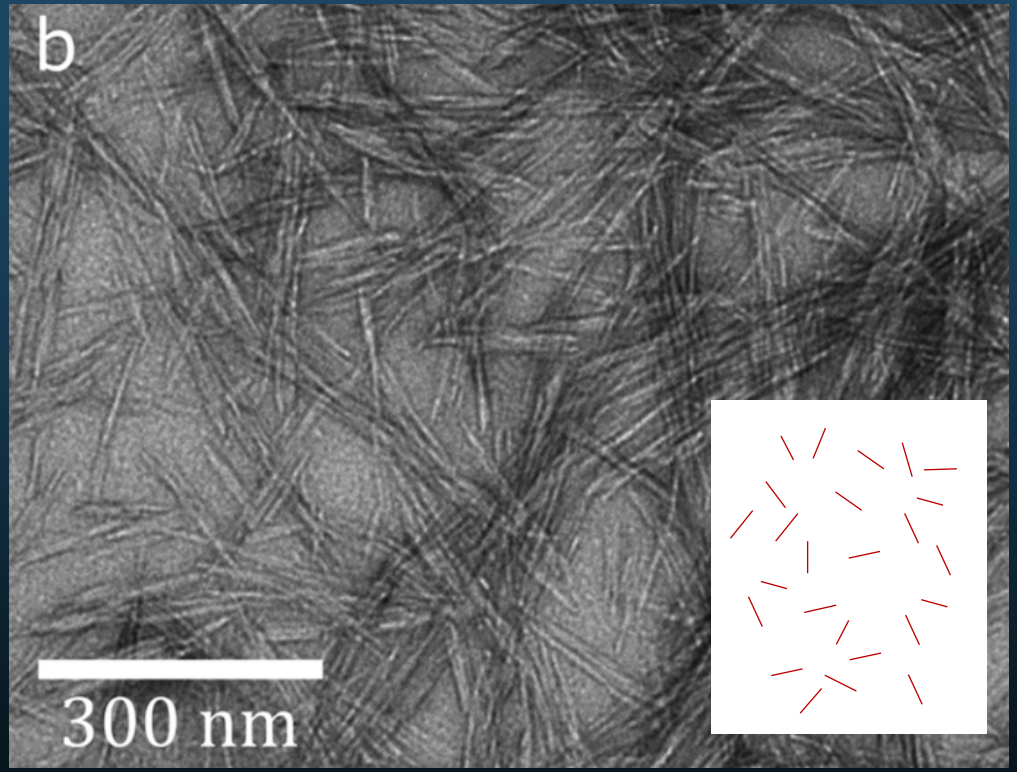
- Flexibles Fibrillennetzwerk
- Fibrillenlänge: >1 µm
- Fibrillendicke: 3 – 100 nm
- Spez. Oberfläche: bis zu 200 m^2/g
- Wässrige Dispersion: 2 - 8 Gew.% CNF
- Energieaufwand zu Herstellung:

  10 kWh/kg(Zellstoff)



Cellulose Nano-Kristalle

- Steife Stäbchen
- Kristalllänge: 50 - 350 nm
- Kristalldicke: 5 - 20 nm
- Spez. Oberfläche: 100 - 250 m^2/g
- Feines trockenes Pulver



Einsatz- und Forschungsfelder von Nanocellulose

Kosmetik

Tinten

Zement

Batterien

Transparente Filme

Hochleistungskondensatoren

antimikrobielle Filme

Lebensmittelüberzüge

Barriere-/Trennmembranen

Elektronik

Klebstoffe

Endlosfasern und Textilien

Bohrflüssigkeiten

Wirkstoffabgabe

Katalysatorträger

Papierprodukte

Schicht-Folien

elektroaktive Kunststoffe

transparent-flexible Elektronik

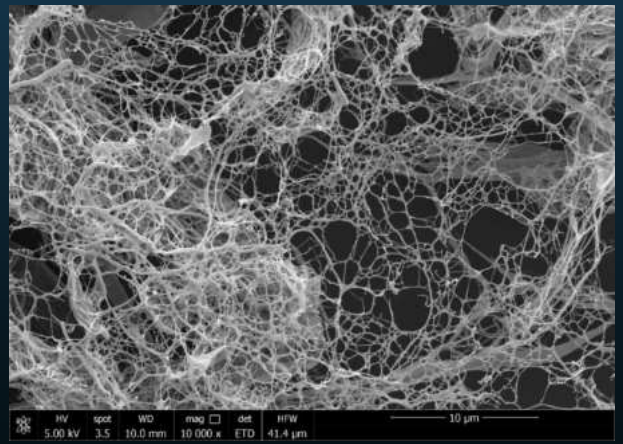
Kunststoffverstärkung

Schäume

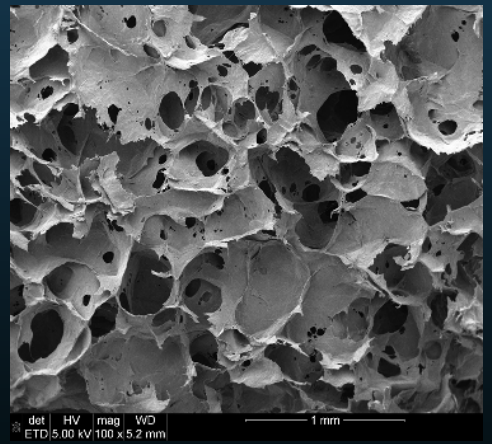
Biomedizinische Gerüststrukturen

Gehäuse

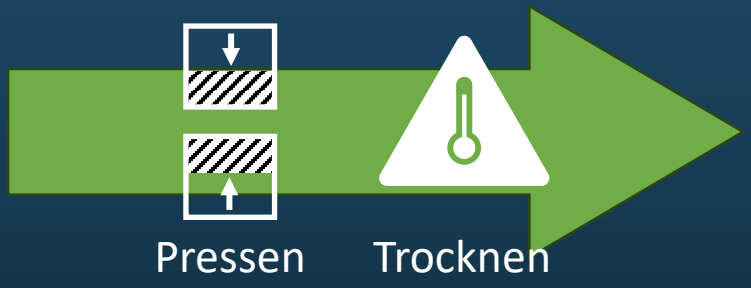
Schäume aus Cellulose Nano-Fibrillen

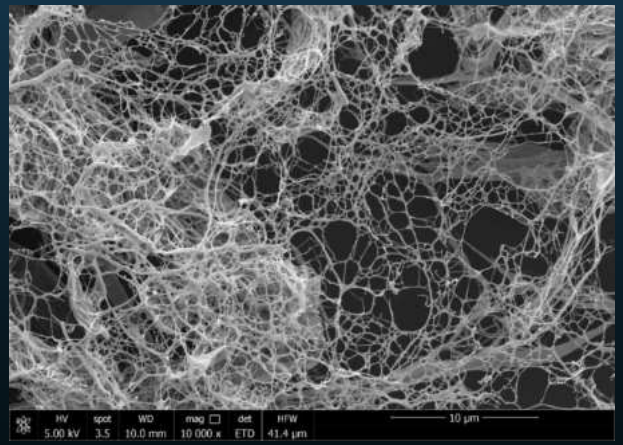


- Gehalt an CNF: 2 Gew.%
- Dichte des Schaums: 29 kg/m^3
- Porosität: 98 %
- Kapazität: 40 $L_{Öl}/kg_{Schaum}$
- druckstabil bis ca. 60 kPa
- Anwendungen:
  Ölabsorber, Dämmung, Filter

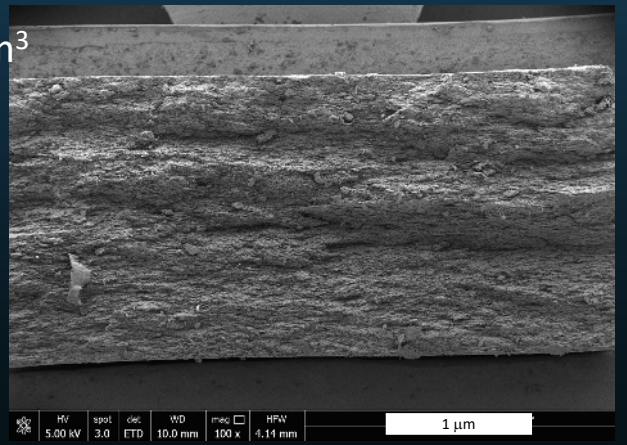


Platten aus Cellulose Nano-Fibrillen

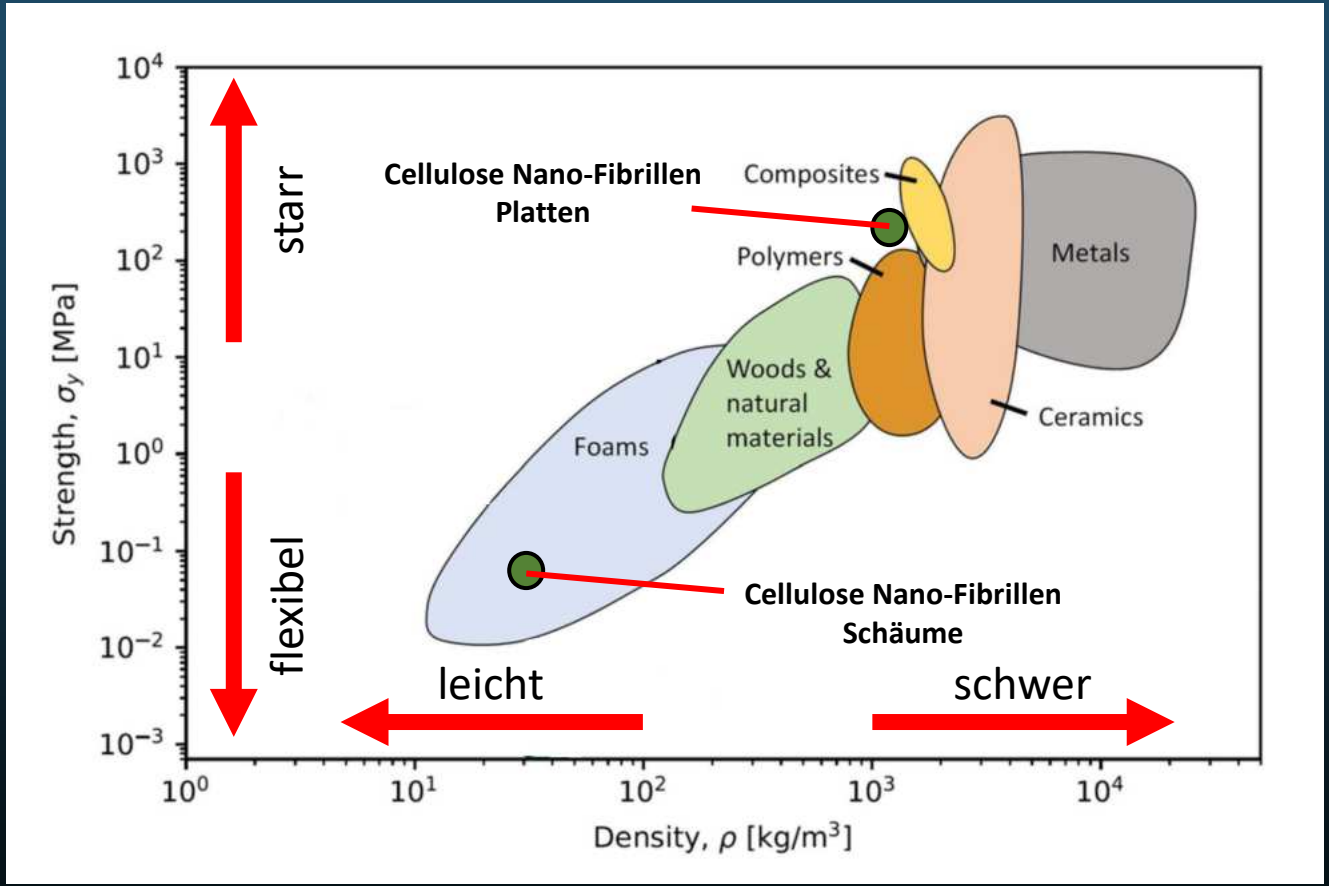




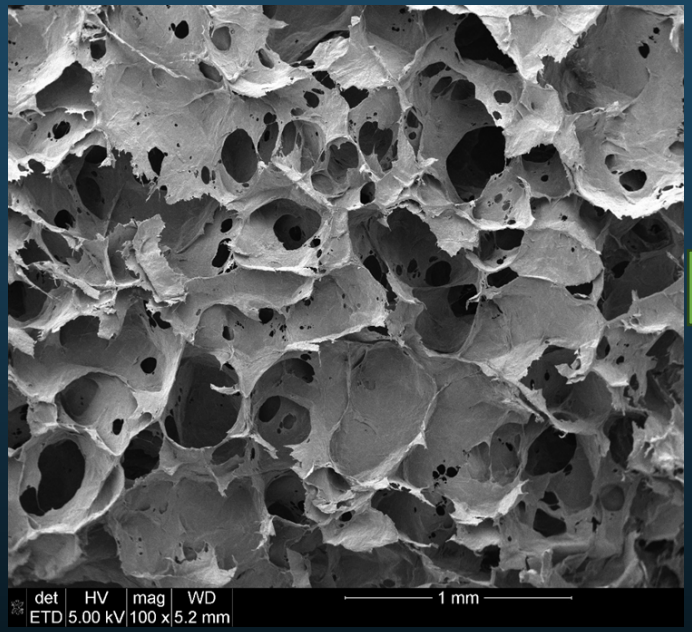
- Dichte der Platte: bis 1500 kg/m^3
- Biegefestigkeit: bis 250 MPa
  Biegemodul: bis 14 GPa
- Zugfestigkeit: bis 150 MPa
  Zugmodul: bis 14 GPa
- Anwendungen:
  Gehäuse, Leiterplatinen

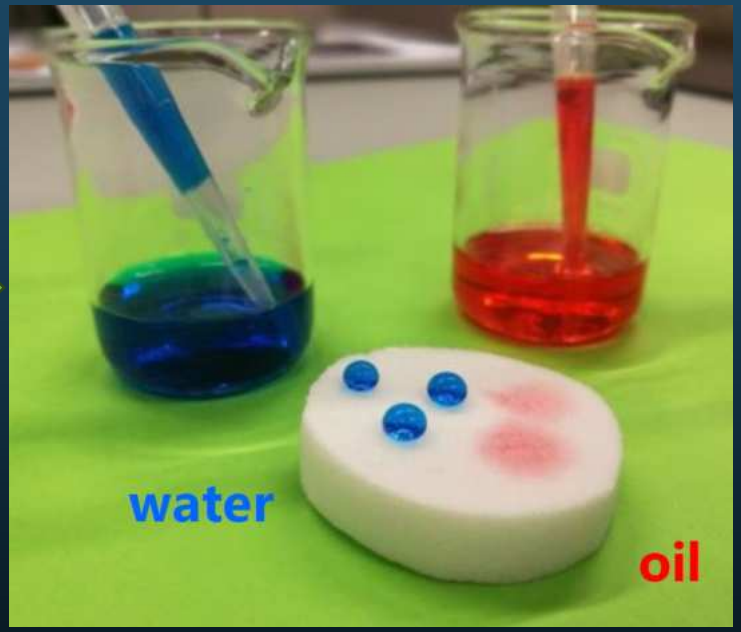


Materialwelten

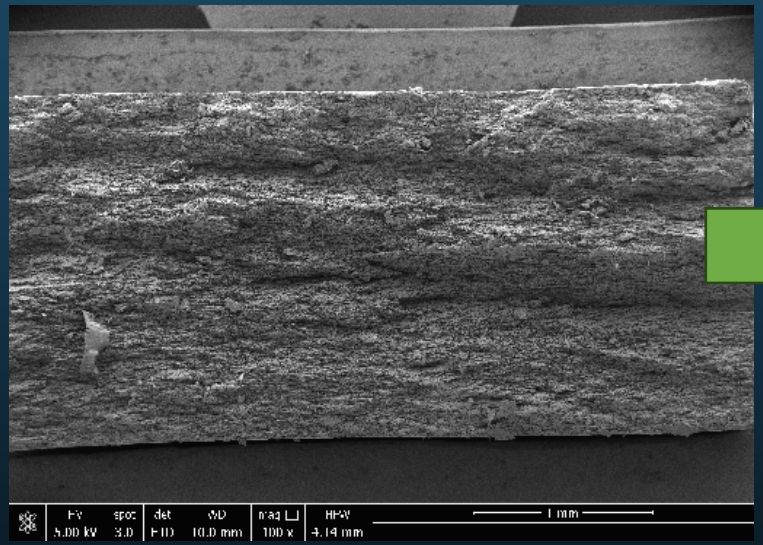


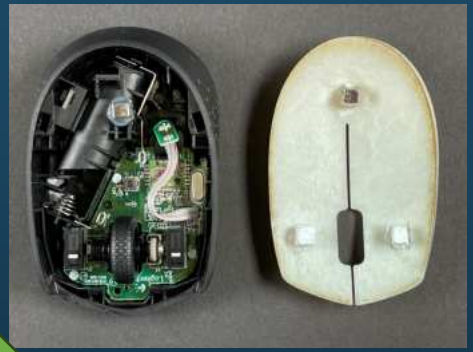
Schäume aus Cellulose Nano-Fibrillen



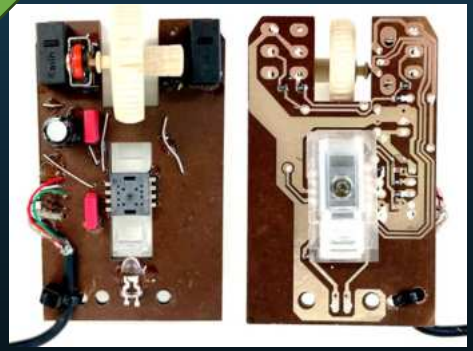


Cellulose Nano-Fibrillen für Computermäuse





Gehäuse für Computermaus



Platine für Computermaus

Empa – The Place where Innovation Starts

Thomas Geiger

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