Dynamic Materials Design Laboratory

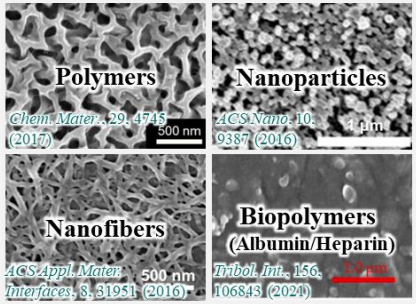
Keyword; biomimetics, soft-matters, surface & interface, 3D/4D printing, biohybrid

– Bioinspired design of functional dynamic hierarchical materials: trans-scale architectures from nano to micro –

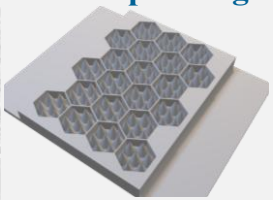
We study bioinspired and biohybrid materials for mechanical systems, focusing on functional surface/interface properties. By combining nano–micro structure fabrication, surface modification, and 4D printing, we design trans-scale architectures (nano to micro) to control wettability, friction, and adhesion. This enables materials with extreme performance—such as superhydrophobic/oleophobic behavior, ultralow friction, and anti-icing—as well as intelligent materials that deform and activate functions in response to environmental stimuli. Our target applications span sustainable materials based on naturally derived substances (eco-materials), biomaterials for medical devices that resist blood and bacterial fouling, and materials for manufacturing processes (e.g., semiconductors). Through these efforts, we aim to address challenges in the environment, healthcare, and advanced materials technologies.

Layered Materials Construction

Micro/Nanostructures

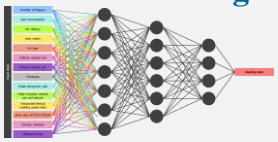


3D/4D printing



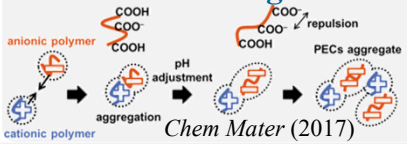
Sci Tech Adv Mater (2025)

AI-Driven Materials Design



Chem Eng J (2021)

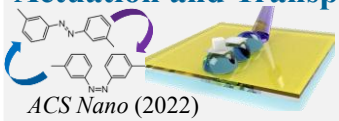
Material Bonding Control



Chem Mater (2017)

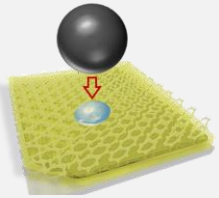
Material Interface Control

Actuation and Transport



ACS Nano (2022)

Ultralow Friction

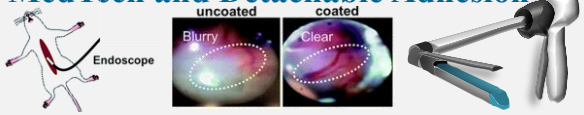


Langmuir (2021)

Anti-adhesion

Adv Mater Interfaces (2020)

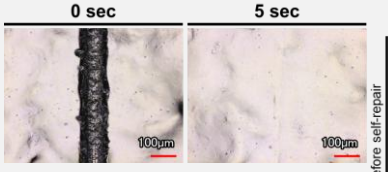
MedTech and Detachable Adhesion



Trib Inter (2021), *RSC Adv* (2016), *ACS AMI* (2015)

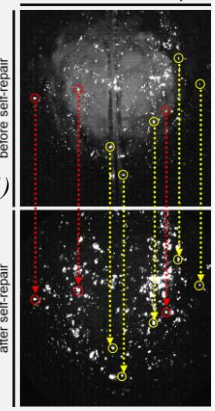
Dynamic Responsive Mater

Ultrafast Self-Healing



ACS Appl Mater Interfaces (2021)
Surf Interfaces (2023) *Langmuir* (2021)

in-situ μPIV



Chem Eng J (2021)

Soft Robotics

Assistant Professor Kengo Manabe (Graduate School of Engineering)
HP: https://sites.google.com/view/kengo-manabe-research/