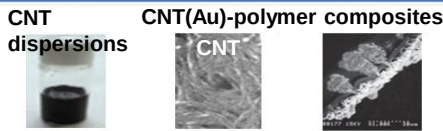


Development of Soft-actuators and Soft-sensors

Mechano-Activated Materials Research Group Takushi SUGINO

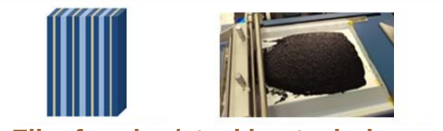
~ For practical applications on the technologies of haptic displays and tactile sensing ~

[Core technologies in our group]



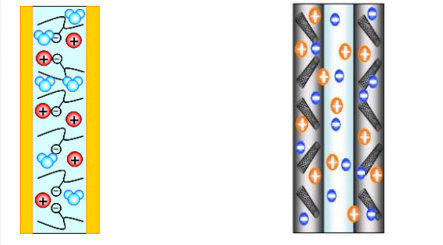
CNT dispersions CNT(Au)-polymer composites

Dispersion techniques



Film forming/stacking techniques

Three-layered SA and SS





Cations (Na⁺, K⁺...)



Water molecule



Polymer electrolytes (Nafion, Flemion)



: Cation = EMI⁺



: Anion = BF₄⁻



CNT

Developments of soft actuators (SA) for IoT society

(Appl. Examples) Haptic displays and Micropumps



Six characters

Braille dot

up (V≠0)
down (V=0)

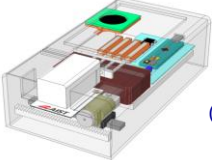
CNT actuator

Haptic display



CNT actuator

Micropump (ca. 30 mm²)



Handy-type health diagnostic devices with thin and light-weight micropumps

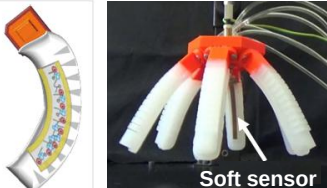
(Other Ex.) Focus-adjustable Intraocular lens



Telemedicine, Displays in cars, games, VR (Virtual Reality) ect..

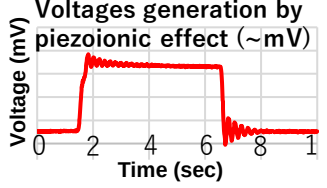
Developments of soft sensors (SS) for IoT society

(Appl. Examples) Soft robot hands to make up for labor shortage



Soft sensor

https://www.aist.go.jp/aist_j/press_release/pr2022/pr20221201_2/pr20221201_2.html (Press release)



Voltages generation by piezoionic effect (~mV)

Time (sec)



(Packing operations: Foods/ e-commerce products)



Aging Society: Labor shortage

- Packing for Bento (foods) and e-commerce products
- Harvesting operation

Soft robot hands with built-in piezoionic sensors to detect tactile sensing and make up for labor shortages