

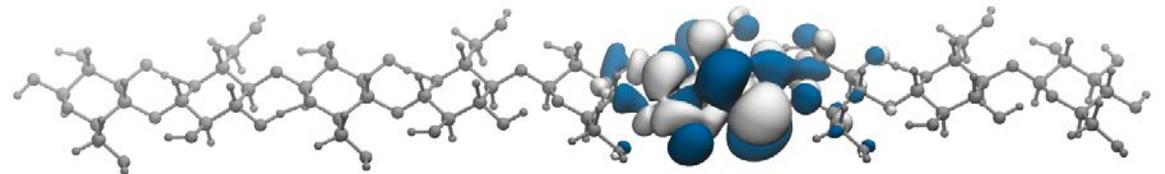


Prifysgol
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University

Computational Design of wood-based circular materials

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Biomass waste

We live in a finite world, with limited resources...



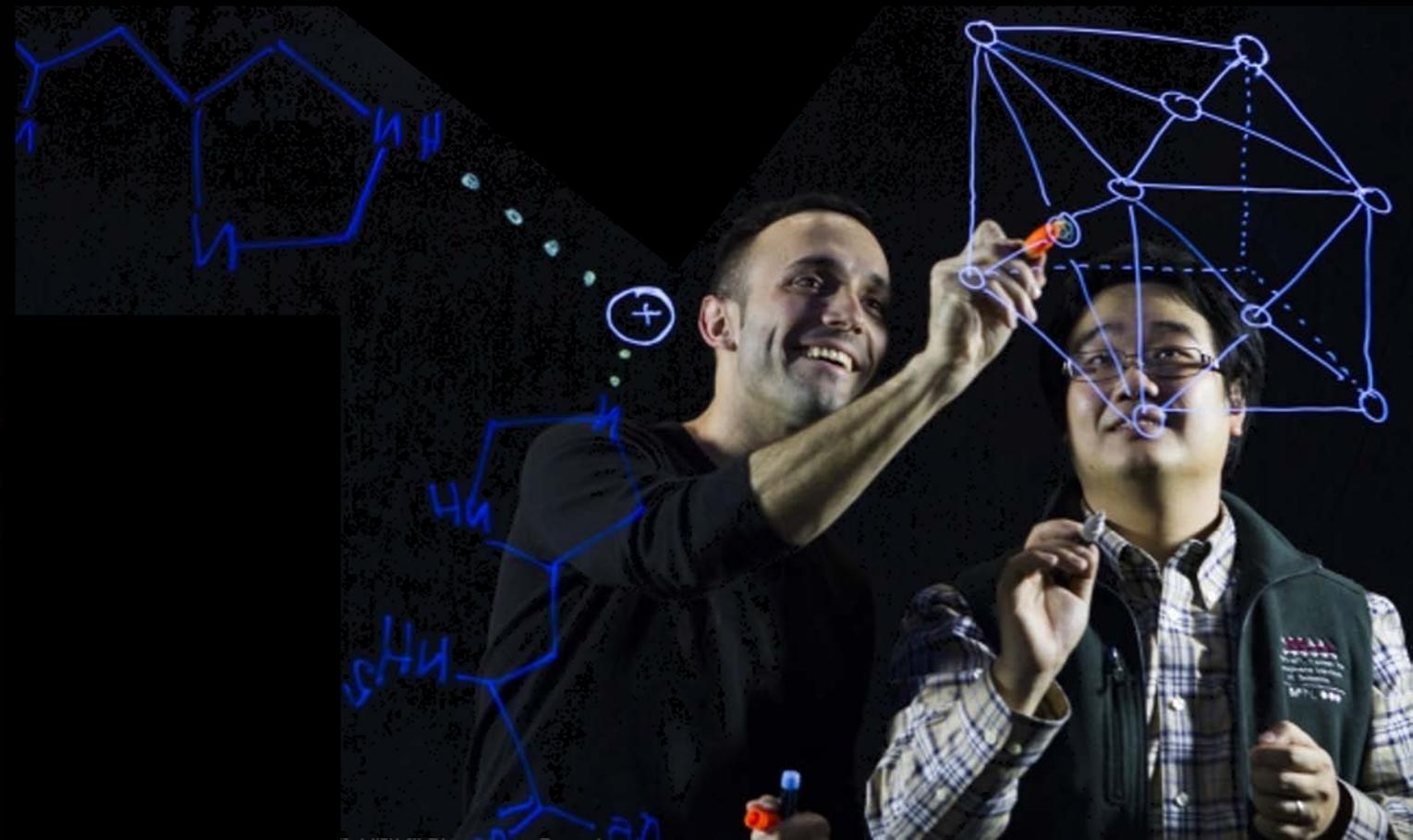
Challenges

... And increasing global population

SUPERPODERES INSPIRADOS EN LA NATURALEZA

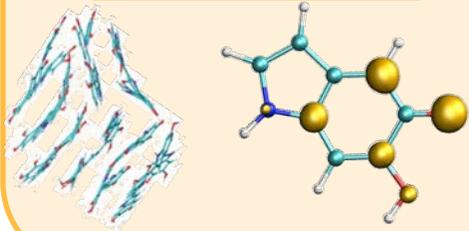
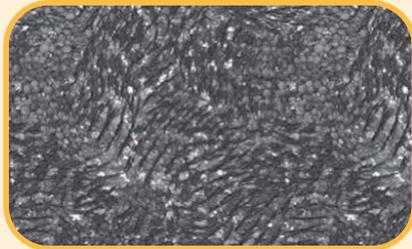
Robots flexibles, pegamentos ultrafuertes, cascos irrompibles... La ciencia de la biomimética imita las propiedades de animales, minerales y plantas para crear nuevos materiales y tecnologías revolucionarias.

Un reportaje de ESTHER PANIAGUA



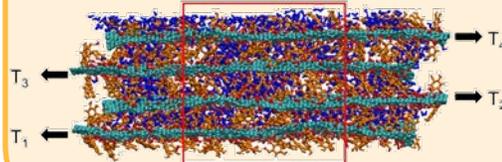
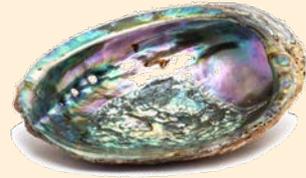
Bioinspired materials

Mussel's threads



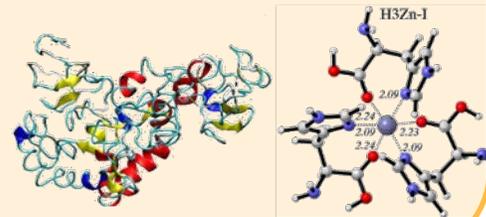
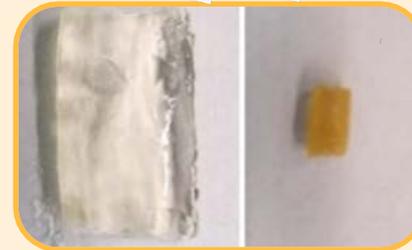
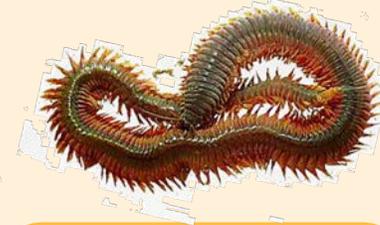
Chem. Sci., 8, 1631, 2017

Abalone's nacre



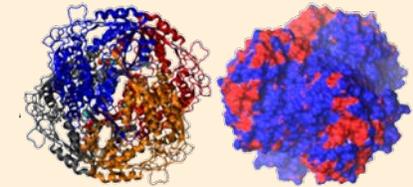
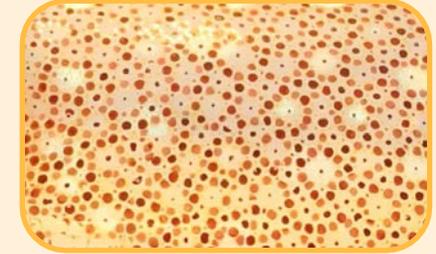
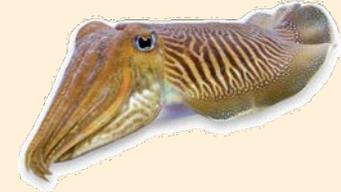
Nano Futures, 1 (1), 011003, 2017

Nereis virens' jaw



ACS Nano, 11, 1858, 2017

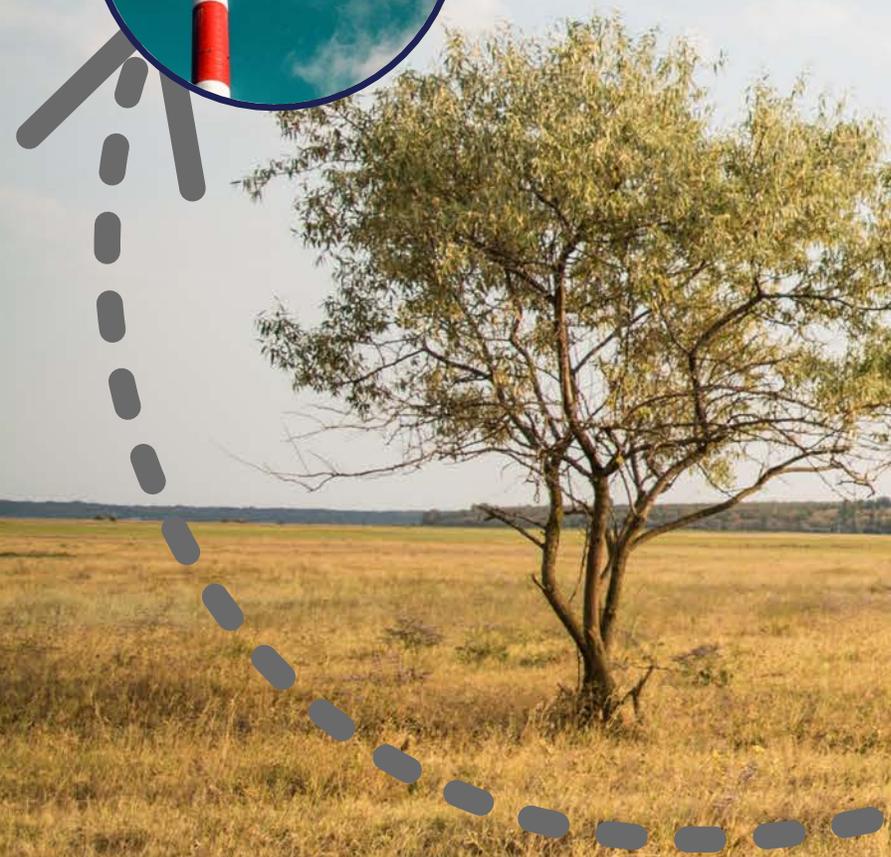
Cuttlefish skin



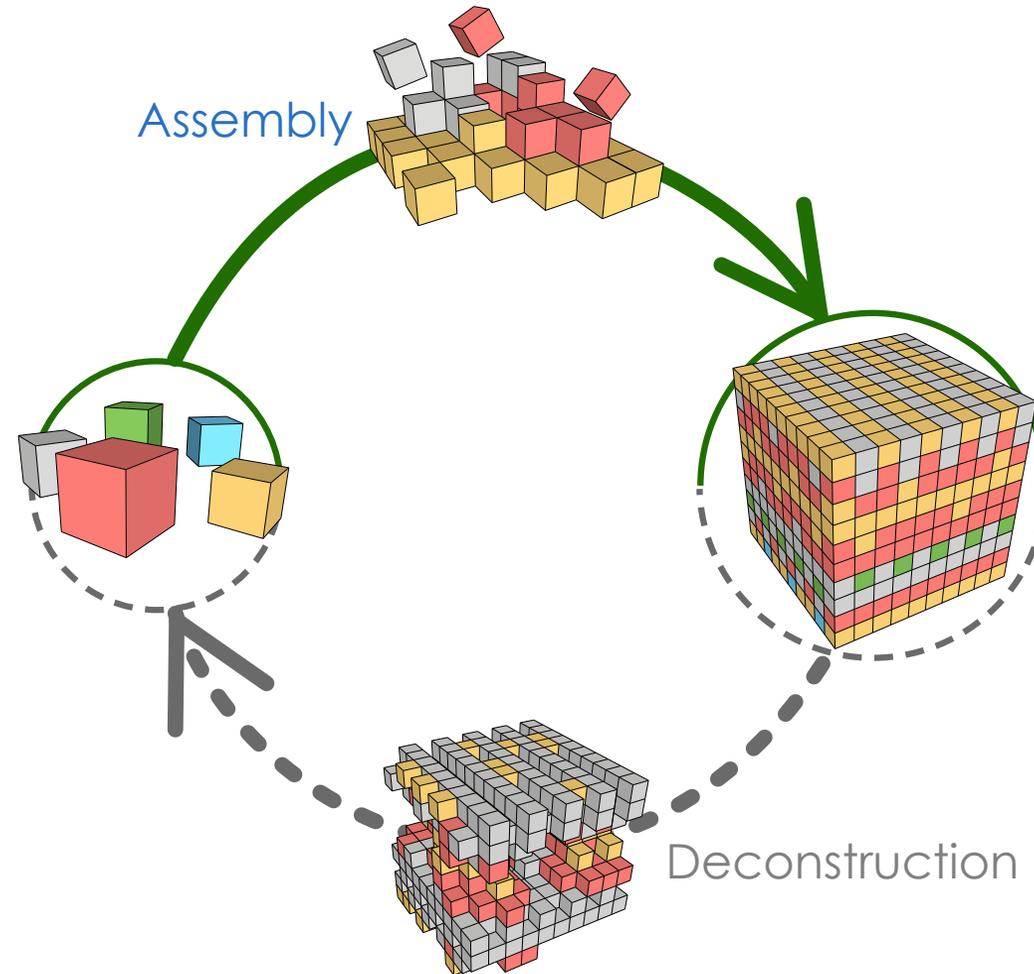
Nature Comm., 10 (1), 1004, 2019

Design for performance

Design for reuse as well as performance



Can we mimic Nature's circularity?



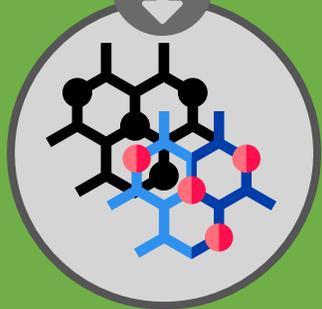
Sustainable sources

Applications

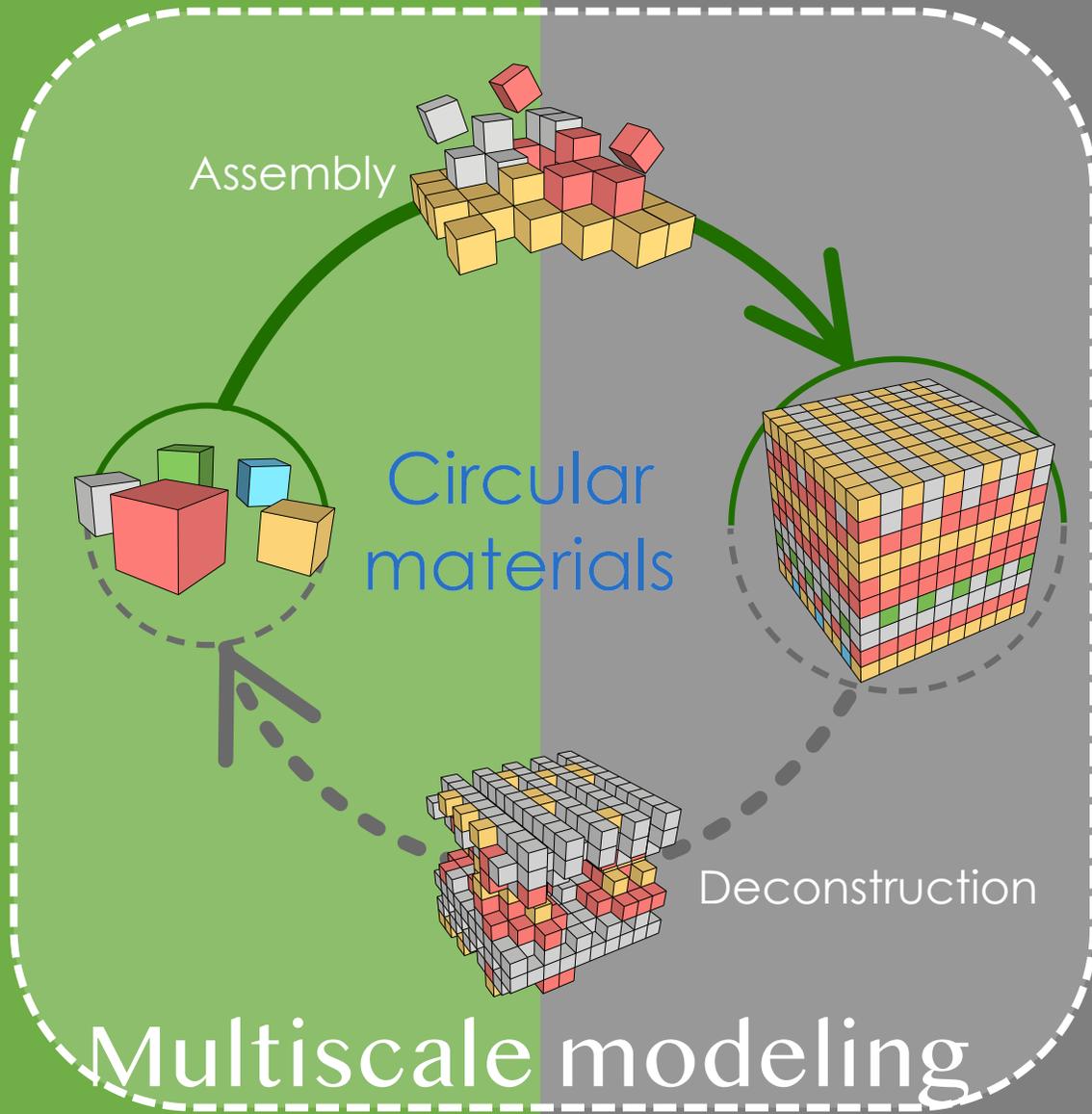
Biomass



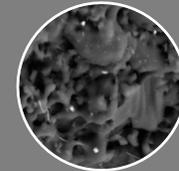
HTP



Nanomaterials



Biobased asphalt



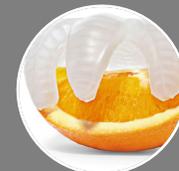
Energy storage



Precision agriculture

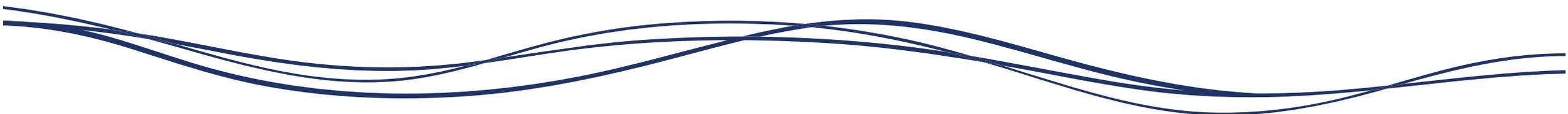


Wood nanotechnology

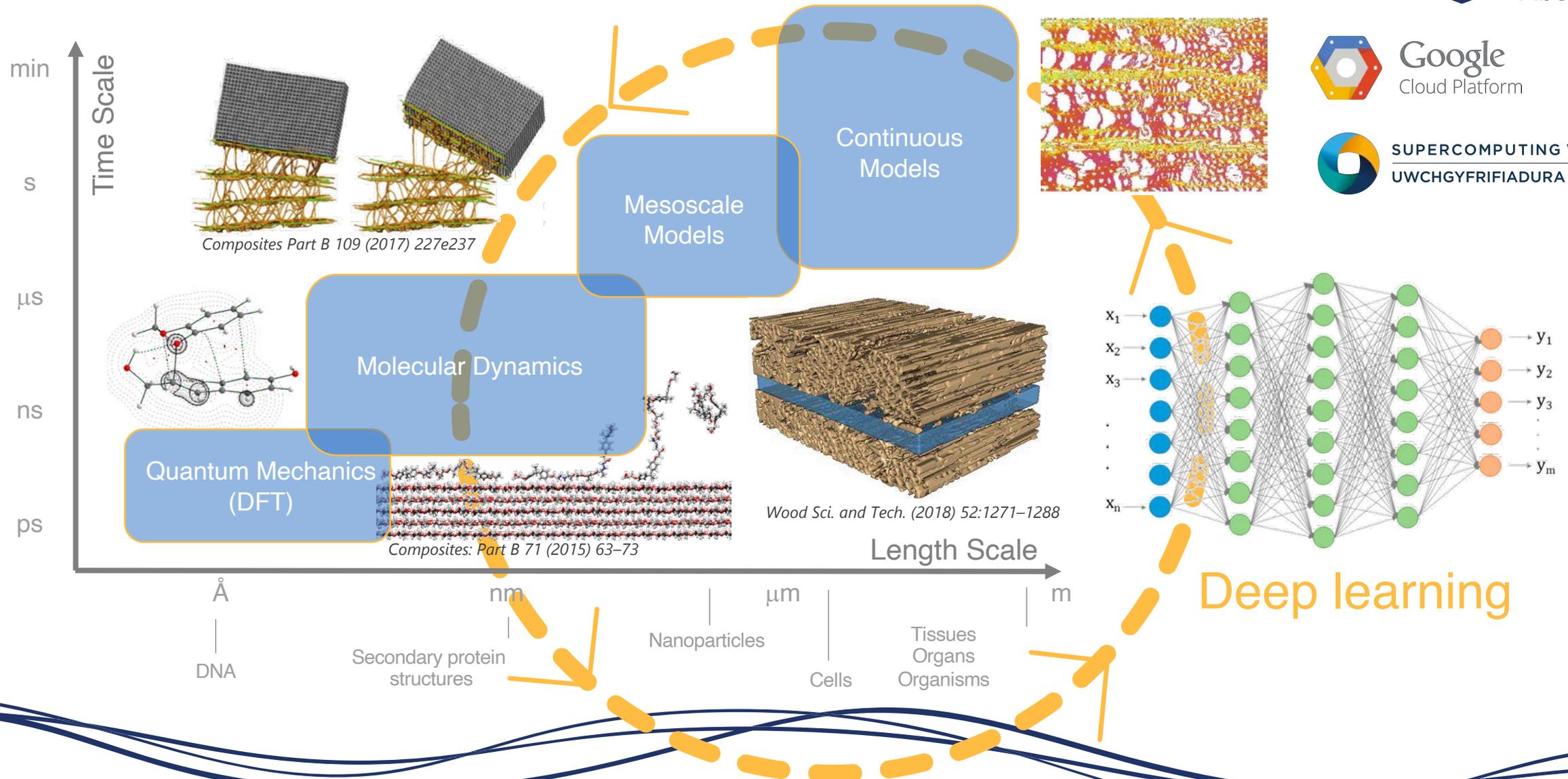


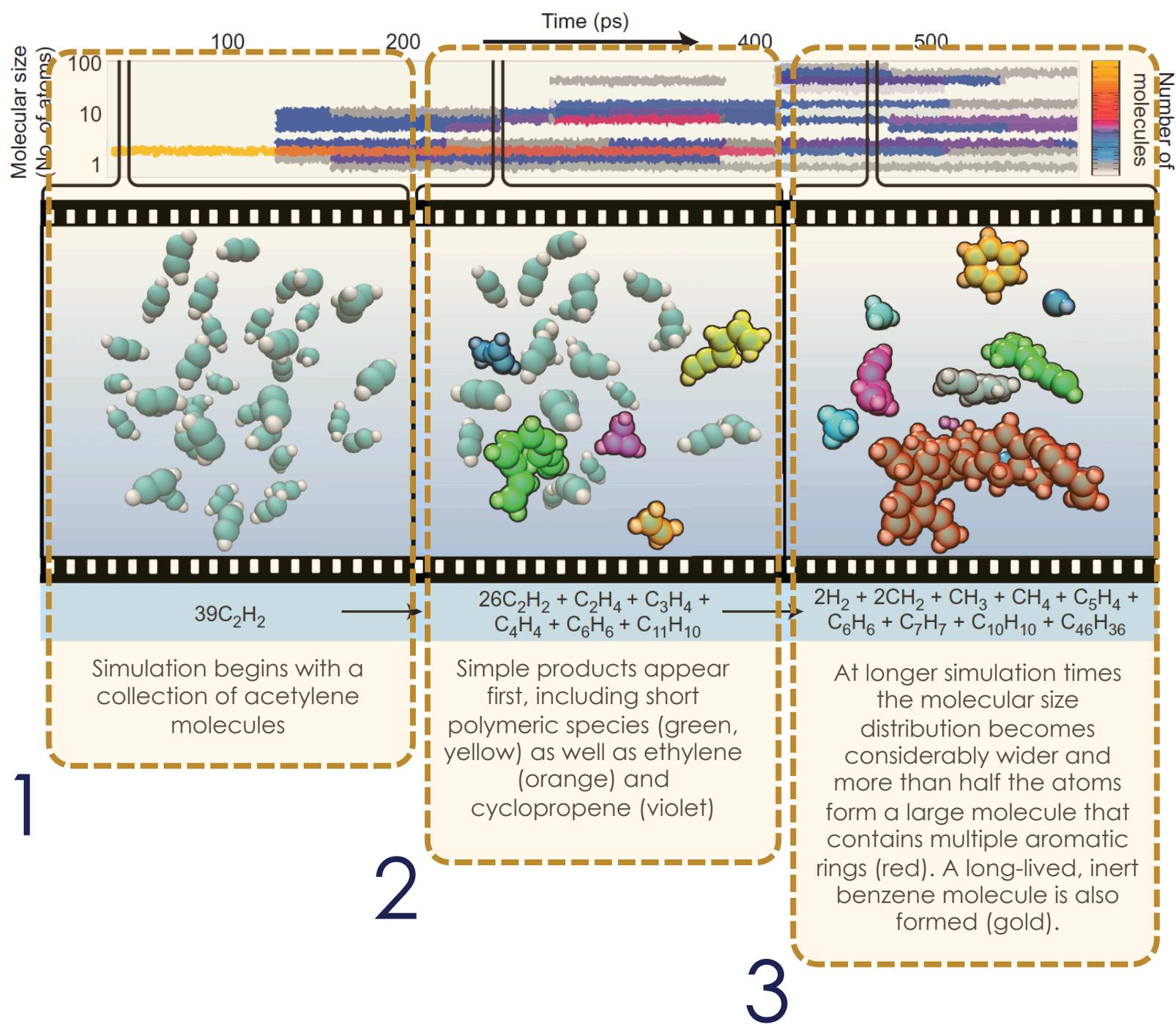
Soft robotics

Computational design by multiscale modeling and machine learning?

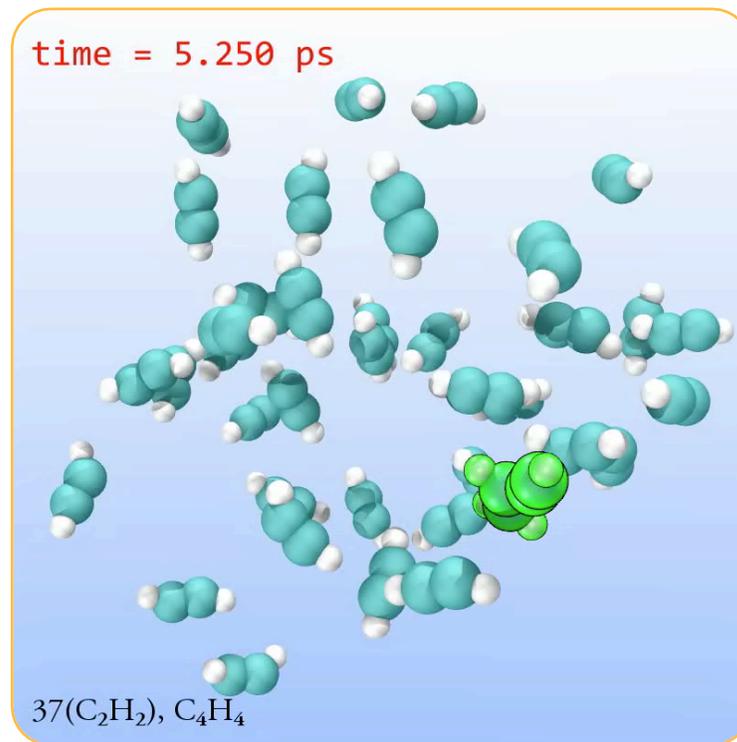


Materials by design: multiscale modeling





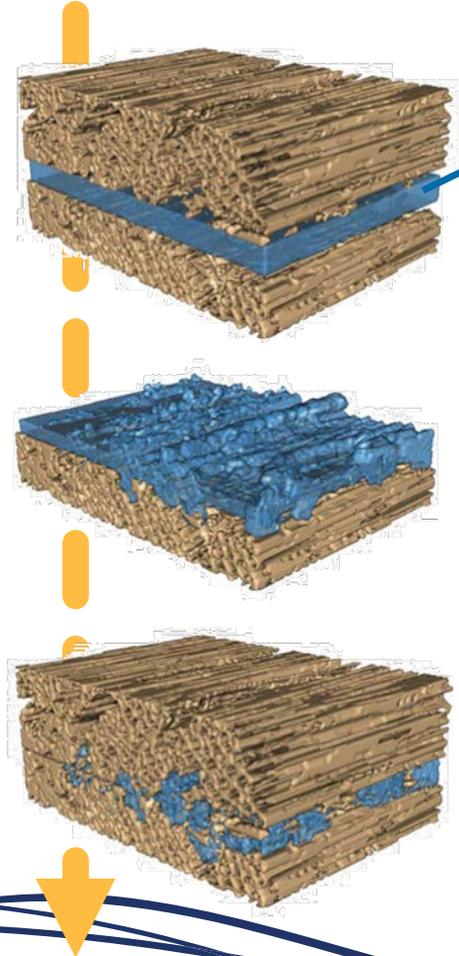
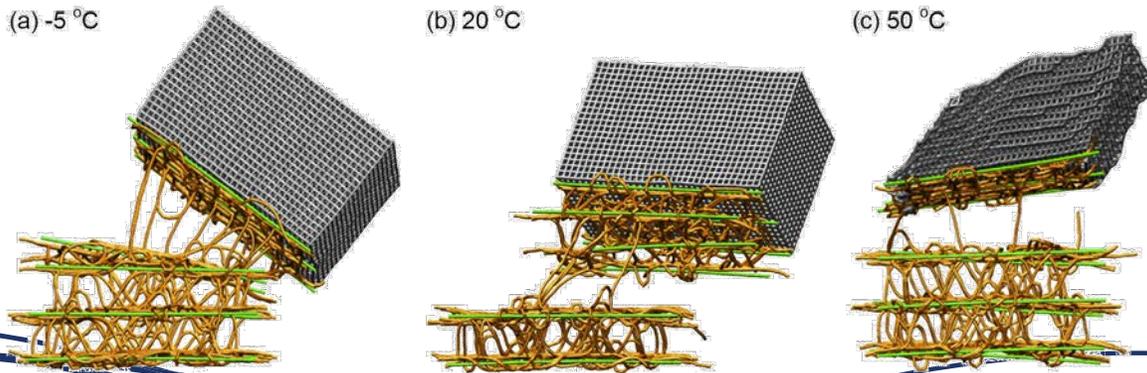
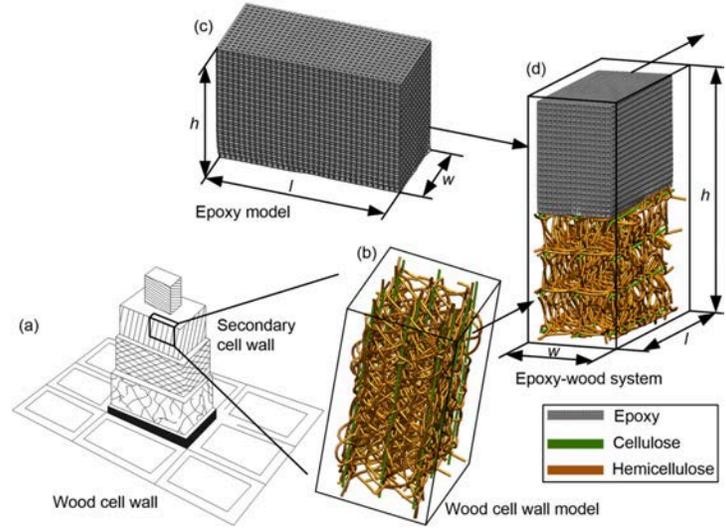
How does it look like?



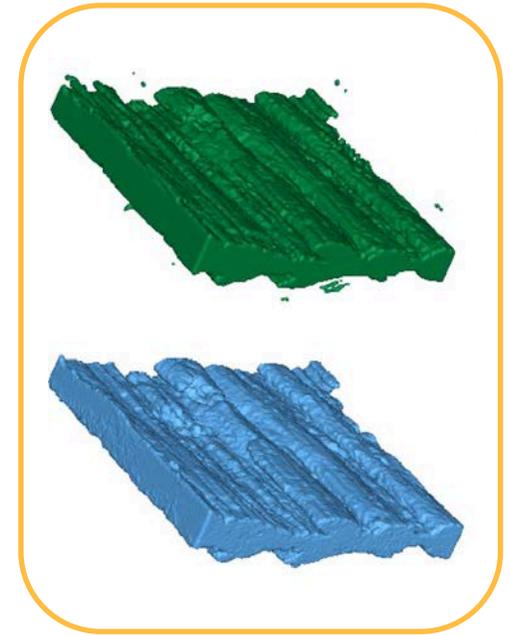
New molecules are automatically highlighted with molecule-specific colours to indicate the observed reactivity

Effect of temperature on the interfacial behavior of CFRP-wood composite

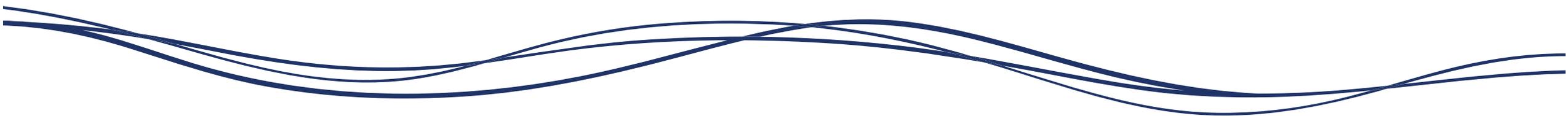
Adhesive penetration into wood structures by material point method (MPM) simulations



Polyvinyl acetate/phenol formaldehyde blend

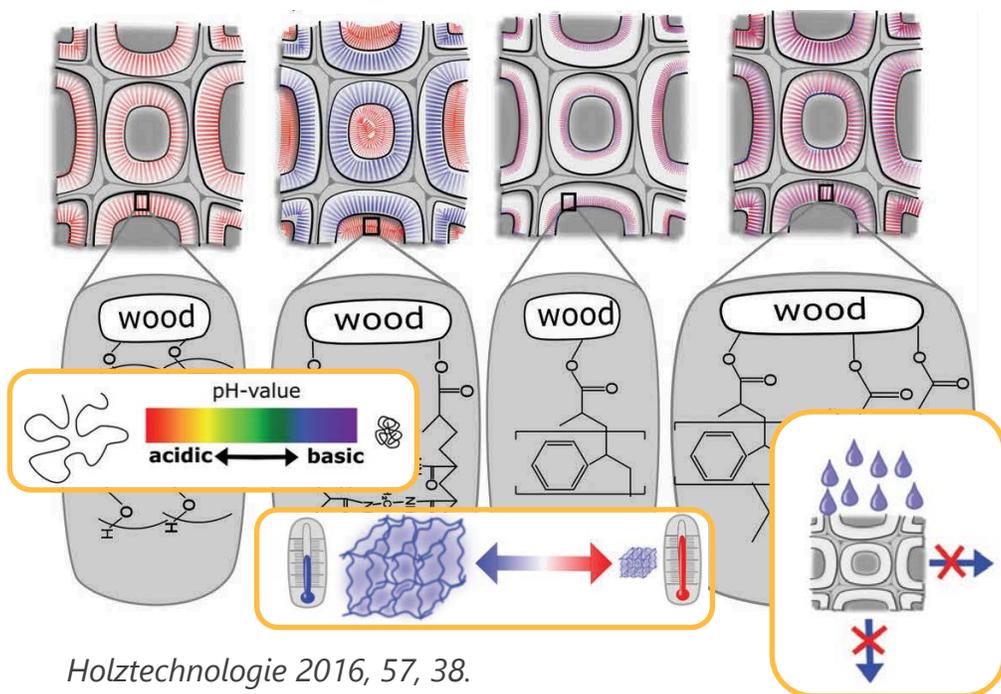


Biospired wood-based nanotechnology

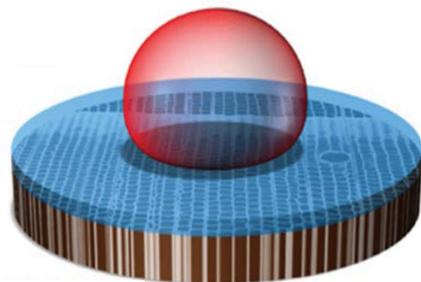


Bioinspired wood-based nanotechnology

Polymer Functionalization

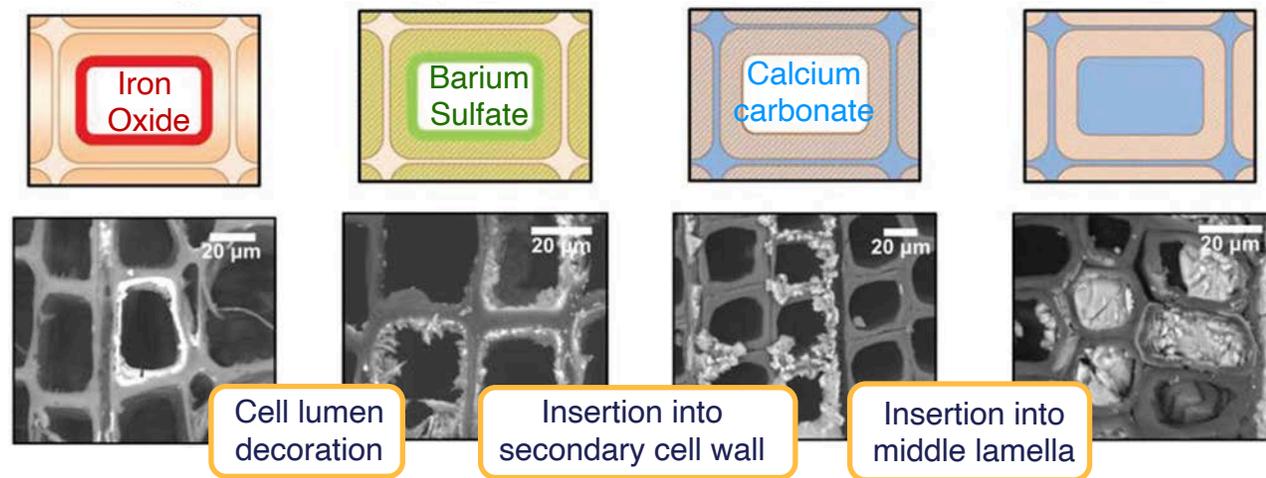


Holztechnologie 2016, 57, 38.

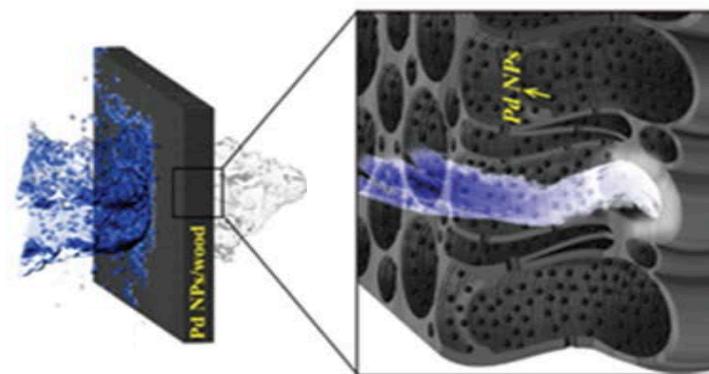


Separation of water and oil at a wood surface interface.

Wood–Mineral and Wood–Metal Hybrids



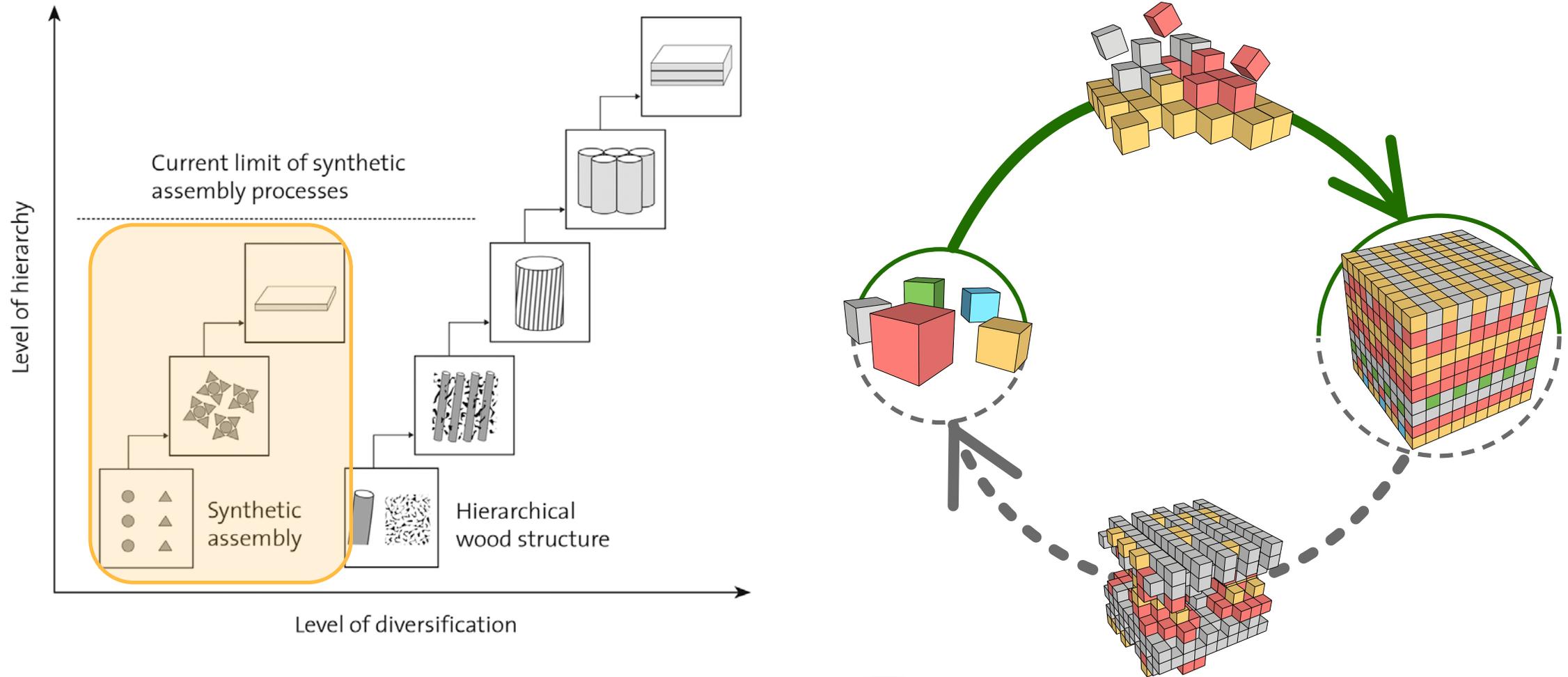
Cryst. Growth Des. 2017, 17, 677; *Green Chem.* 2015, 17, 1423; *ACS Appl. Mater. Int.* 2014, 6, 9760



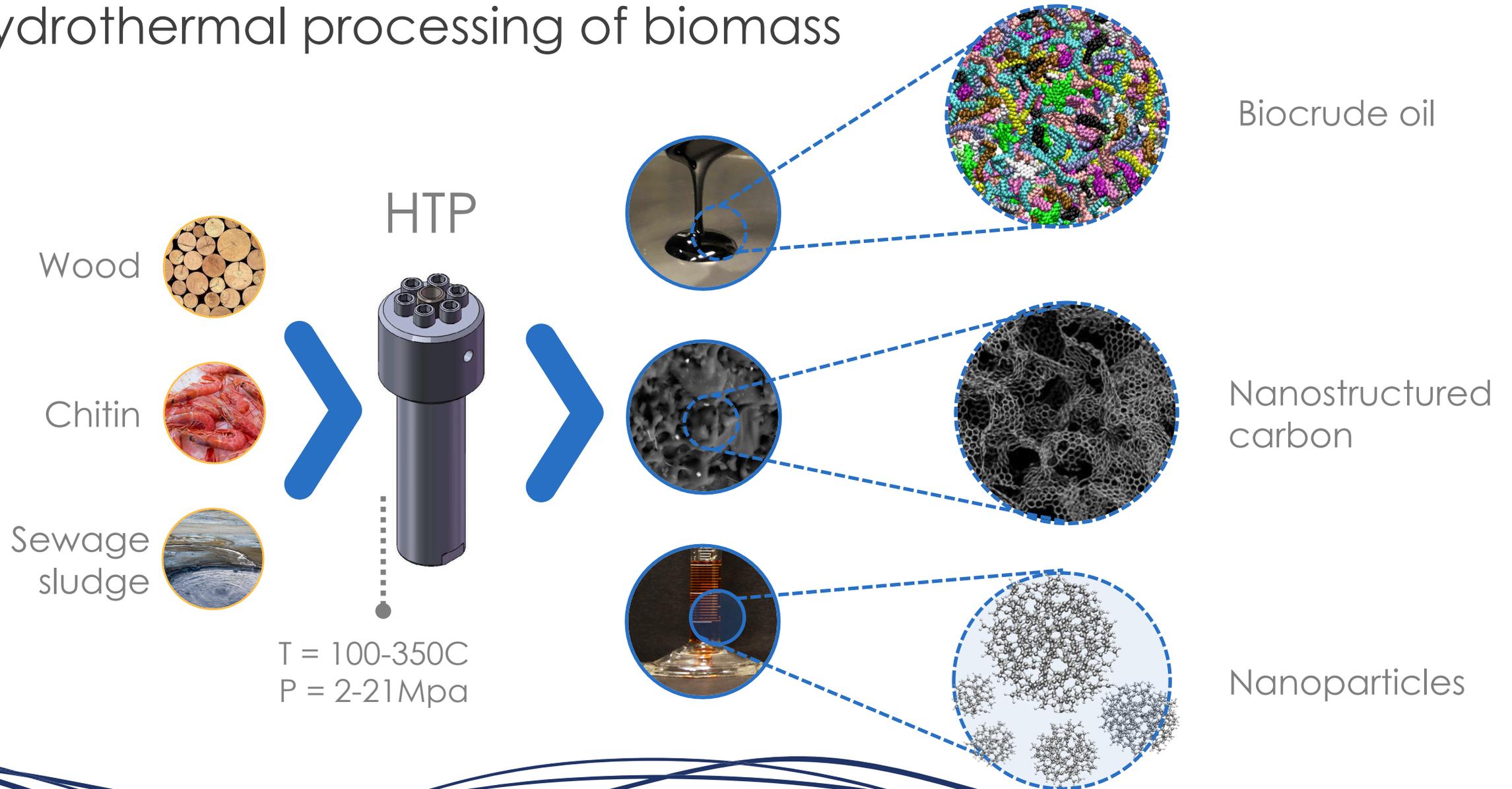
Basswood membrane decorated with palladium nanoparticles for water purification.

ACS Nano 2017, 11, 4275

Bioinspired wood-based nanotechnology



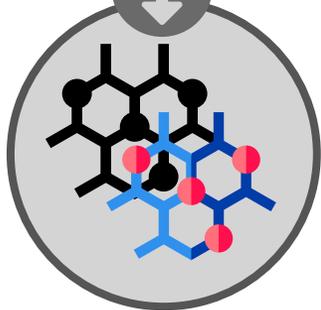
Hydrothermal processing of biomass



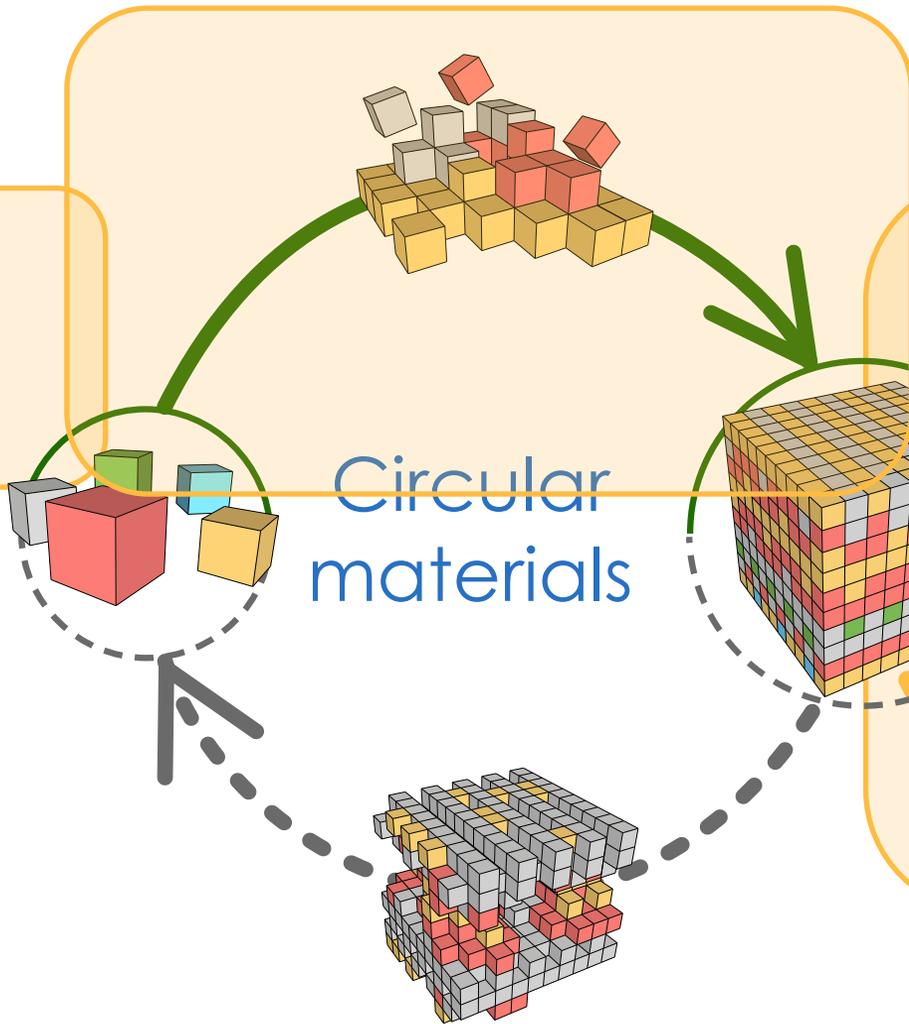
Biomass



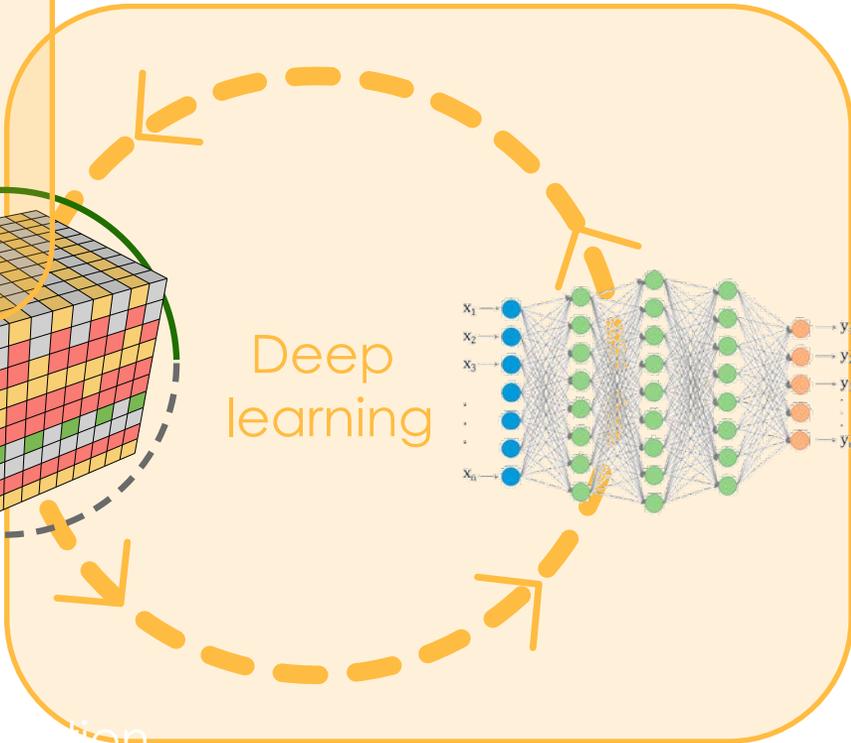
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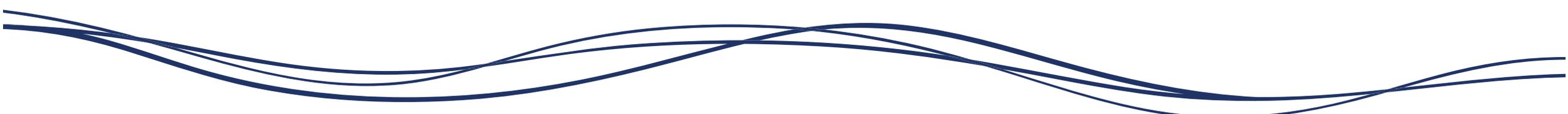
Nanomaterials



Circular materials



Deep learning



Design for reuse as well as performance



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Prof. Jingjie Yeo (Cornell University)
Christine Ortiz (MIT, Station1)
Ellan Spero (MIT, Station1)
Prof. Zhao Qin (Syracuse University)
Dr. Gang Seob Jung (Oak Ridge National Lab)
Dr. Chun-The Chen (Berkeley University)
Prof. Leila Deravi (Northeastern University)
Prof. Antoni Forner (TU Eindhoven)



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Thank you