



The Harvey M. Krueger Family Center
for Nanoscience and Nanotechnology

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“Nano – bio mimetika; materiali za prihodnost”



Naši trenutni materiali, strukture in stroji

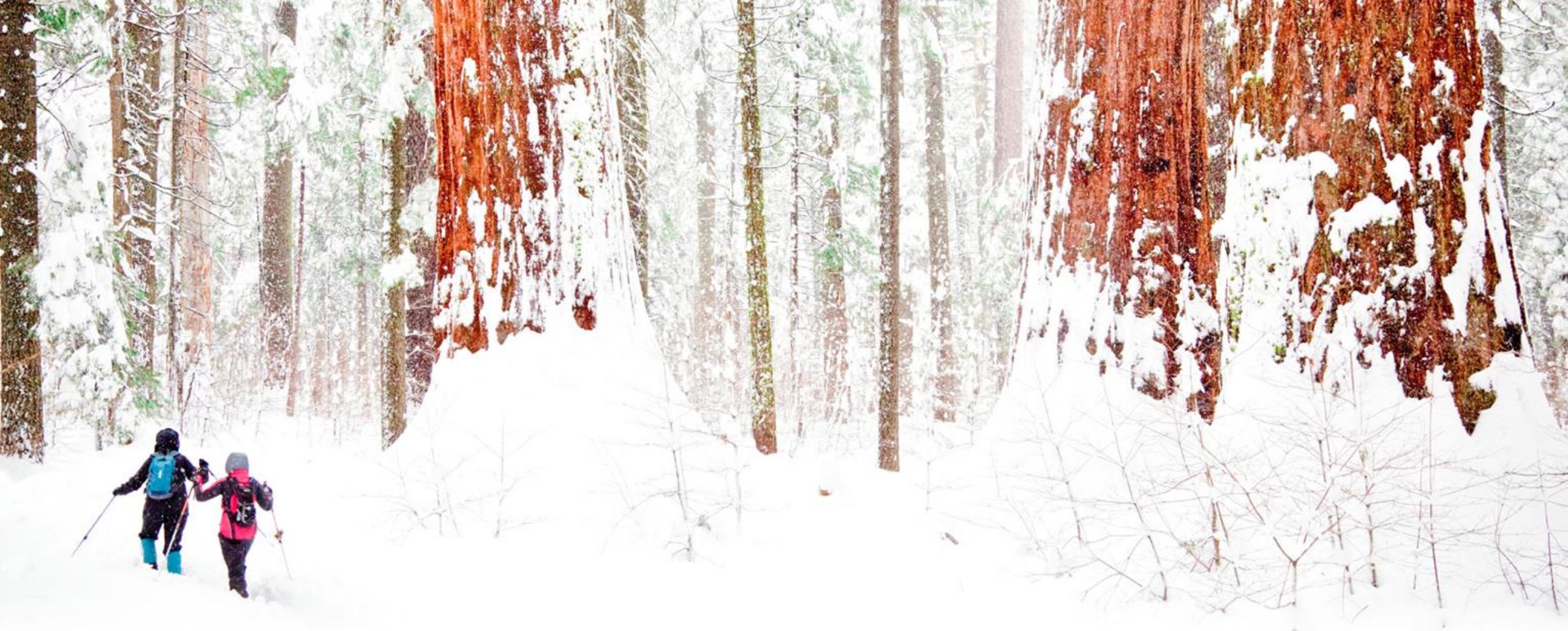


Naši trenutni materiali in strukture



**3 bilijoni let
evolucije je privedlo do vrhunskih
materialov in struktur**



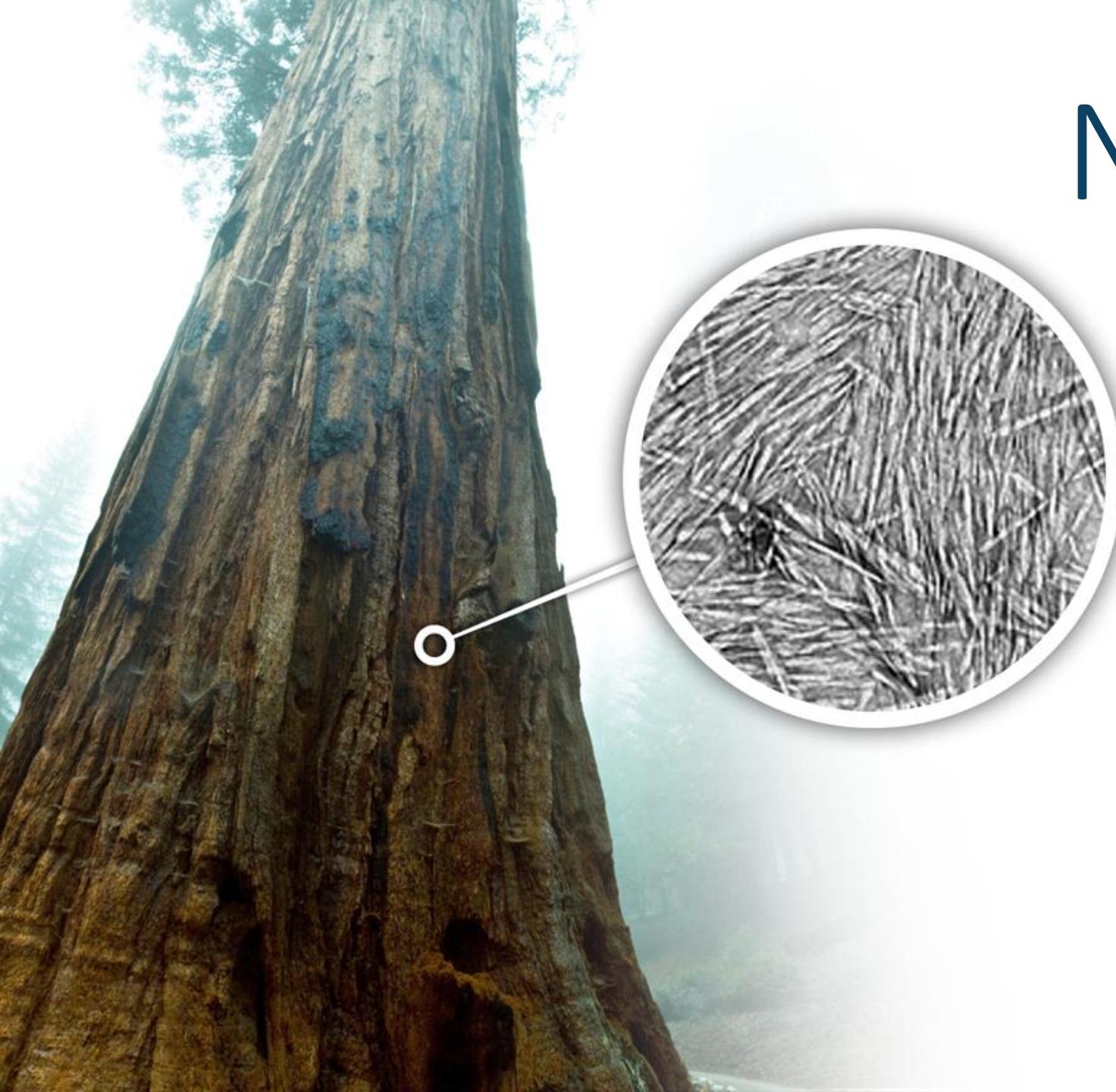


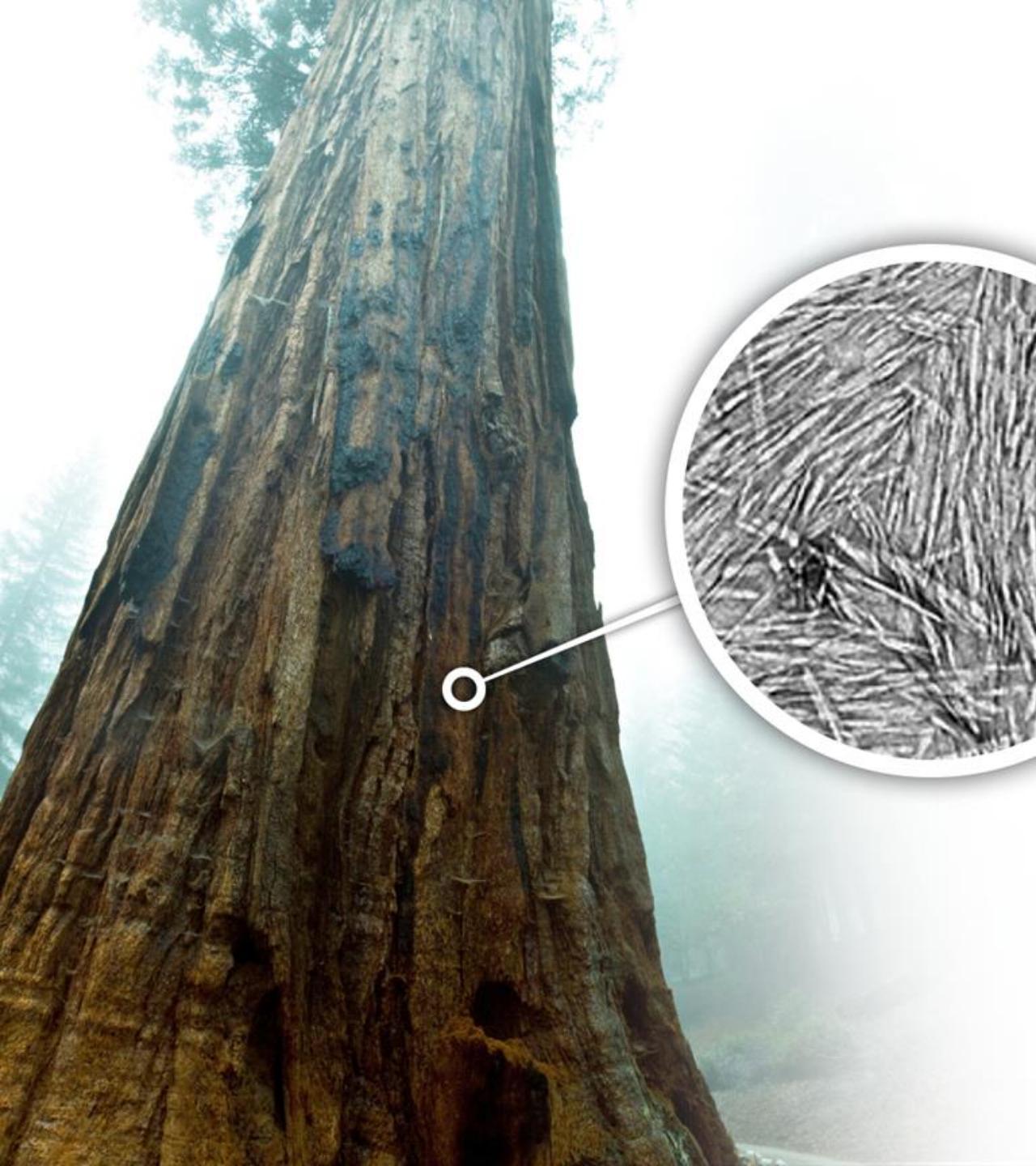
**Drevo sekvoja-
stotine ton za stotine let**



Na soncu in UV svetlobi

Narejeno iz:





Narejeno iz



sladkorja!!!

10
krat
močnejše
kot jeklo!



CNC; prihodnost industrije



Google™



Alibaba.com™

ebay™



Odpadki celulozne in papirne industrije,
odličen vir za CNC

**11M ton
odpadkov
letno,**

samo v Evropi





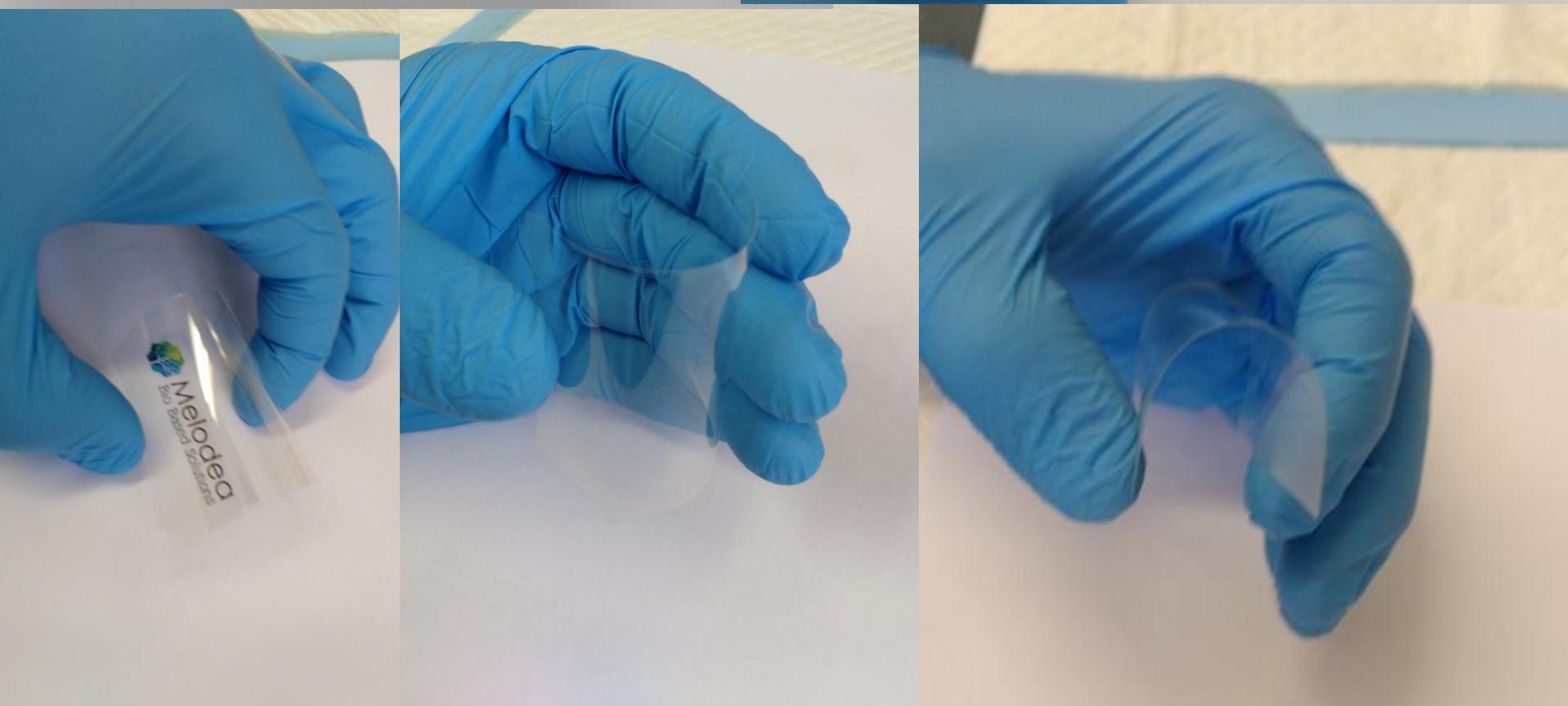
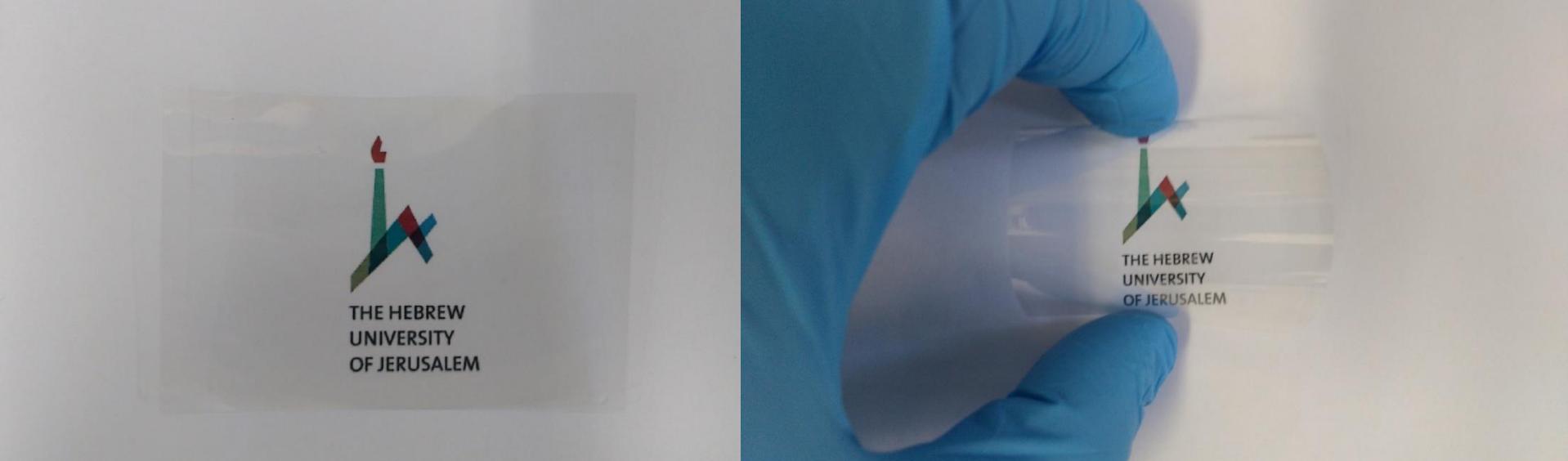
Melodea
Bio Based Solutions



Kako prevesti okoljski
problem
v rudnik zlata



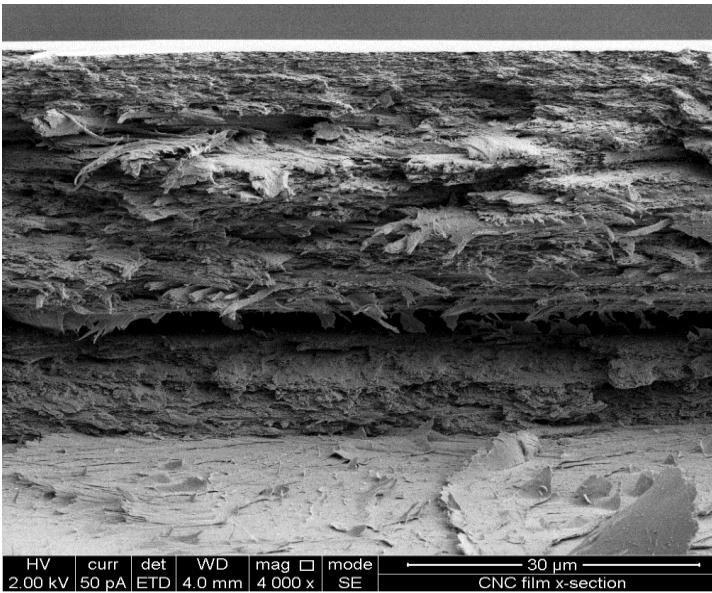
Slika CNC z
elektronskim
mikroskopom



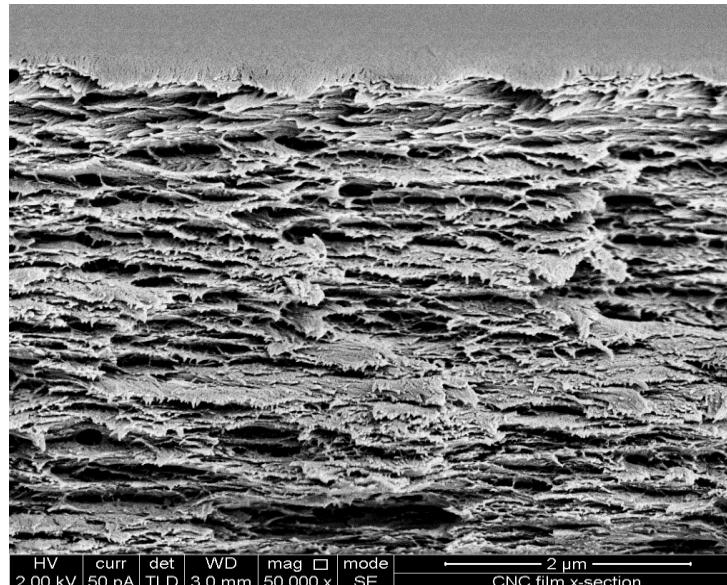
SEM analiza prečnega prereza zamreženega in običajnega CNC filma

OBIČAJNI

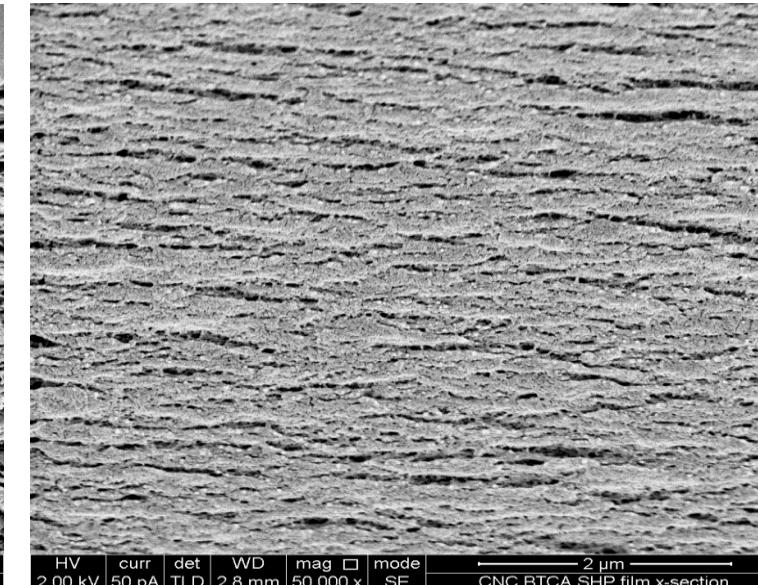
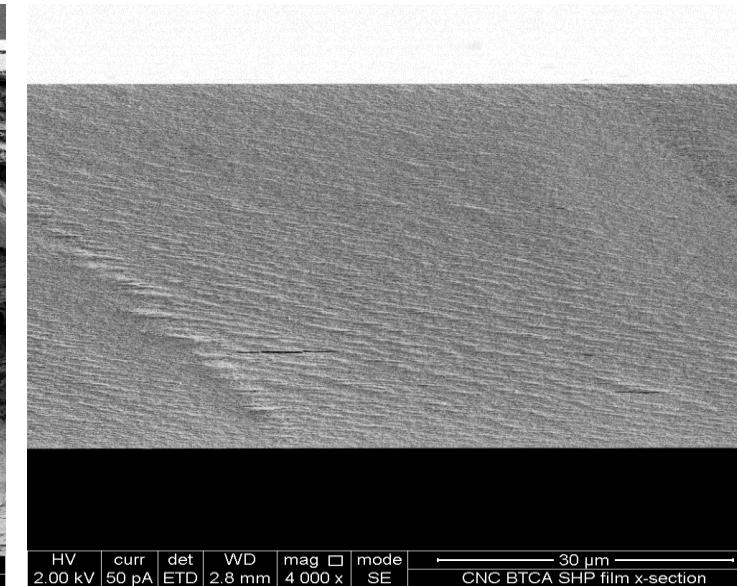
100,000 ×



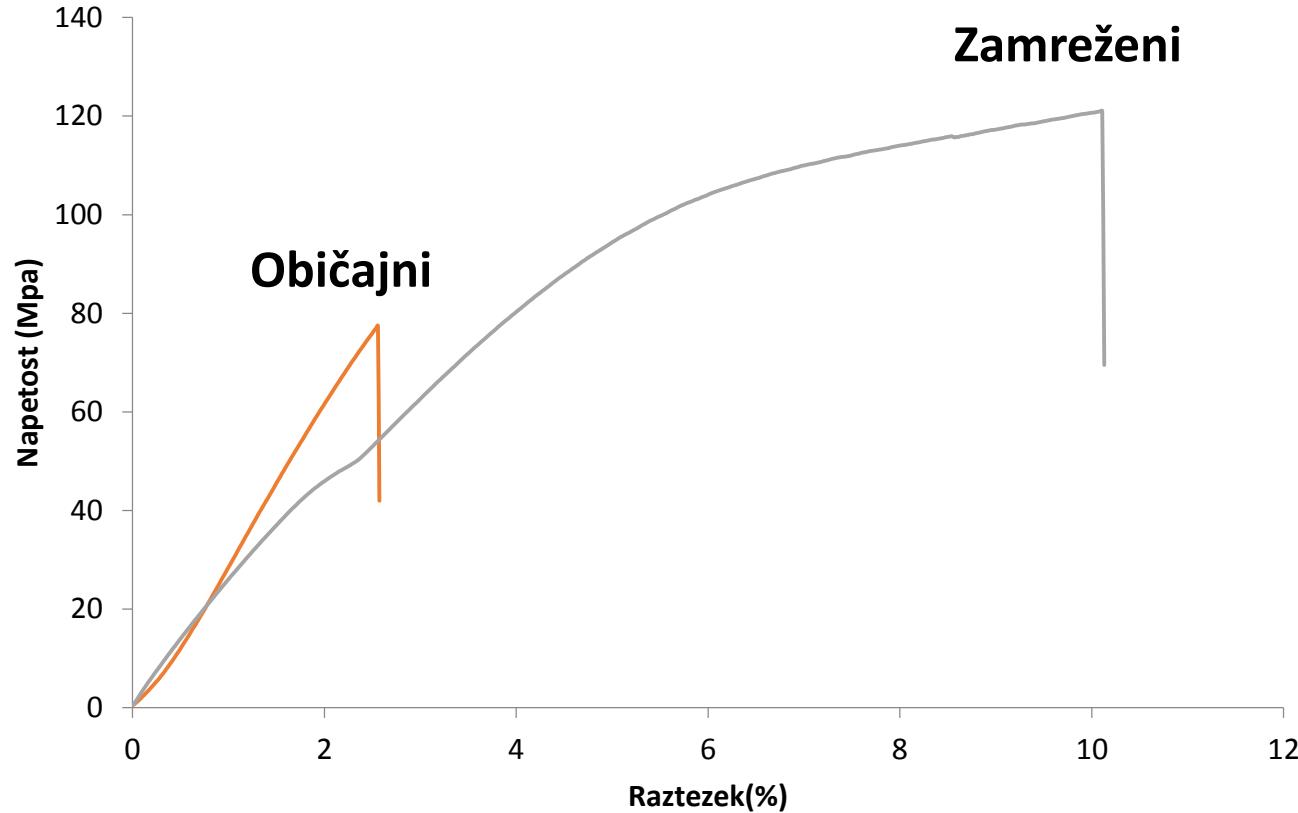
200,000 ×

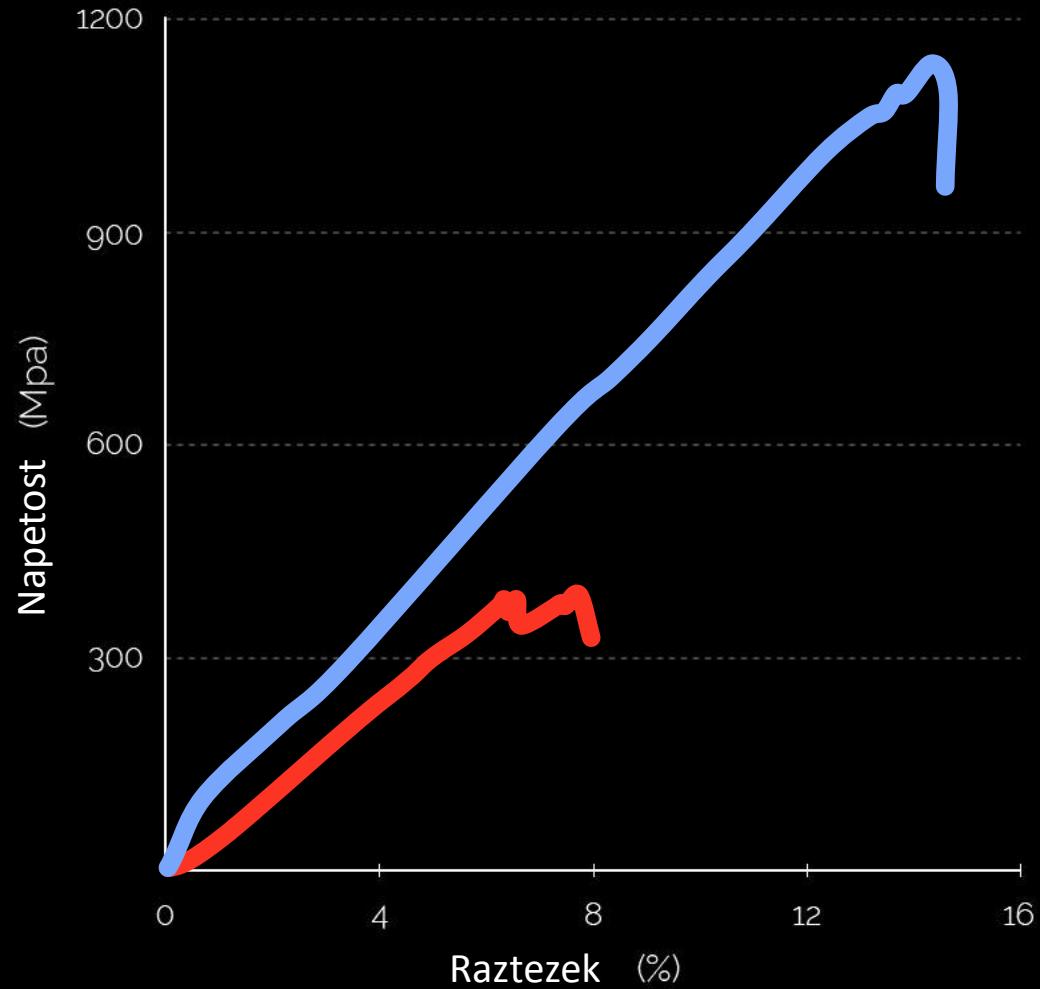


ZAMREŽENI

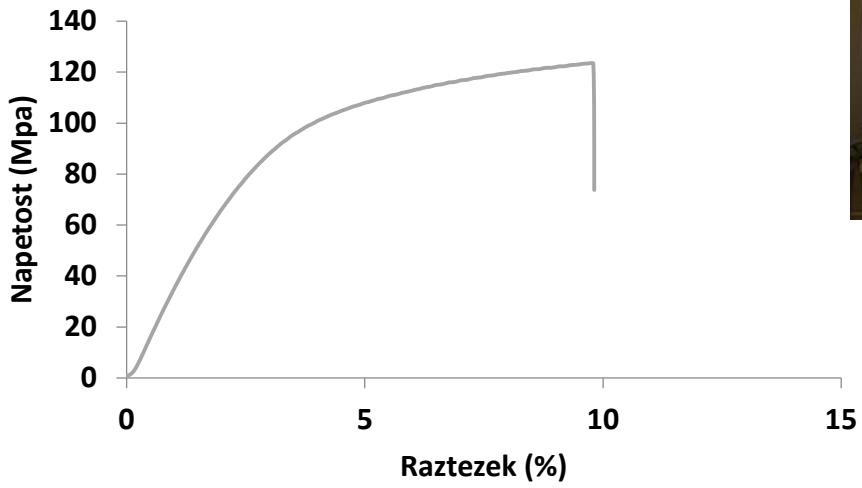


Utržna jakost normalnega in zamreženega CNC filma





CNC/CNT (Tortech CNT) kompozitni prevodni filmi



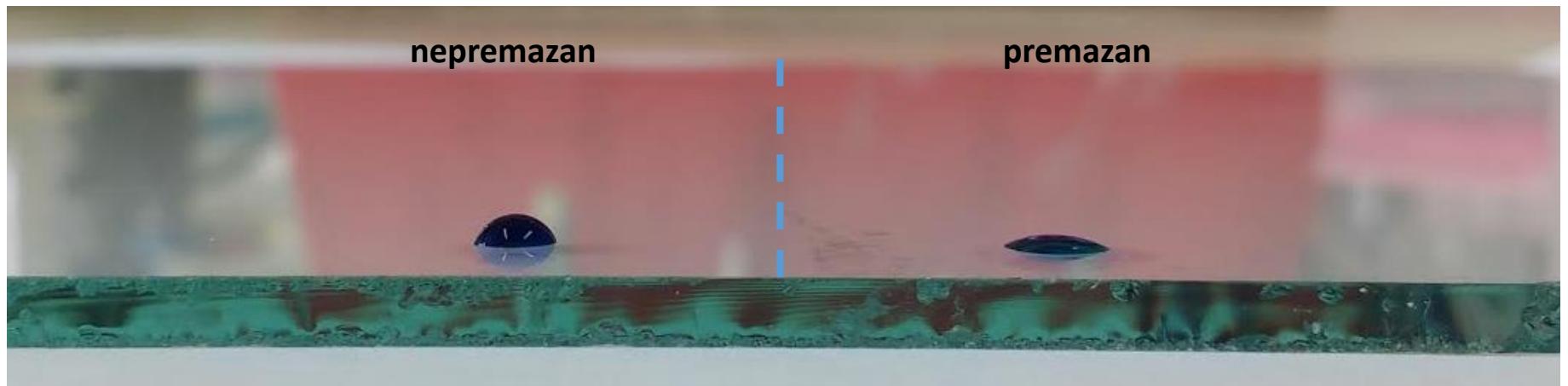
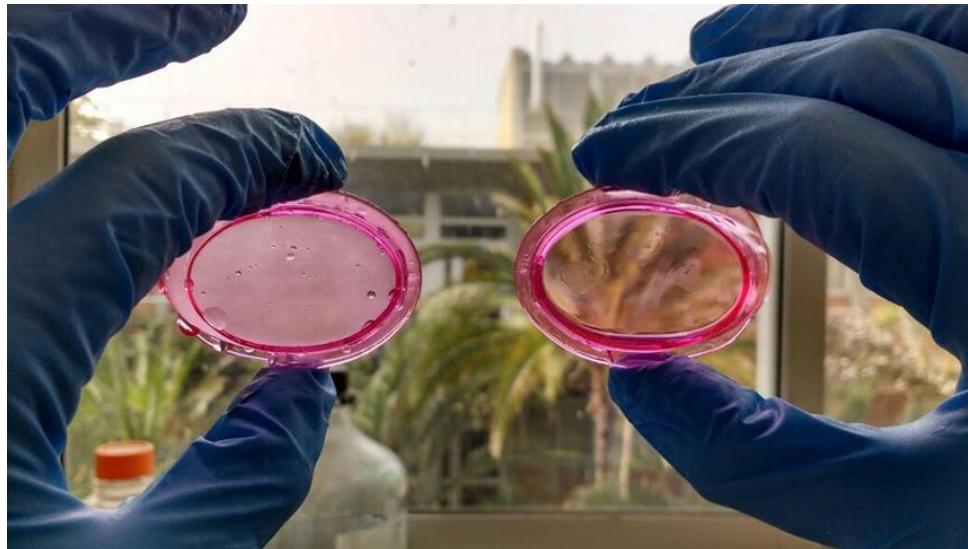
POV.	
Žilavost (MJ/m ³)	7.8
Young modul (Mpa)	4000

Električna upornost: 29 Ω/sq



CNC Super hidrofilni premaz

Spray premaz na osnovi
CNC

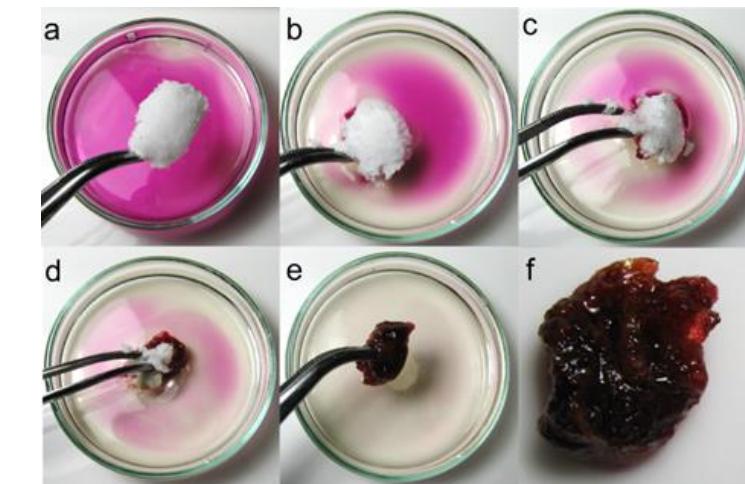
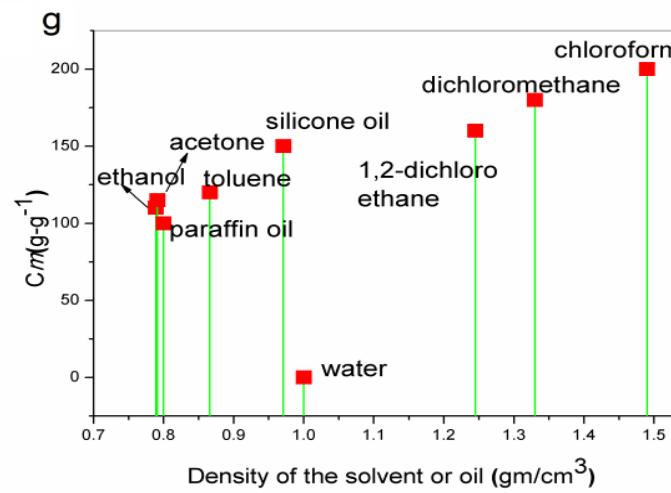
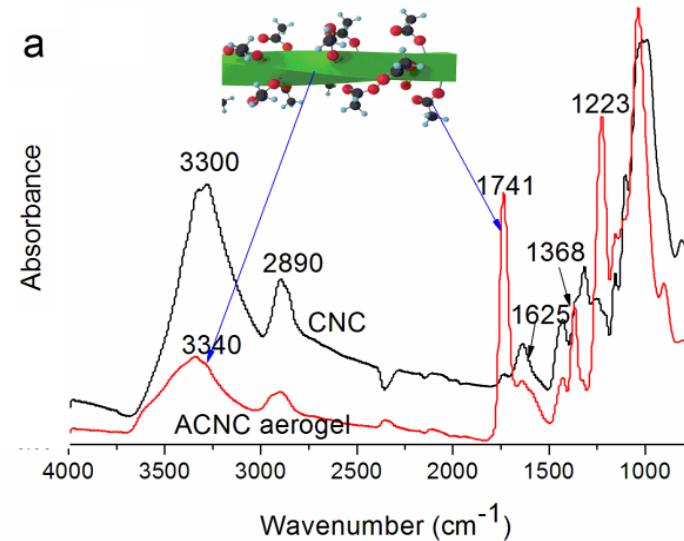


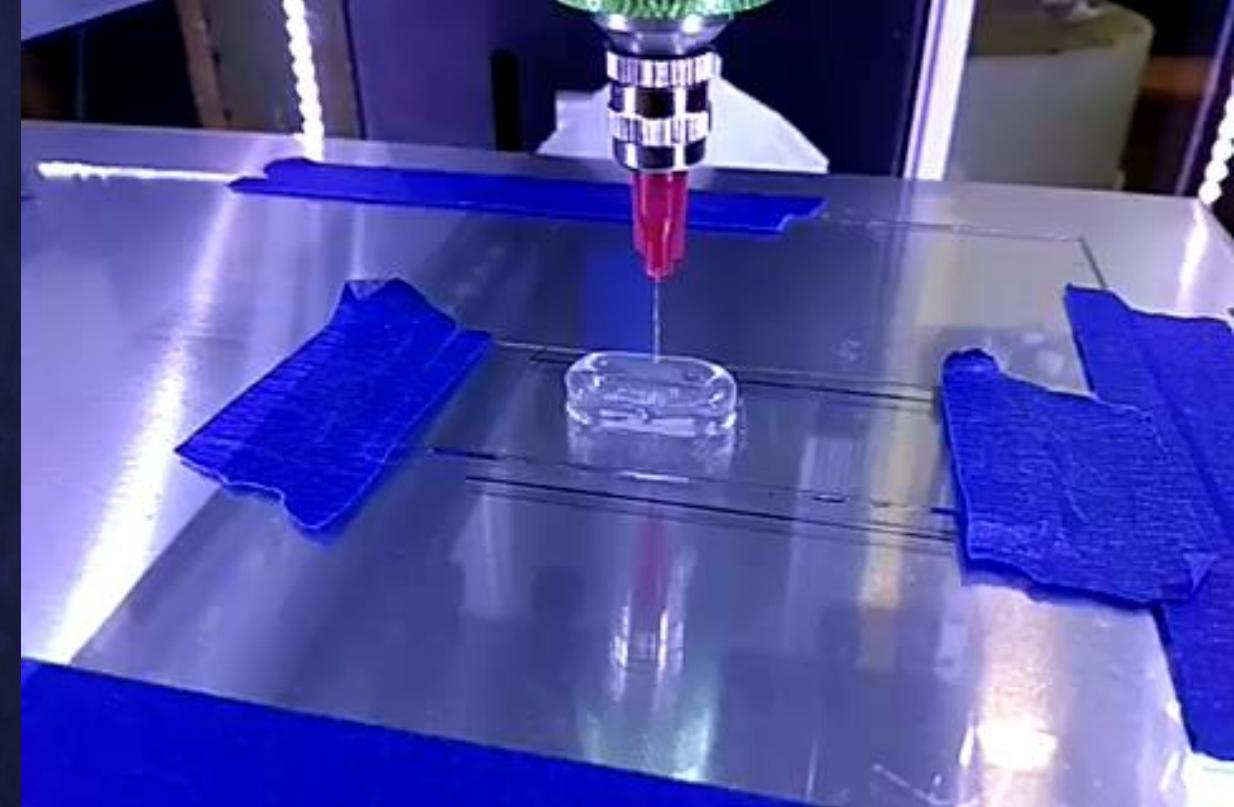
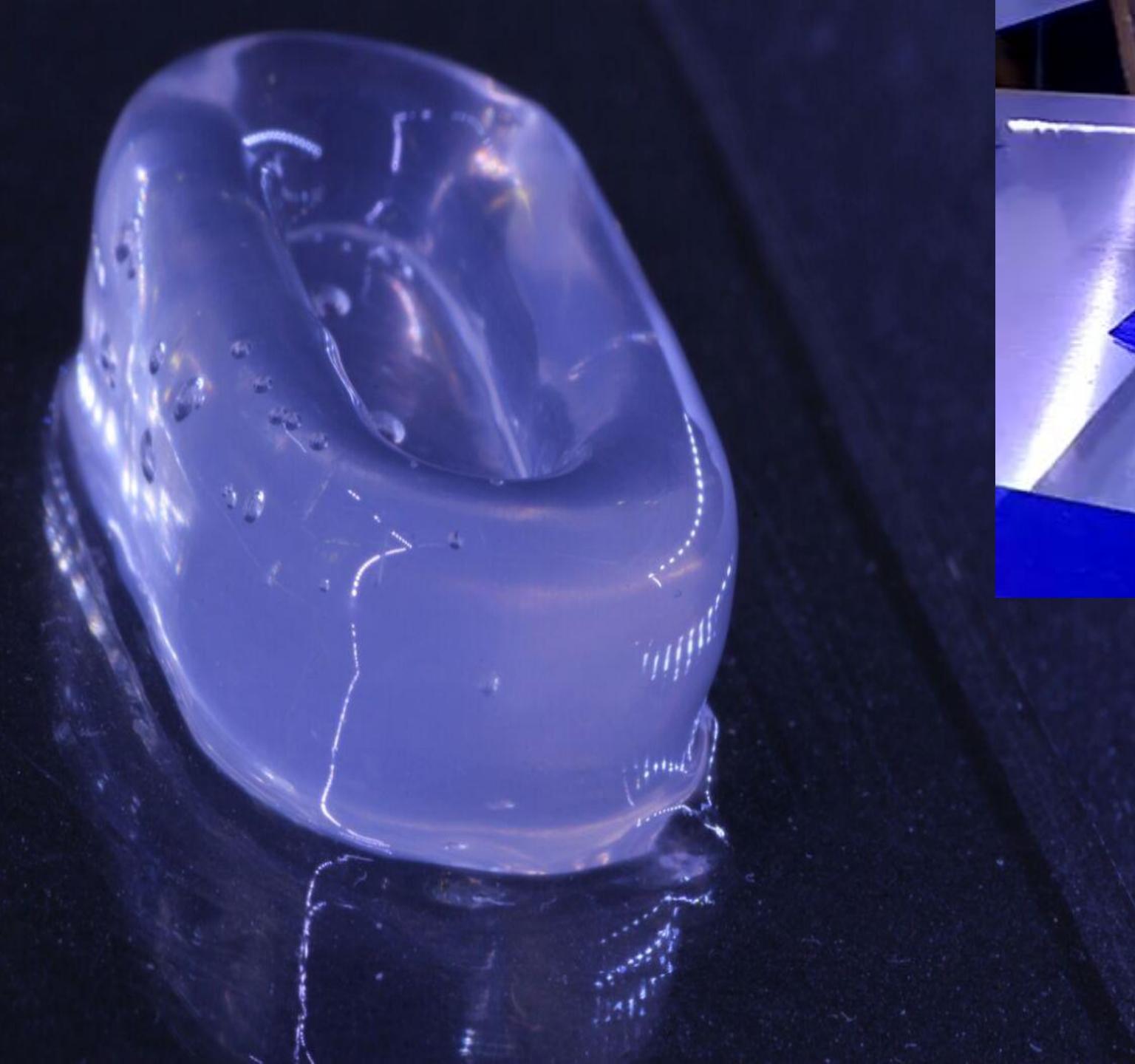
i

water drops



Super hidrofobni aerogel





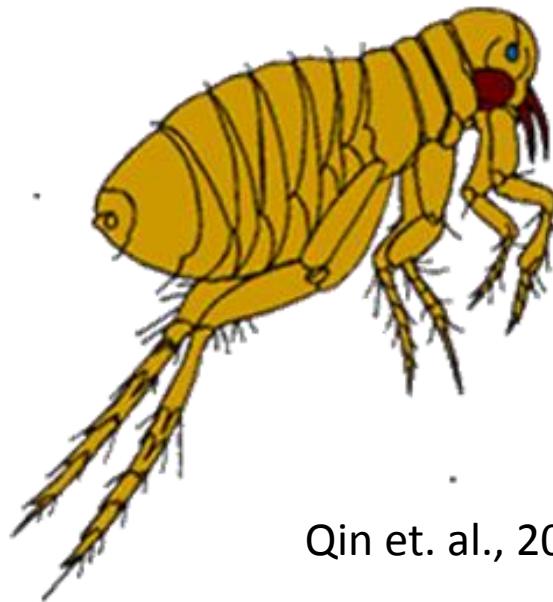
Bolha - Skakalne sposobnosti



ekvivalent
človeškemu
skoku
400 m v
višino



Proizvodnja rekombinantnega rezilina oblikovanega z celulozno vezno domeno (CBD)



Qin et. al., 2009. Biomacromolecules. 10(12):3227-34.

Dodatek kapljice rezilina v košček trde CNC pene





Skoči više!

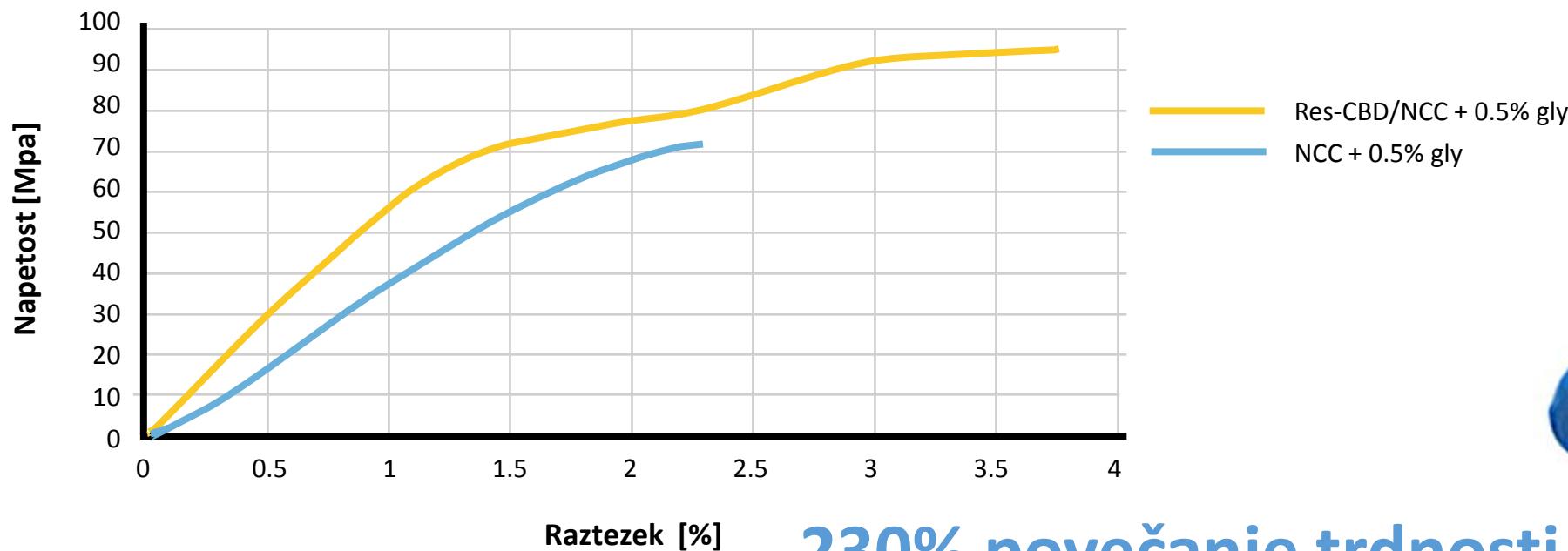


Res-CBD-CNC film

Super uspešen material !!!

močan, elastičen, prosojen

Instron krivulje napet./razt. testiranih filmov z vsebnostjo NCC in Res-CBD-NCC



Meritve žilavosti:

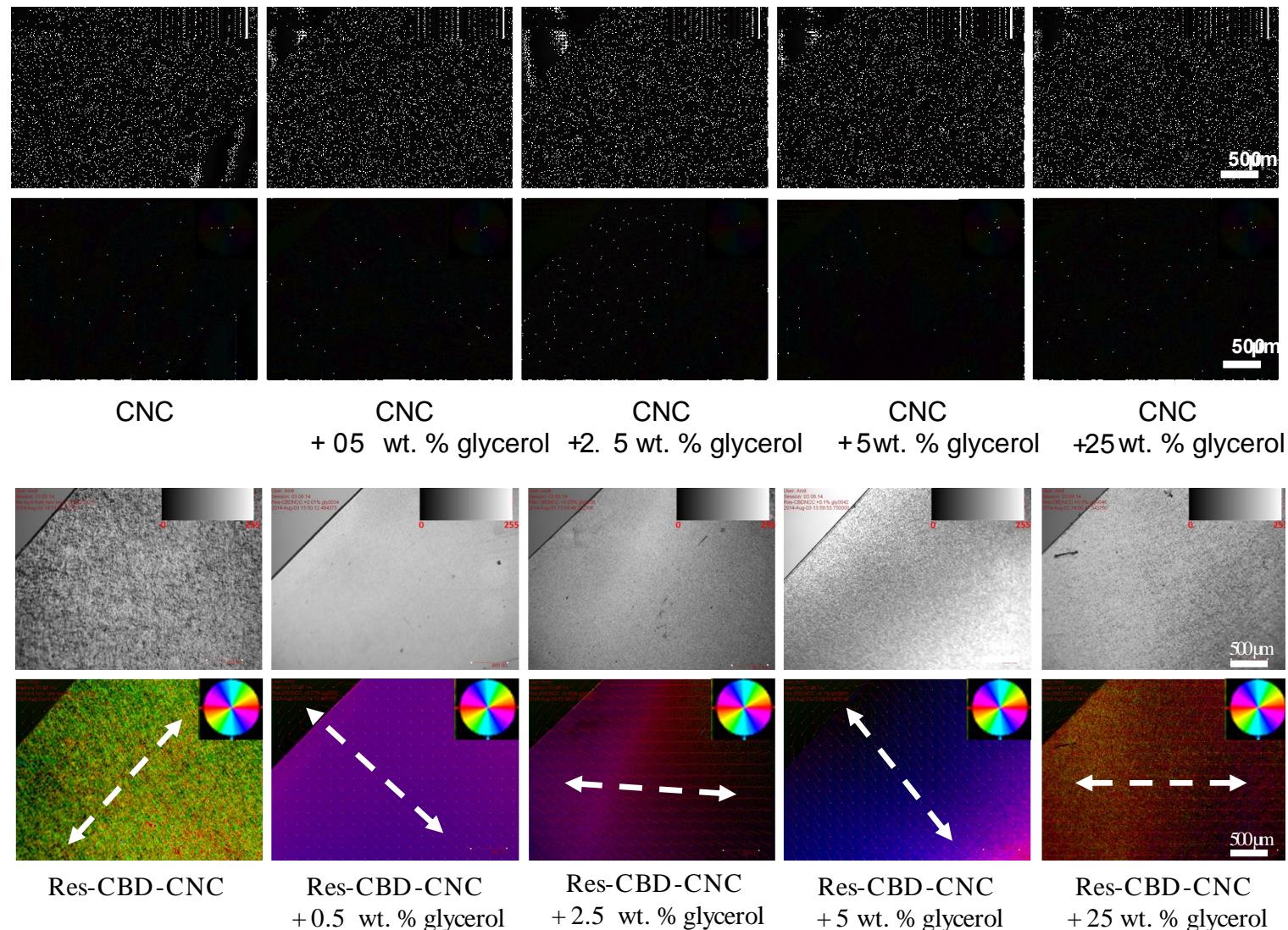
- Res-CBD/NCC + 0.5% glycerol: 2.36 [MJ/m³]
- NCC + 0.5% glycerol: 1[MJ/m³]

230% povečanje trdnosti

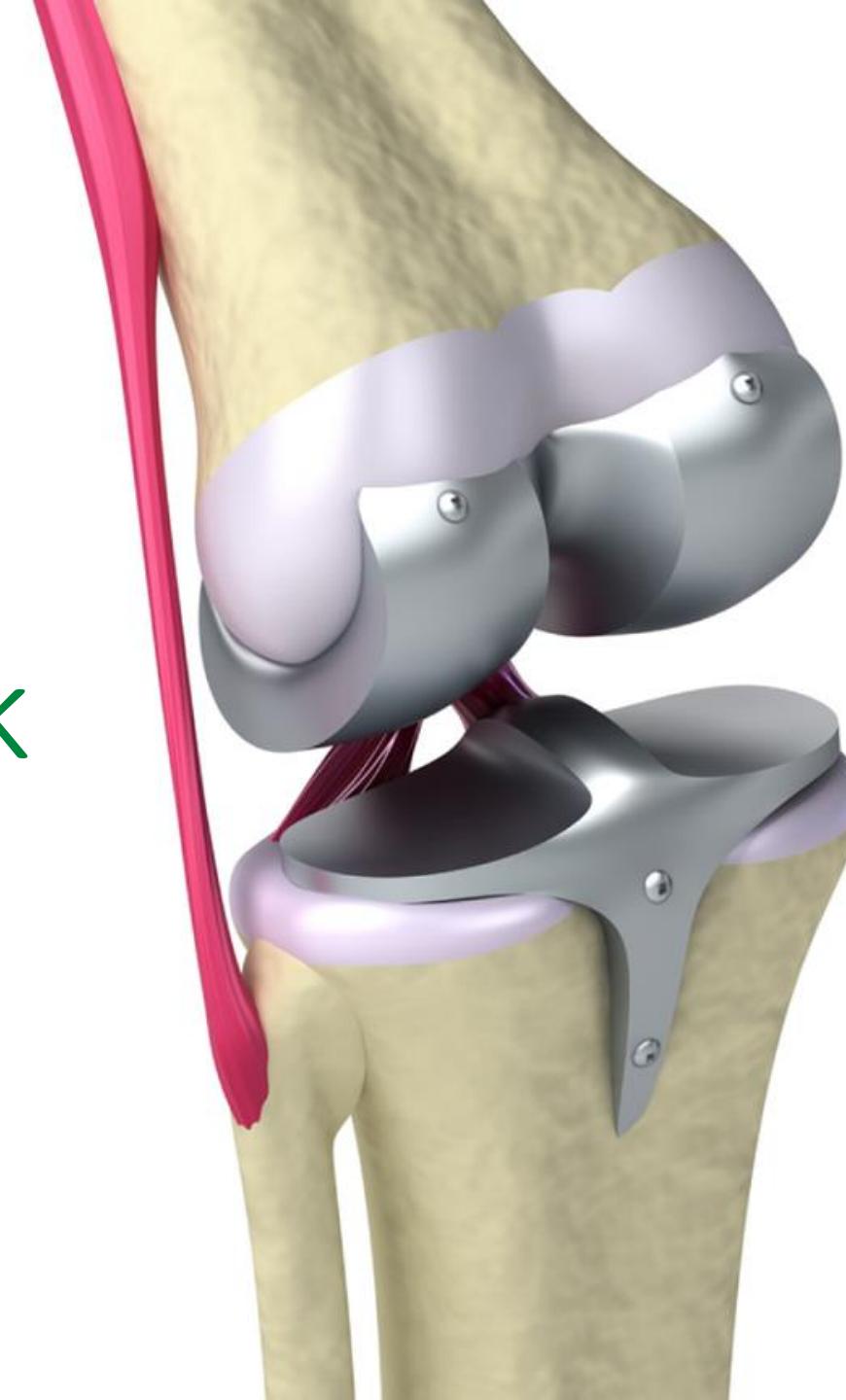


Rezilin-CBD narekuje konstantni molekularni red v CNC filmu

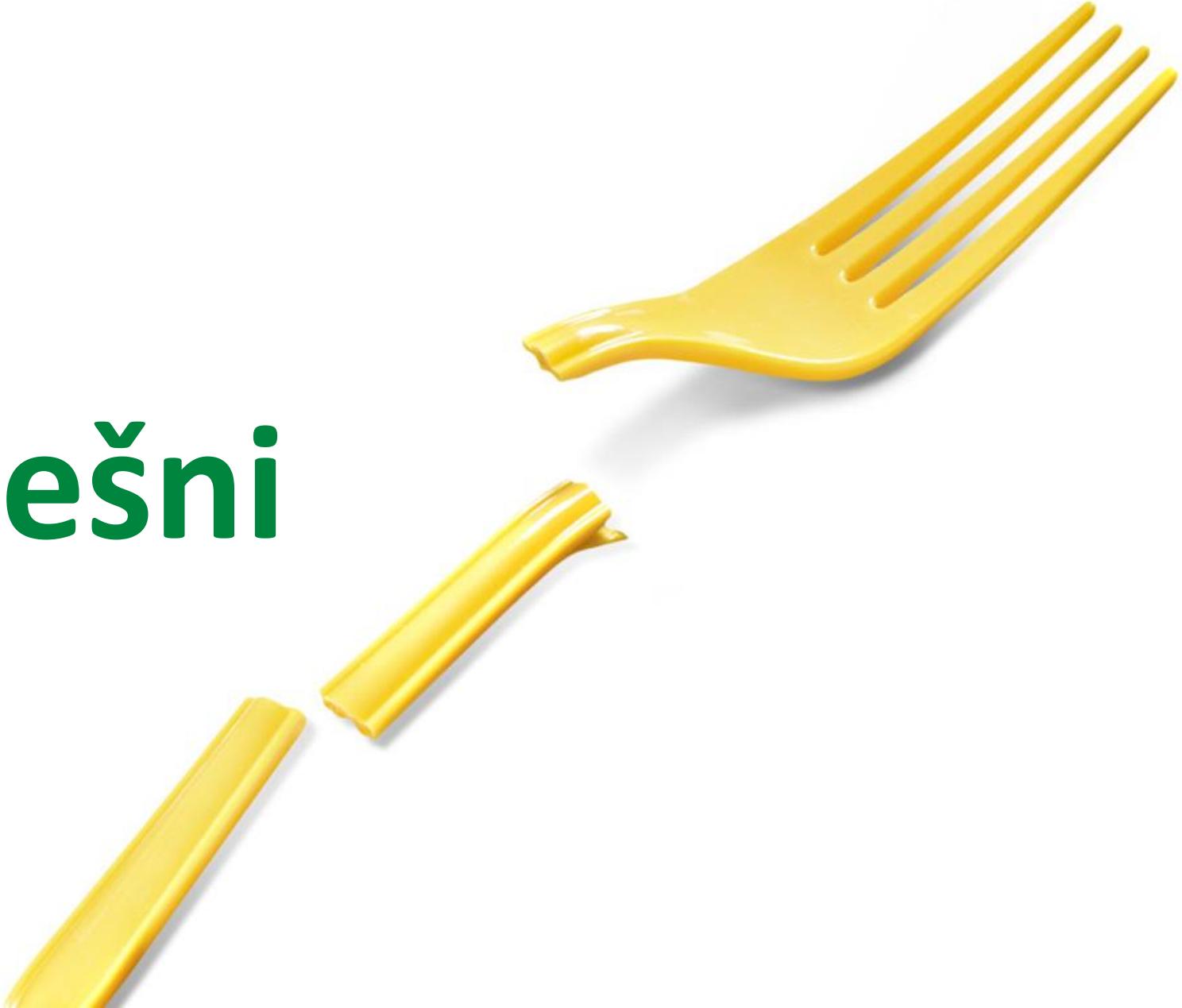
Polarizirana optična mikroskopija



**Sintetični
medicinski vsadek
“vijak in lepilo”**

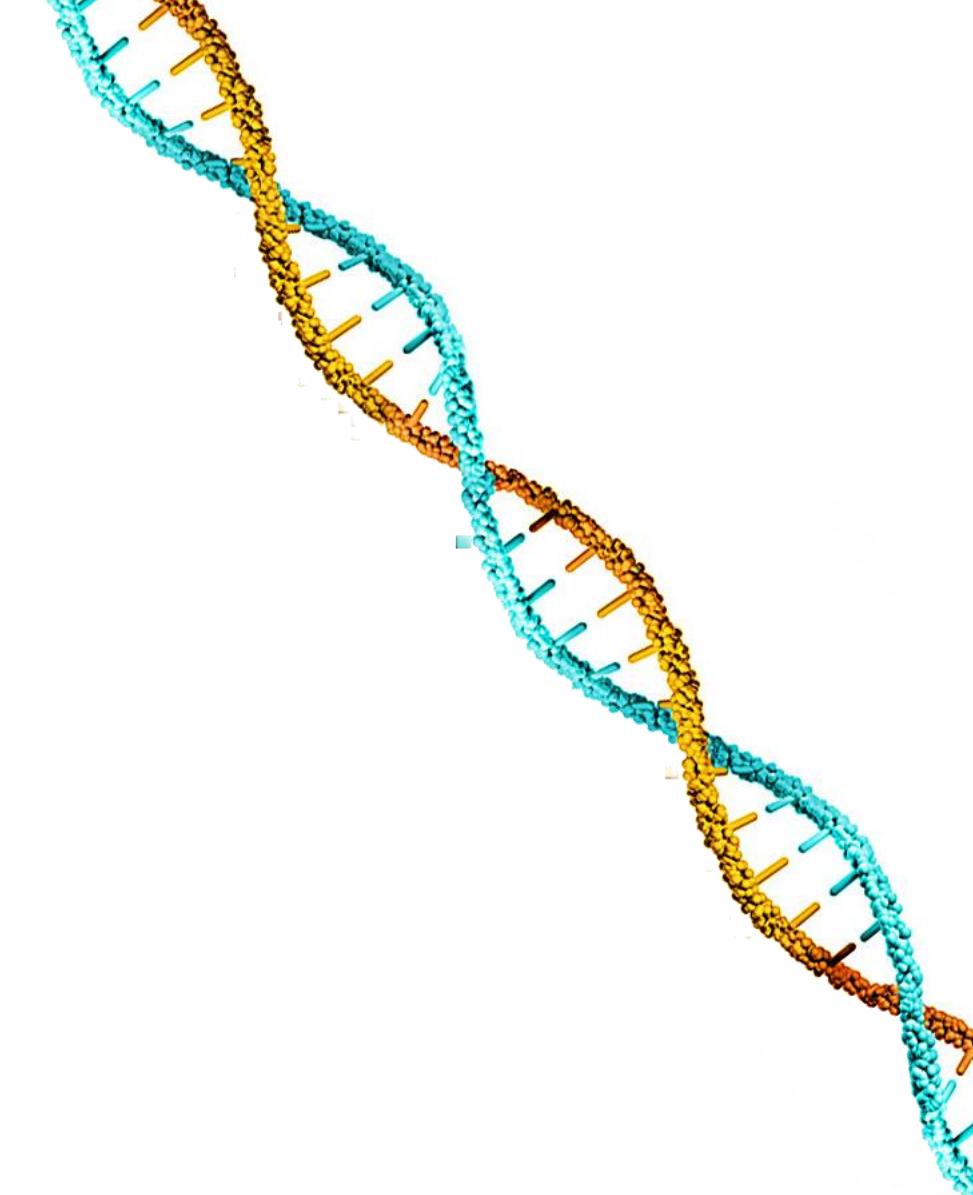


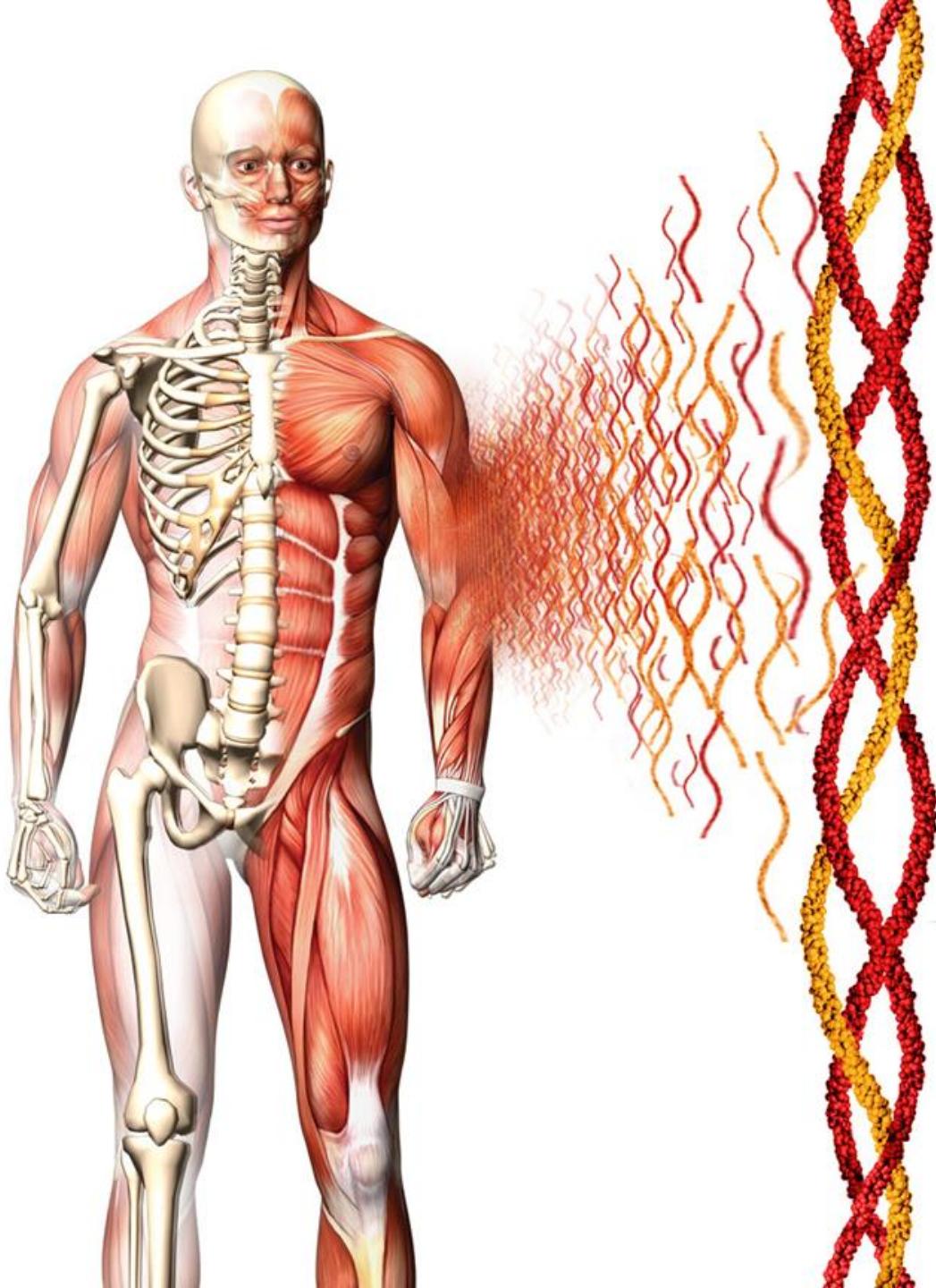
Sintetitični
materiali
niso uspešni



V naravnih
organizmih

sami nastajajo



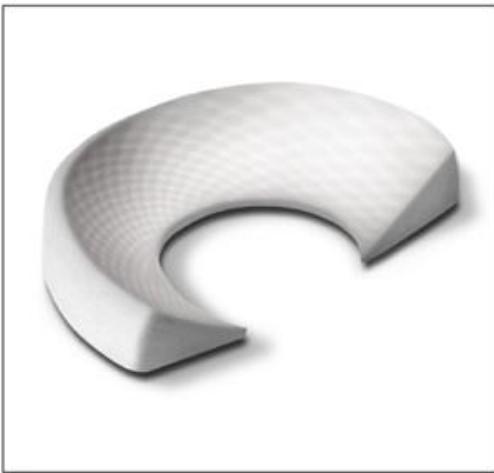


Naše telo je
sestavljeno
iz
kolagena

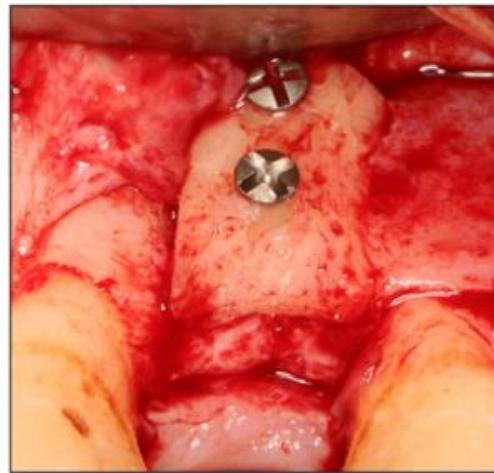
trojna kolagenska vijačnica



Umetni meniskus



Avtogeni polimer v masi



Biološka srčna zaklopka



"Autogenous block graft" by Dental Specialty Group - Own work. Licensed under Creative Commons Attribution-Share Alike 3.0 via Wikimedia Commons - http://commons.wikimedia.org/wiki/File:Autogenous_block_graft.jpg#mediaviewer/File:Autogenous_block_graft.jpg

"Carpentier-Edwards biological heart valve" by Stif Komar - Own work. Licensed under Creative Commons Attribution-Share Alike 3.0 via Wikimedia Commons - http://commons.wikimedia.org/wiki/File:Carpentier-Edwards_biological_heart_valve.jpg#mediaviewer/File:Carpentier-Edwards_biological_heart_valve.jpg



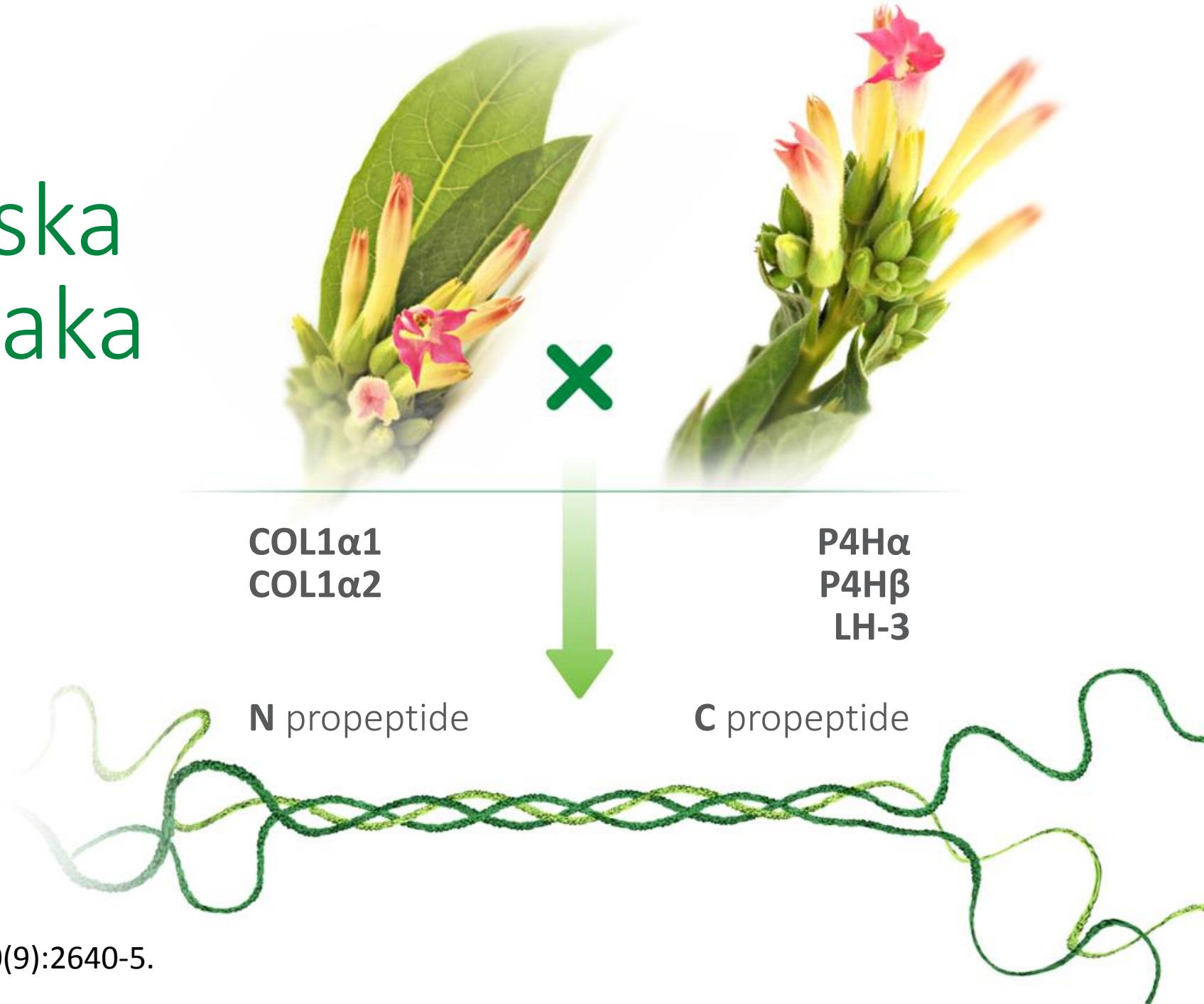
Varnost ima
velik pomen





Zvezni register
12. januar, 2007:
**FDA predlaga prepoved
uporabe določenih vrst
mesa v zdravilih,
bioloških in medicinskih
napravah, ki se
uporablja za ljudi**

Transgenetska rastlina tobaka izraža pet človeških genov







Velika količina človeškega kolagena nastaja v rastlini tobaka



Vergenix™ FG komplet

Flowable Gel



-Popolno zaprtje rane po 4 tednih enkratnega zdravljenja

Rezultati kliničnih poskusov

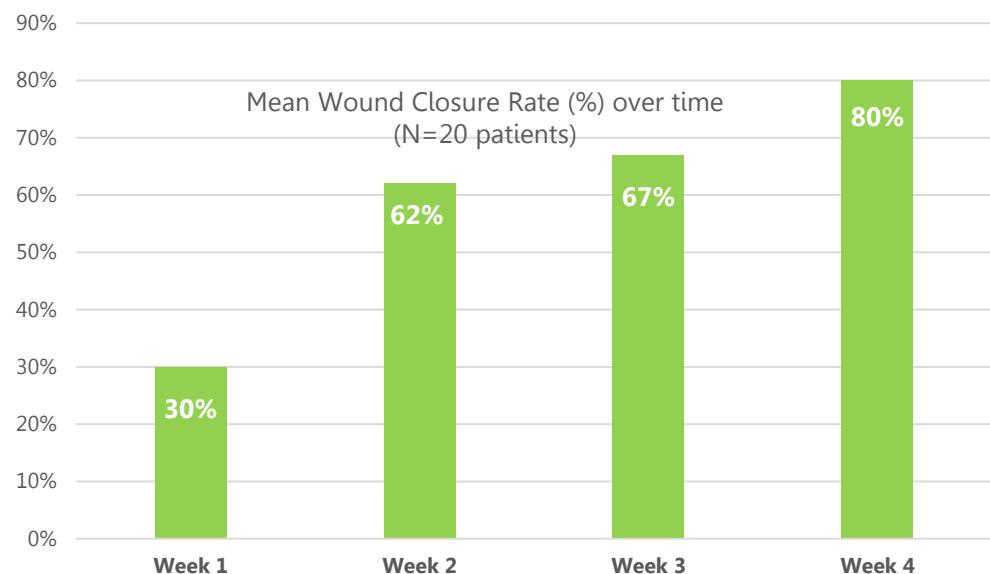
Načrtovanje študije

- Študija za eno ramo
- 20 bolnikov z ulkusom na nogi
- Enkratno zdravljenje
- Stanje po 4 tednih
- Zaključek – varno, zmanjšanje rane

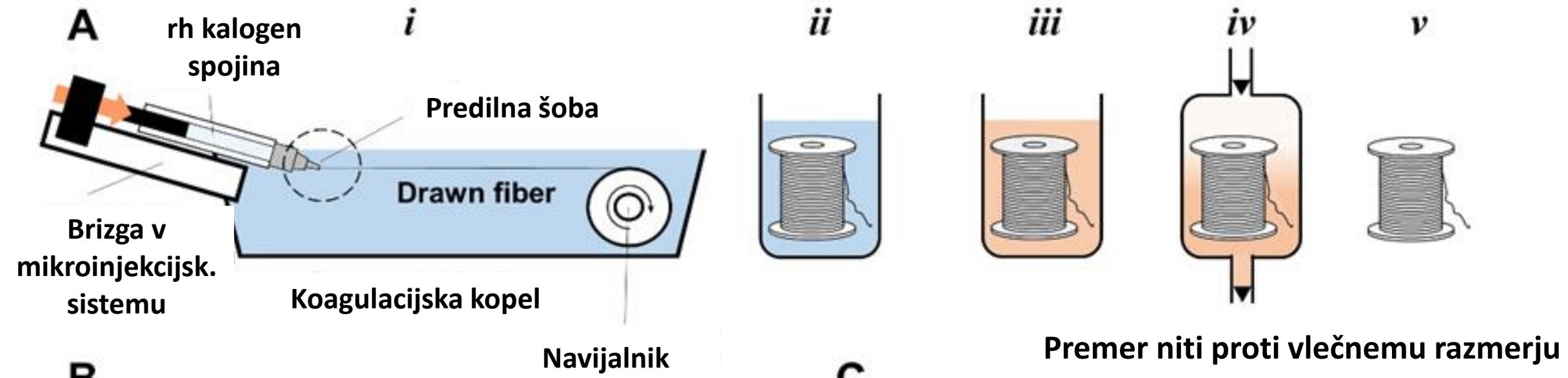


Rezultati študije

- Rana se je zaprla v povprečju za 80 %
- Rana se je popolnoma zaprla pri 9 od 20 pacientov (45%)
- V primerjavi z 24% bolnikov po 12 tednih po SoC¹



1. "The efficacy and safety of Grafix for the treatment of chronic diabetic foot ulcers: results of a multicenter, controlled, randomized, blinded clinical trial," Lavery et al, International Wound Journal, 2014.

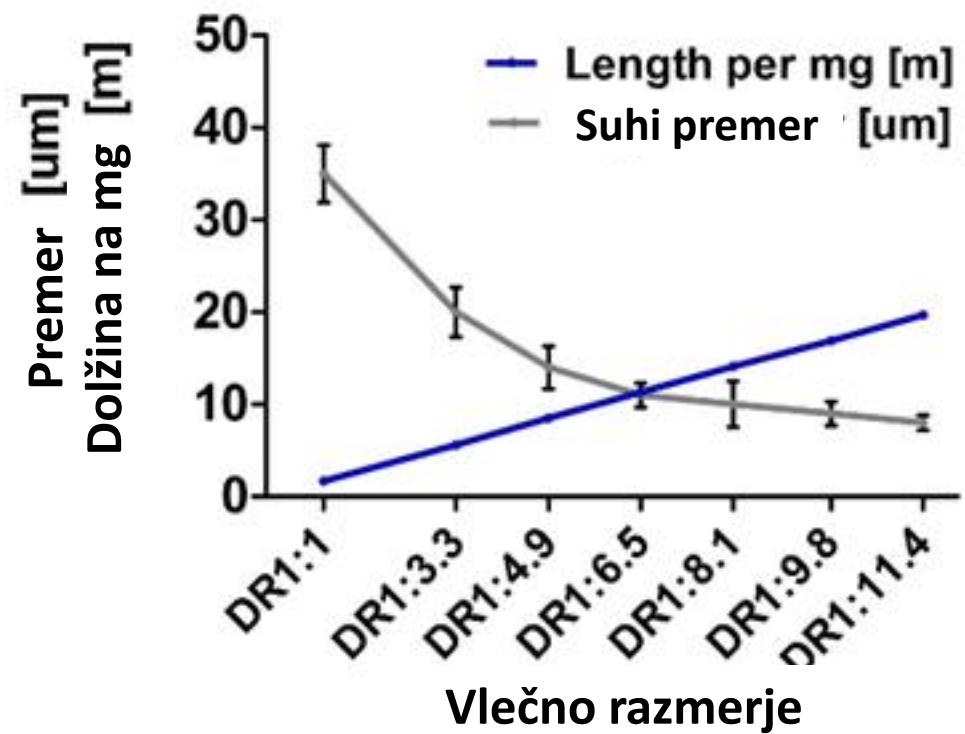


B

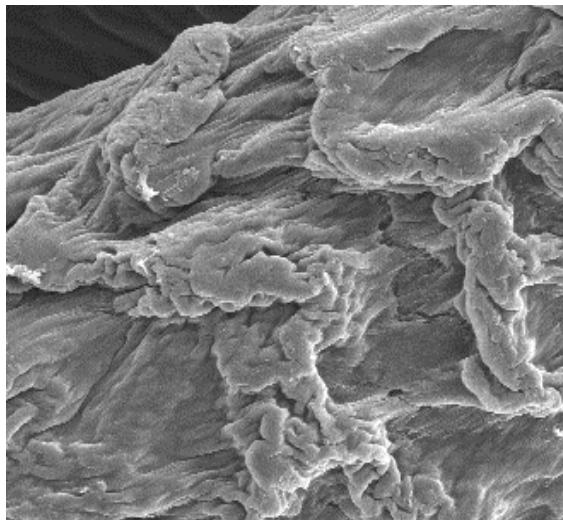


C

Premer niti proti vlečnemu razmerju



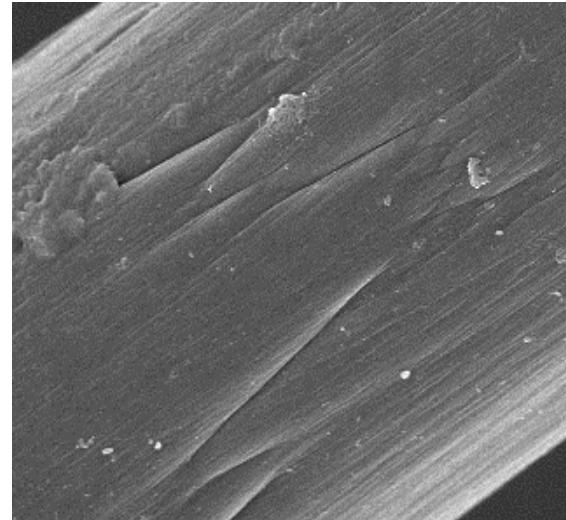
Morfologija vlaken odraža stopnjo usklajenosti (Scanning Electron Microscopy of fibers)



Mag 2,300X

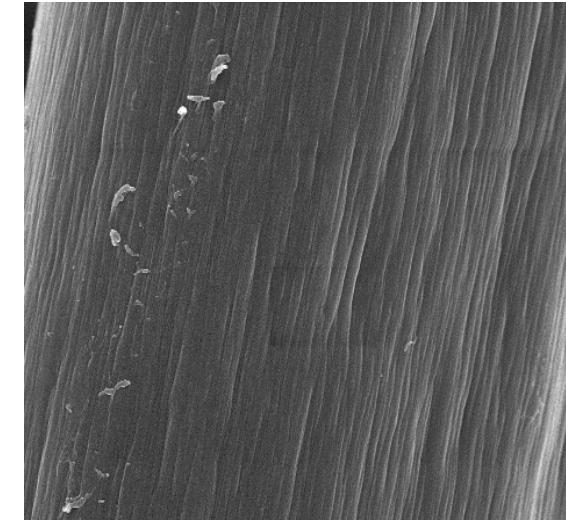
DR 1.0

(DR - Draw Ratio)



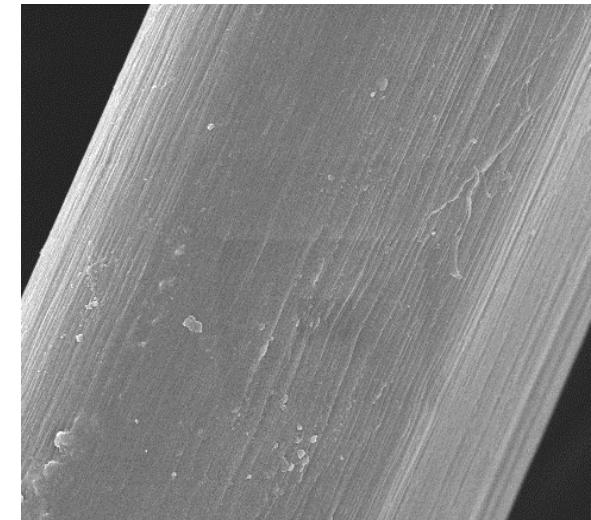
Mag 7,000X

DR 4.9



Mag 9,200X

DR 8.1

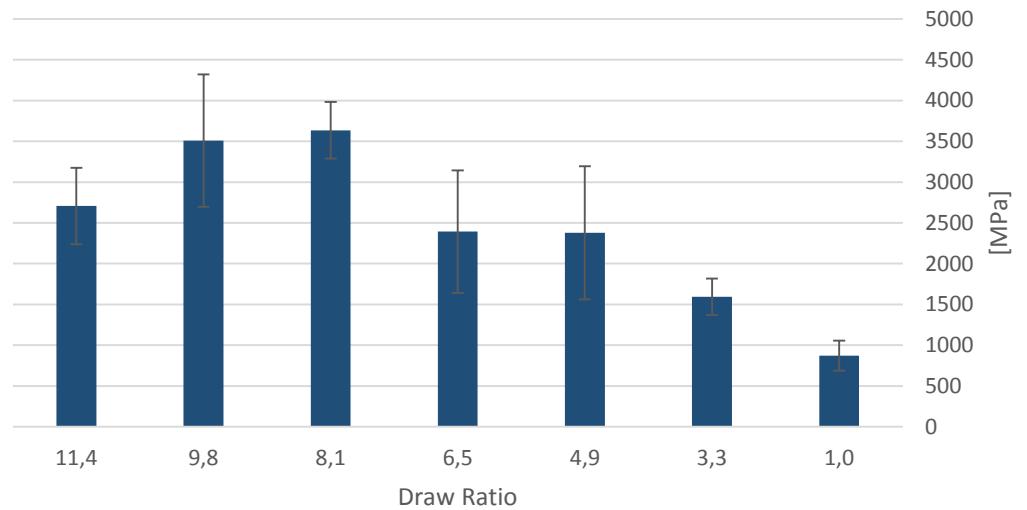


Mag 9,200X

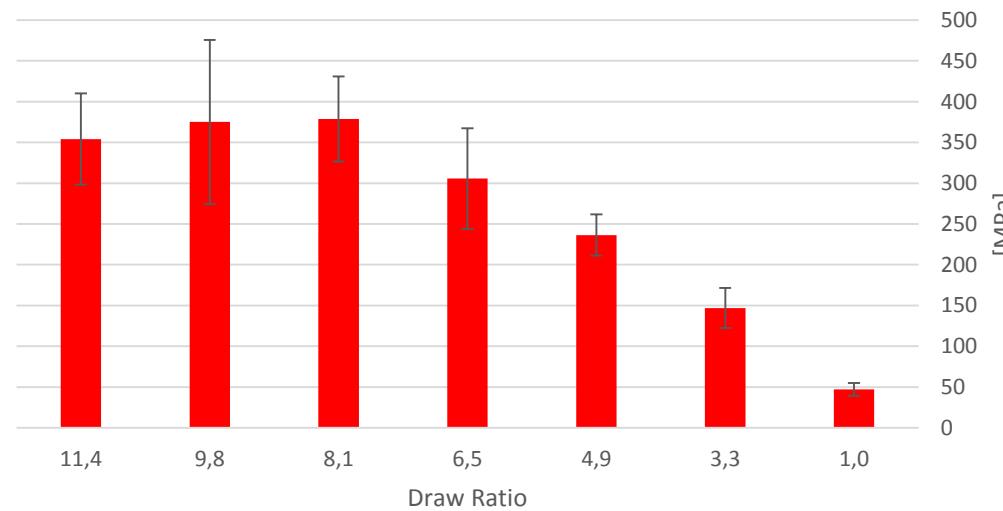
DR 11.4

Mehanske lastnosti vlaken v odvisnosti od vlečnega razmerja

Young's Modulus [MPa]



Tensile Stress at Break [MPa]



Strength [GPa] Toughness [MJ/m³]

rhCollagen wet spun fibers 0.4 44

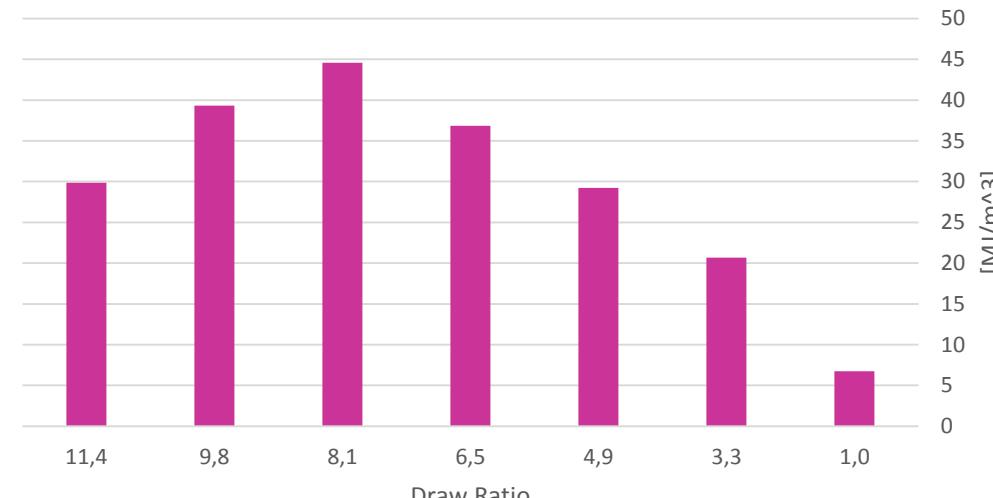
Araneus MA silk 1.1 160

Araneus viscid silk 0.5 150

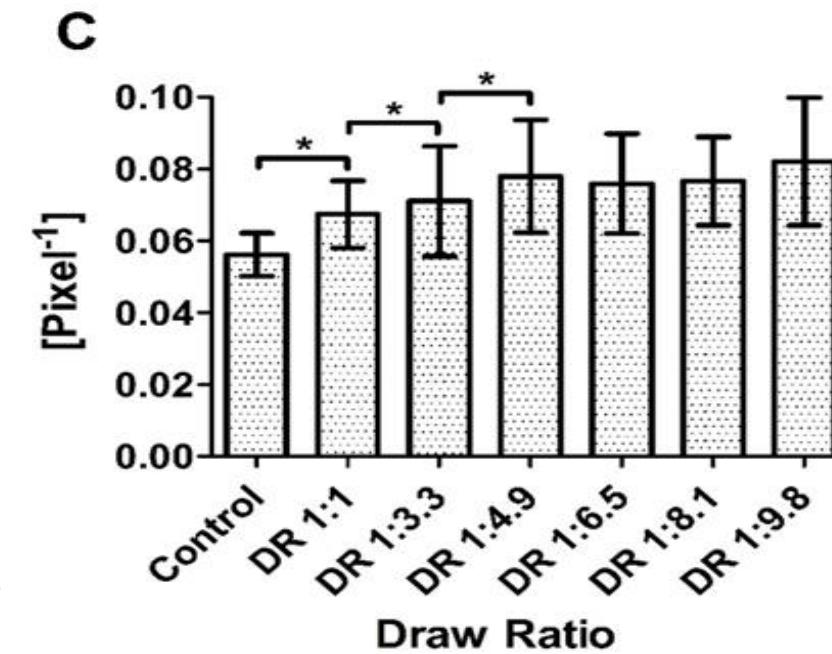
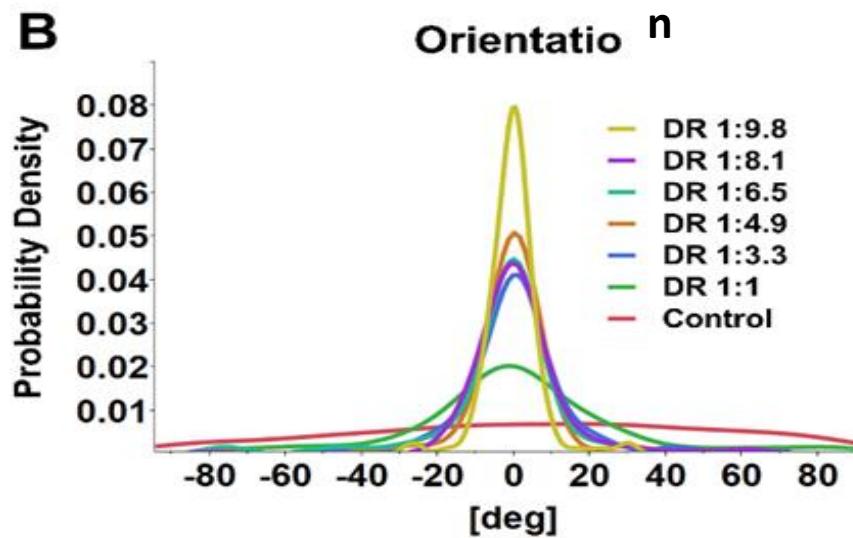
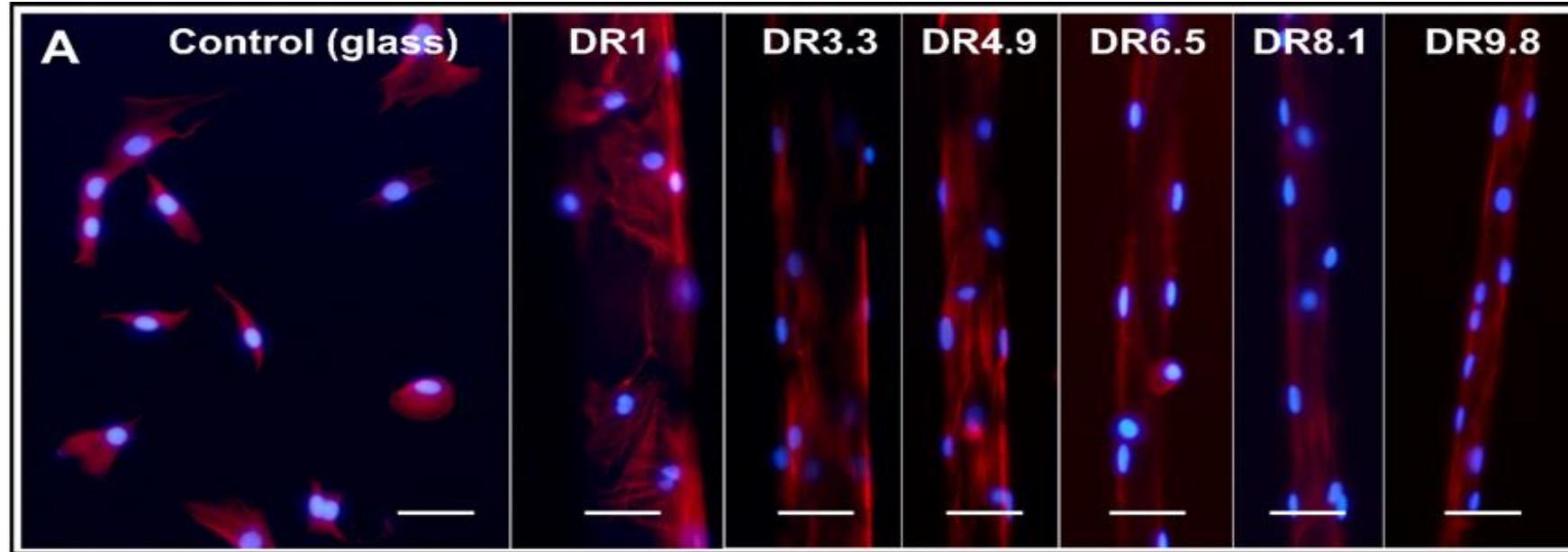
Bombyx mori cocoon silk 0.6 70

Tendon collagen 0.15
Bone 0.16 7.5
4

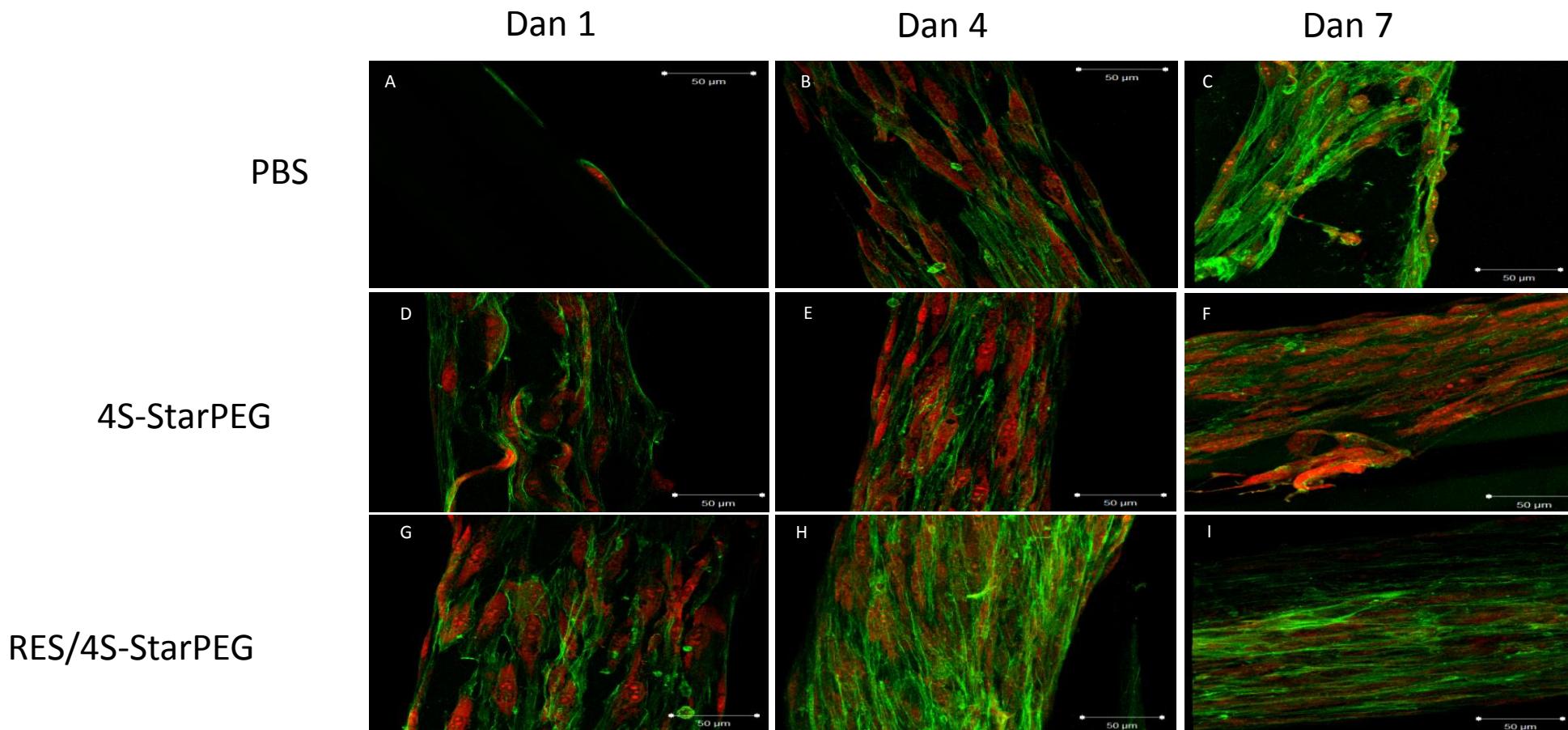
Energy at Break [MJ/m³]



Poravnavo podganjih tenocitov na vlečenih vlaknih rh-kolagena



Kolagen - rezilin kompozitna vlakna



Citoskeletal organization of HDF cells on the surface of the composite collagen-rezilin fibers was visualized using phalloidin-TRITC staining for F-actin; nuclei were stained with EtD-AM. The images show increasing cellular organization and spreading over time.

Krivulje napetost/raztezek pri 0 in 5% rezilina v kolagenskih vlaknih



380% povečanje trdnosti

300% povečanje obremenitve pri zlomu

Kolagen - rezilin
umetna tetiva in ligamenti

Izdelajmo organe za presaditev!





Če želiš novo idejo, odpri kakšno staro knjigo!

