

Towards Multifunctional Bio-based Composites

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[Composite Center Sweden](#)

LULEÅ
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OF TECHNOLOGY



To achieve multifunctional bio-based composites

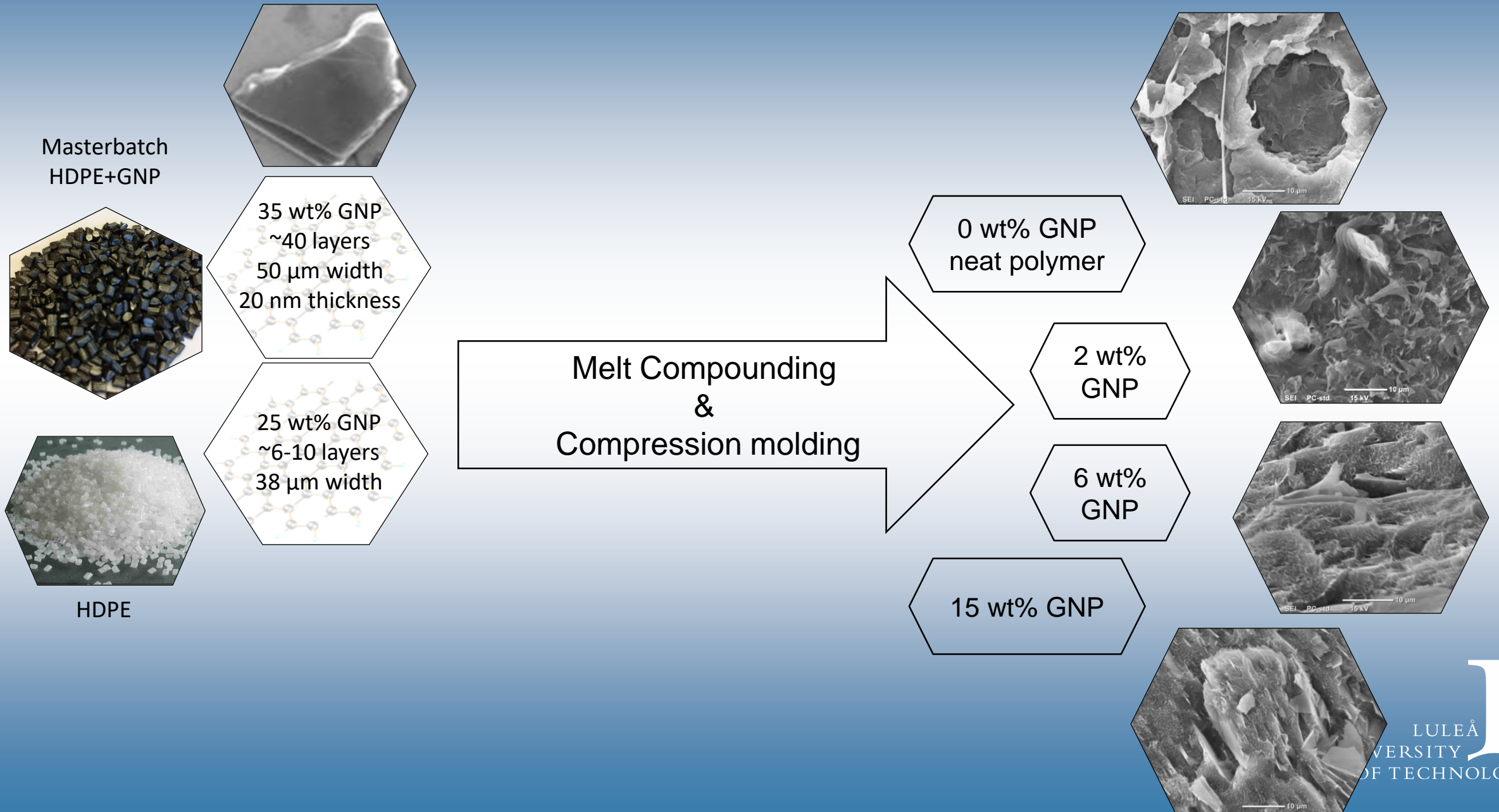
Suitable for advanced applications

Ready to upscale and implement



- Thermal management in buildings
- Advanced decking solutions
- Electronic casings

Matrix Modification

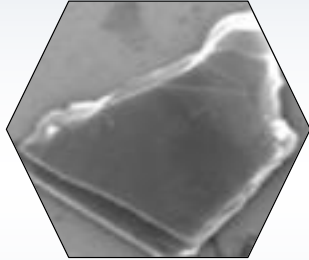


Matrix Modification

WPU 2-4 / 75

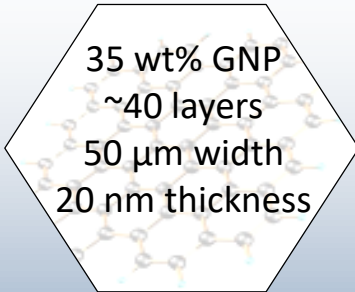


Masterbatch
HDPE+GNP

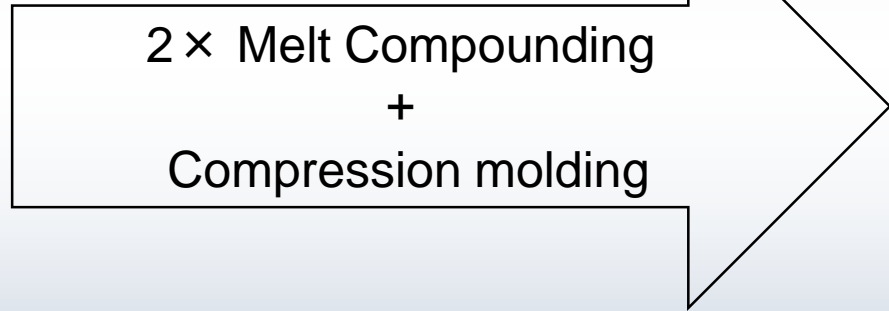


HDPE

35 wt% GNP
~40 layers
50 μm width
20 nm thickness



MAPE E265



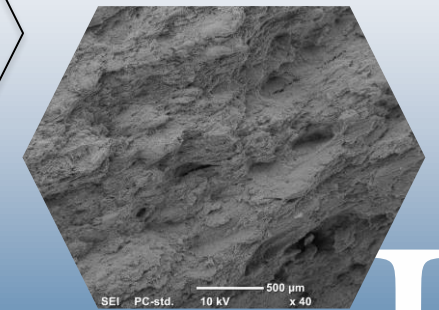
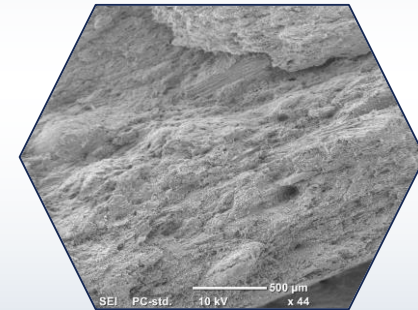
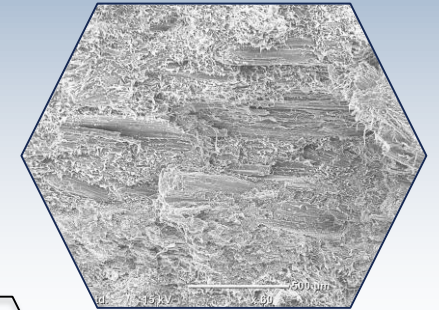
25WPC

25WPC10

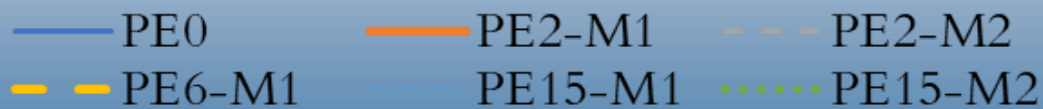
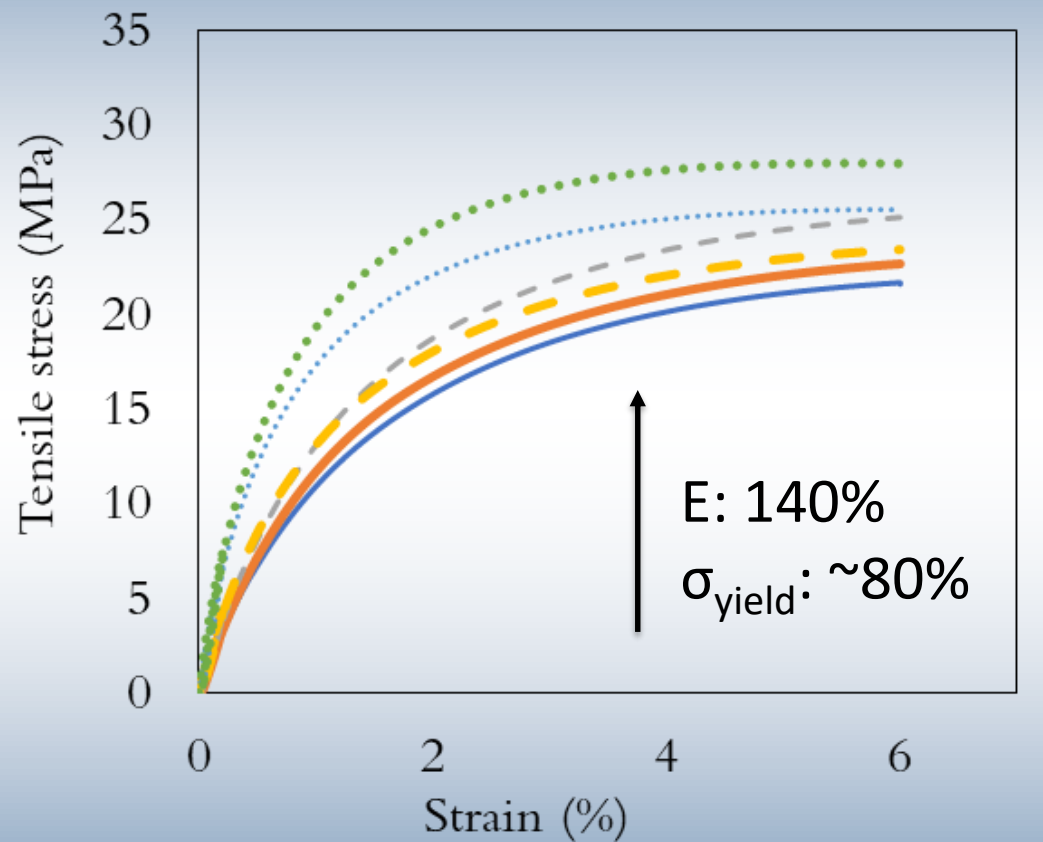
40WPC

40WPC7.5

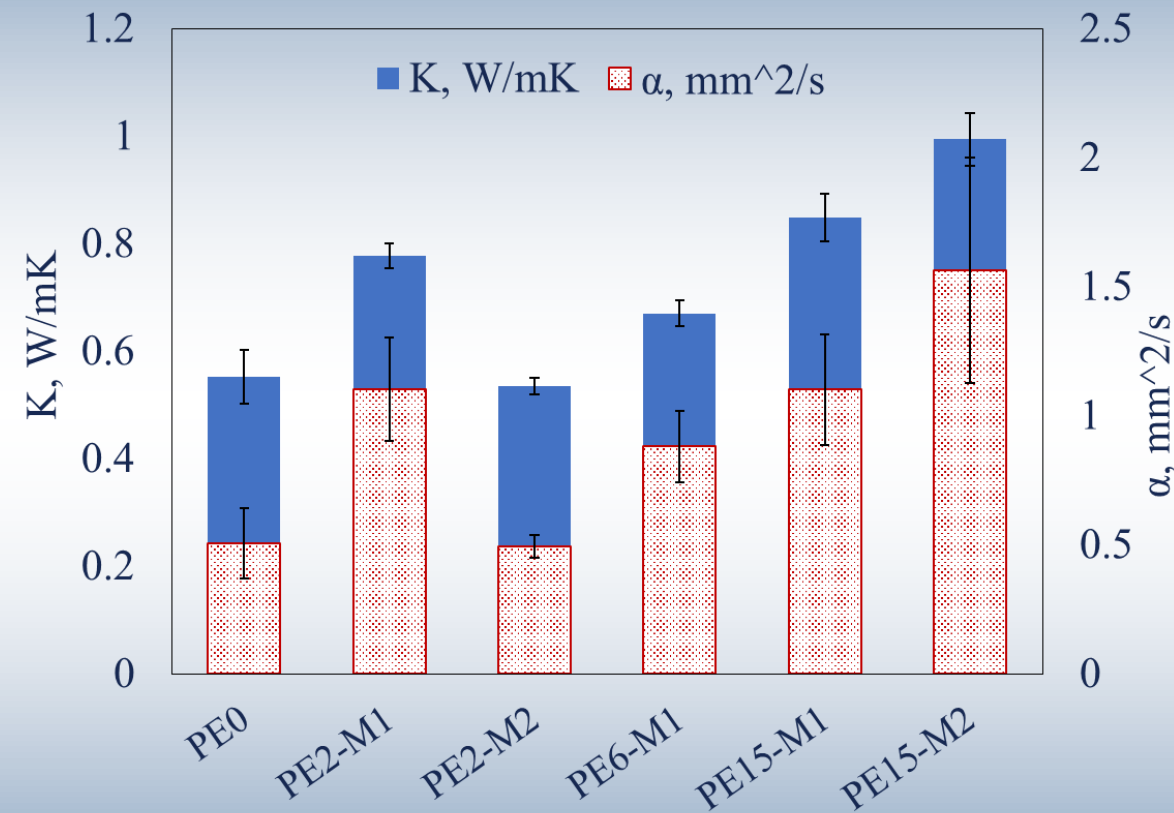
40WPC15



Tensile Properties



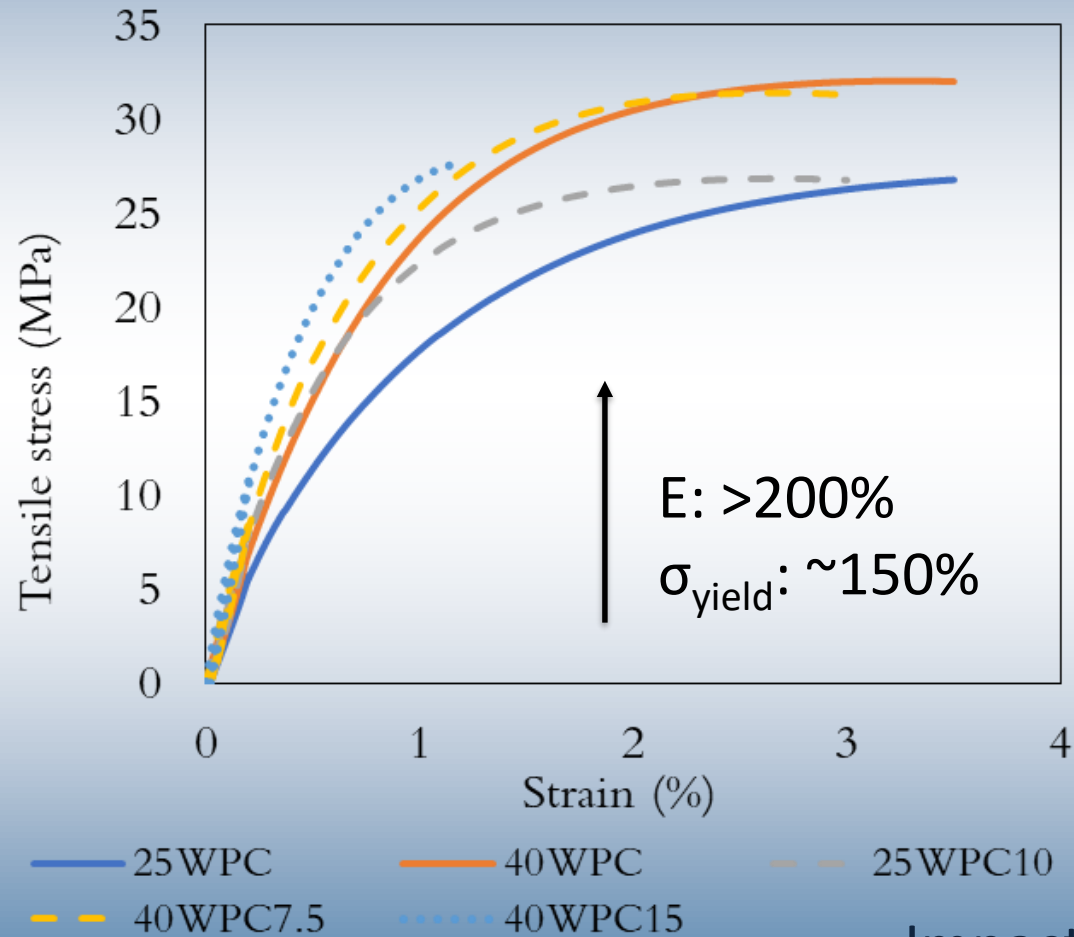
Thermal Properties



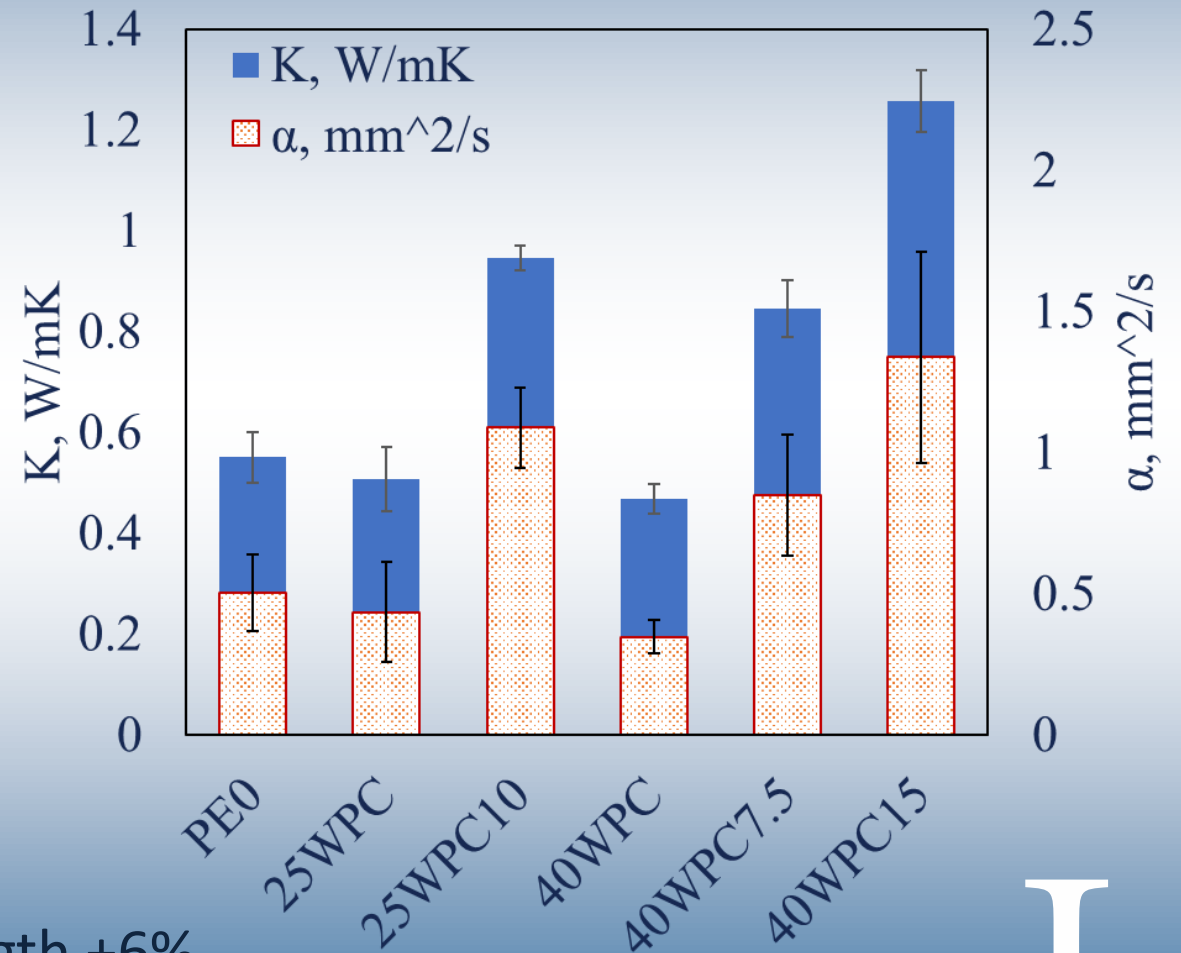
Impact strength +50%

Flexural properties E: 140%, $\sigma_{4\% \epsilon}$: 70%

Tensile Properties

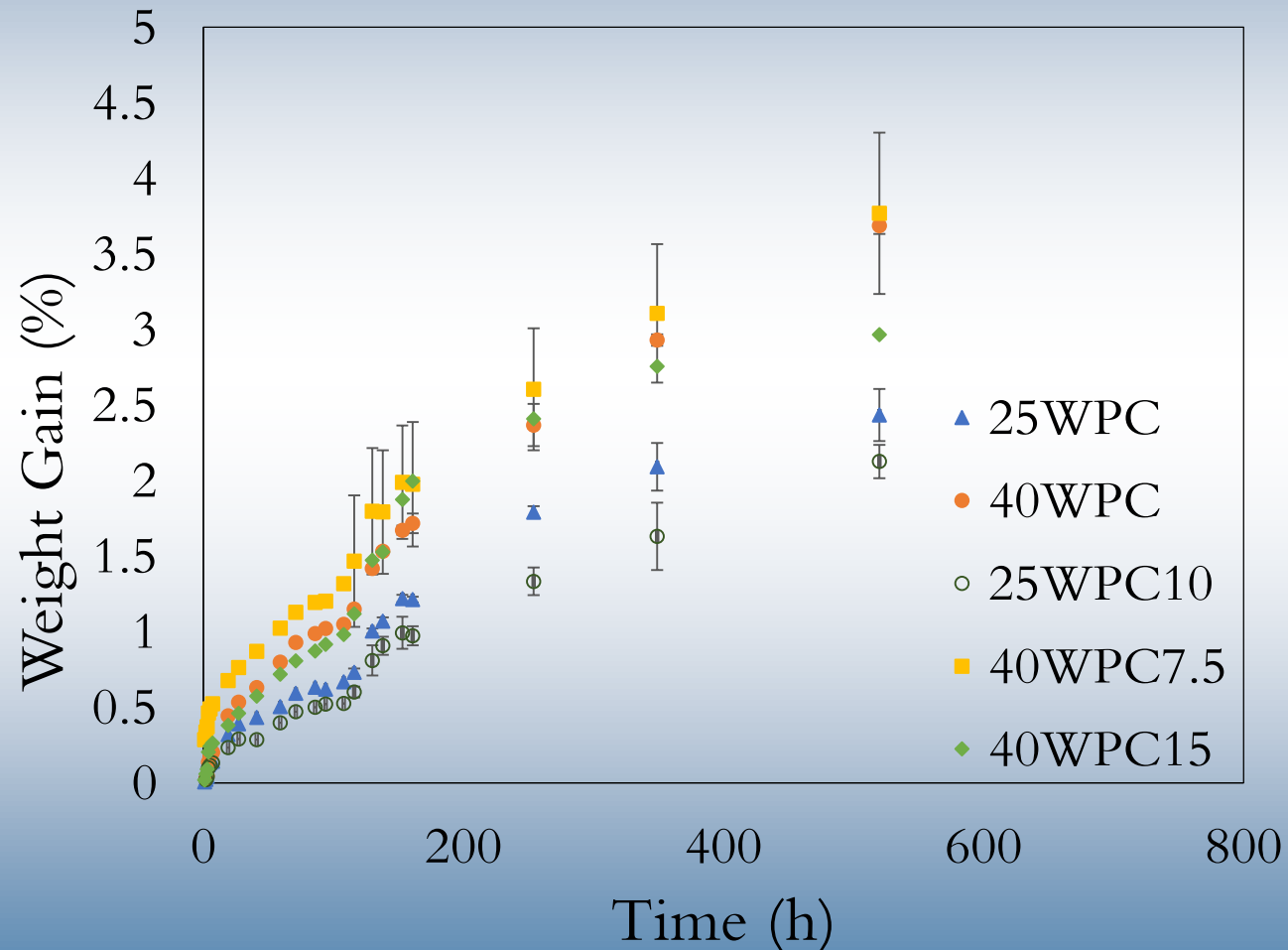


Thermal Properties



Impact strength +6%
Flexural E: +245%, $\sigma_{4\% \epsilon}$: +80%

Moisture Absorption



Sample Name	Surface resistance E+13 (ohm)	Resistivity per square E+14 (ohm/sq)
HDPE	1.28	1.74
HDPE2	1.29	1.77
HDPE6	1.29	1.77
HDPE15	1.24	1.70
HDPE15 (rough)	0.649	0.887

Fiber Modification



Electroless Copper Plating
Series of chemical reactions
Reduction of copper ions into metal

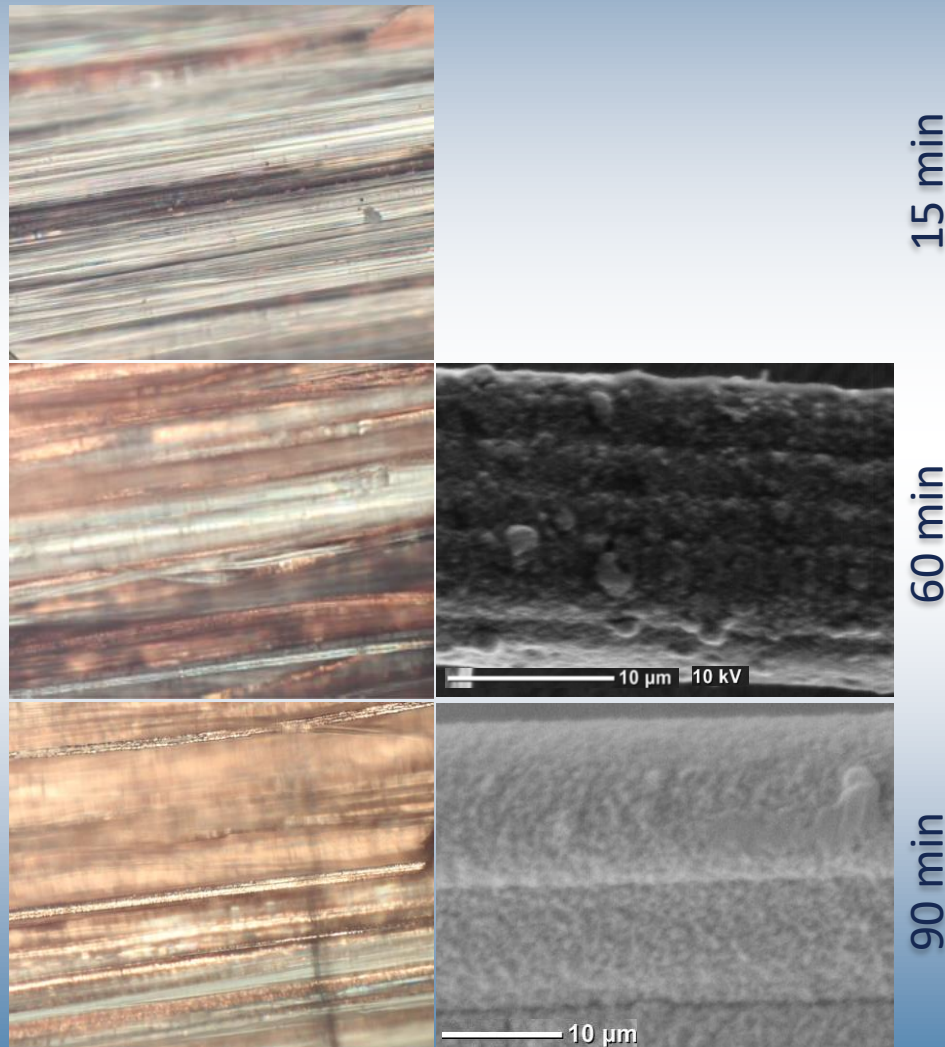
Image source: [Electroless process](#); [Cordenka fibers](#)



Cordenka Super 3
Regenerated Cellulose Fibers
Viscose process

Conductive Regenerated Cellulose Fibers

Microscopic Investigation



15 min

60 min

90 min

Fibers **2019**, 7(5), 38; <https://doi.org/10.3390/fib7050038>

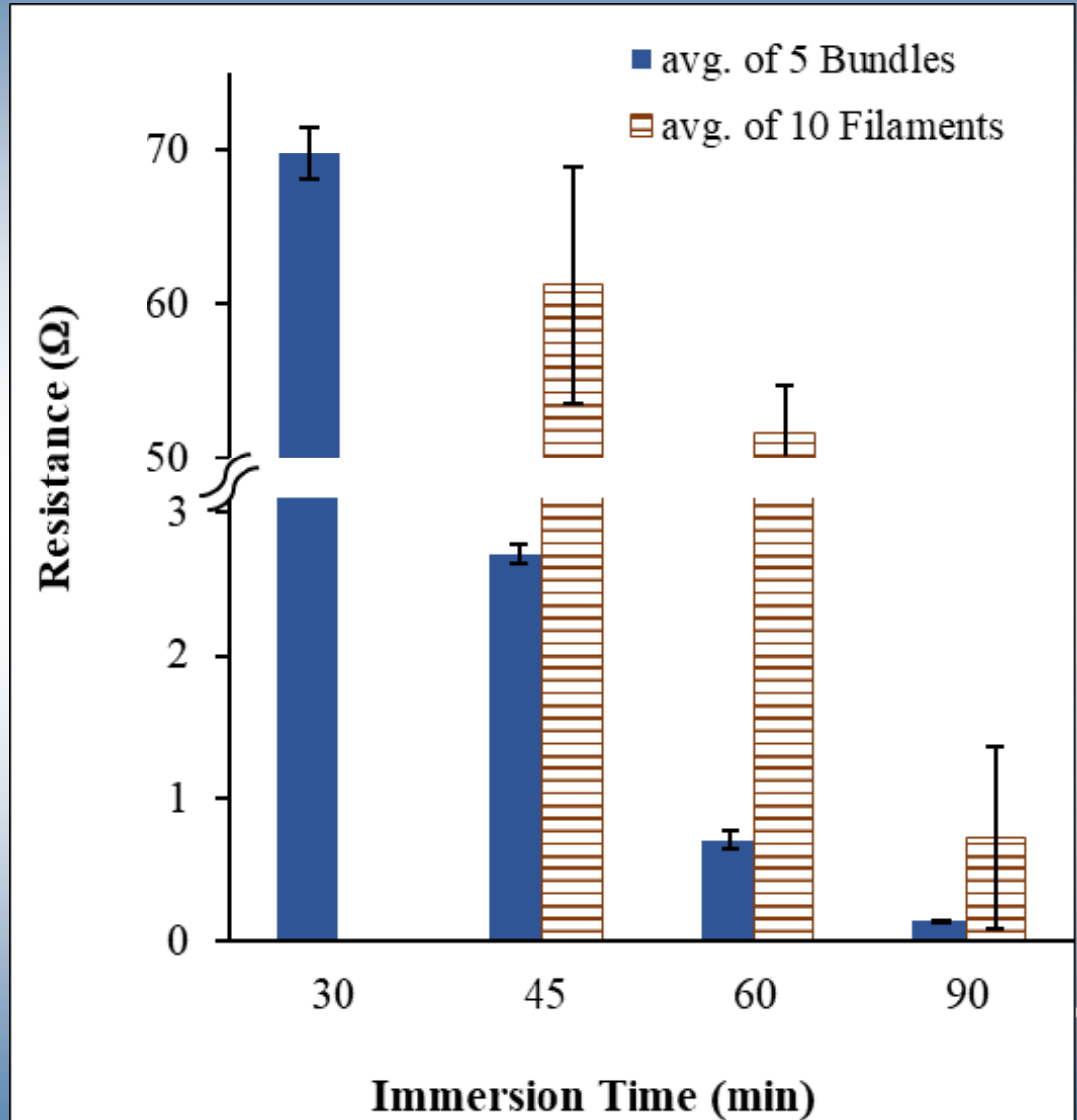
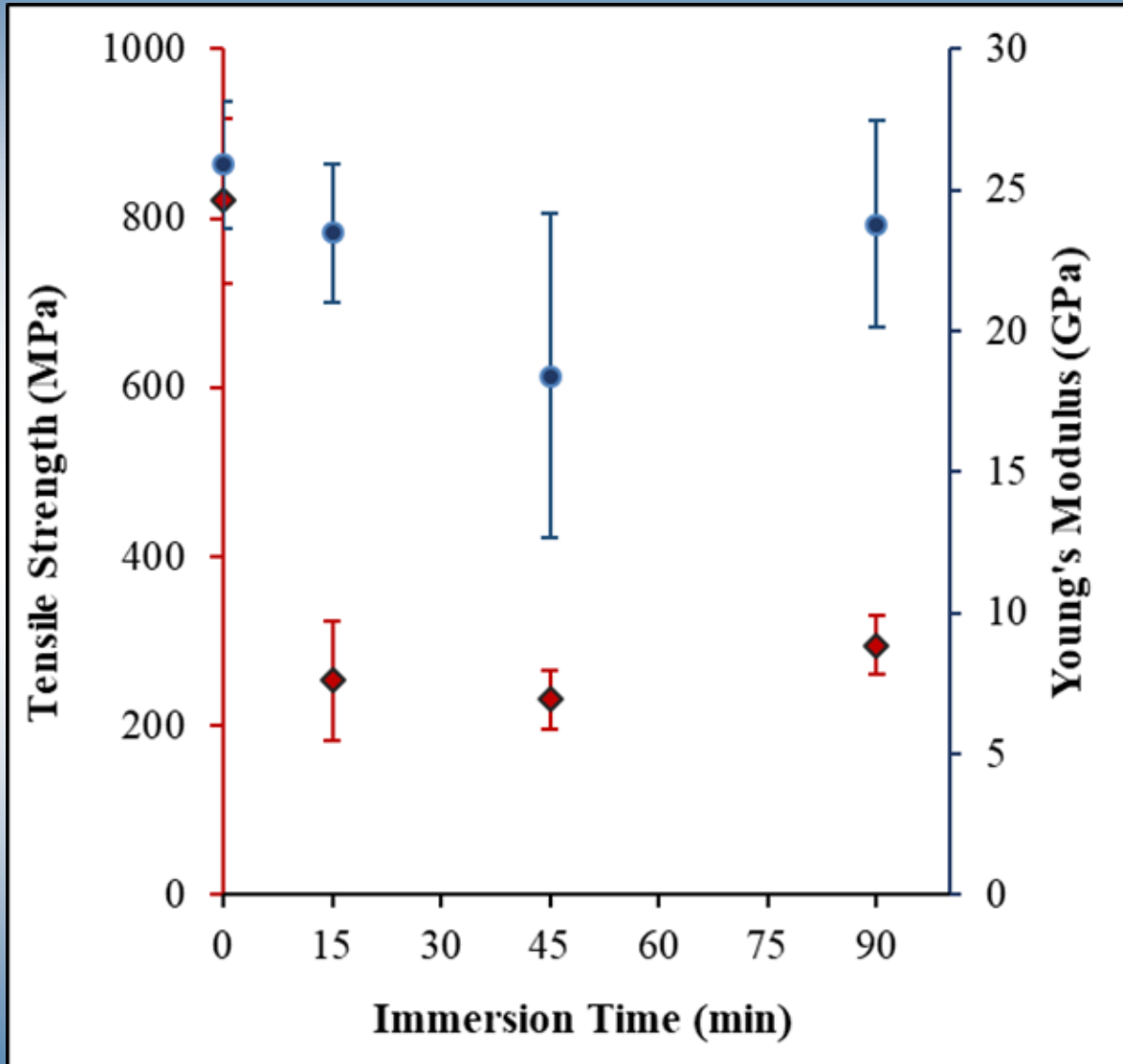
Open Access

Communication

Conductive Regenerated Cellulose Fibers by Electroless Plating

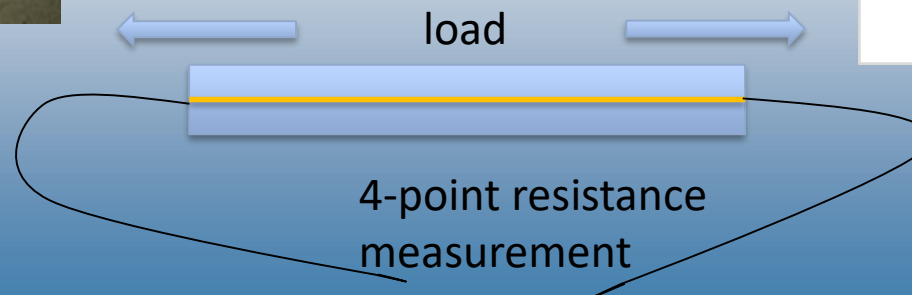
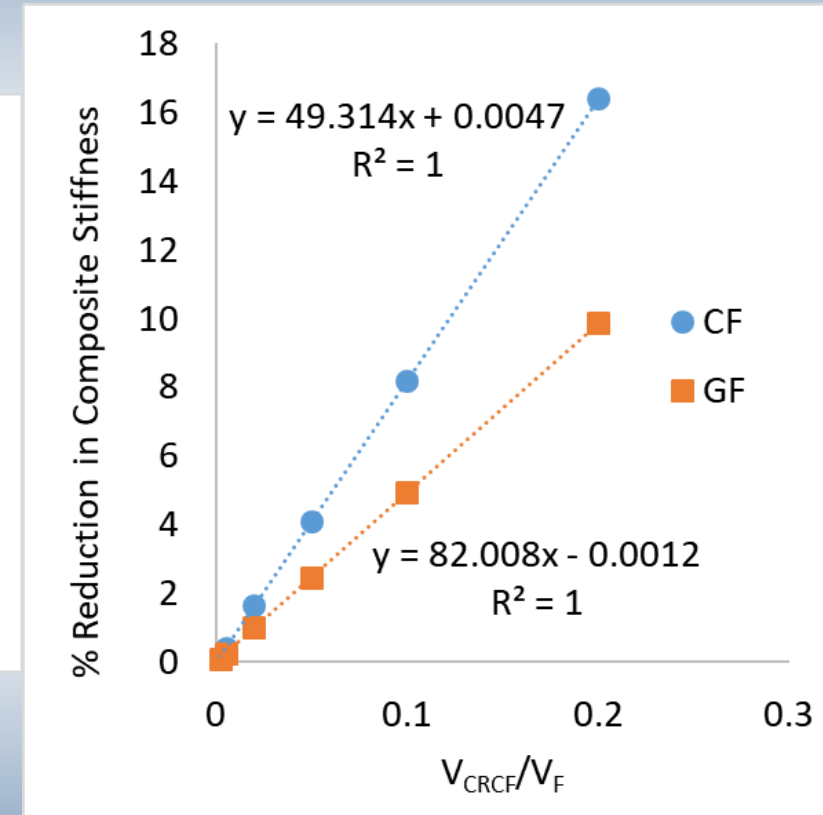
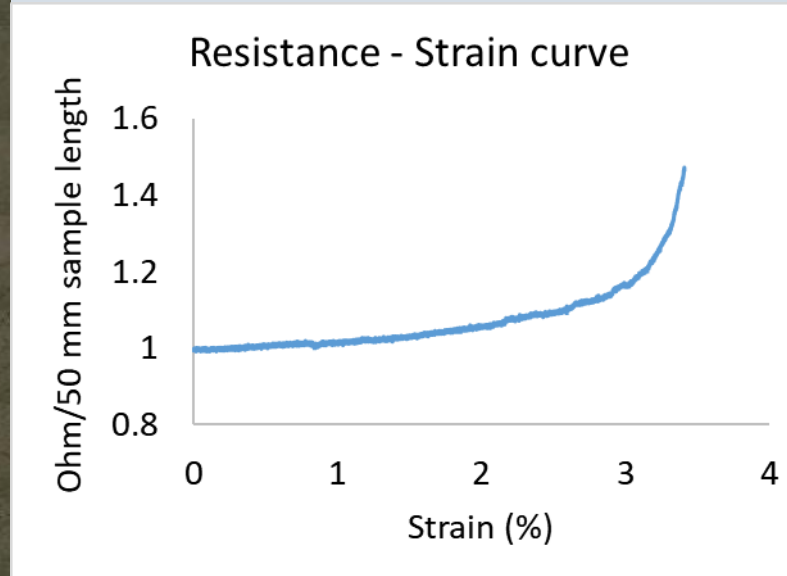
by Zainab Al-Maqdasi ^{1,*}  , Abdelghani Hajlane ^{2,*}  , Abdelghani Renbi ³,
Ayoub Ouarga ² , Shailesh Singh Chouhan ³ and Roberts Joffe ¹

Conductive Regenerated Cellulose Fibers



Measurements on 50 mm long samples

Use as Sensor Materials



ROM Estimations

Summary

- Industrially friendly approaches
- Available commercial/semi-commercial materials
- No process modification
- Improved properties without the use of compatibilizer
- Increase the value of natural resources
- Push the limits of bio-based composite application
- Need to overcome the challenges

Thanks for your attention!

Acknowledgment

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