material

Gel Adhesion and 3D Fabrication Techniques

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Purpose of Research

Adhesion is critical processes for integrating materials with diverse functions to create advanced composite systems. Hydrogels, with their flexibility and high-water content, are attractive materials for applications such as soft actuators and tissue regeneration scaffolds as biomimetic functional materials. However, their substantial water content renders them challenging to bond. Our research group is studying adhesive control technologies for hydrogels to construct functional materials using hydrogels as component parts.

Summary of Research

We have achieved adhesion for various hydrogels where conventional adhesives are difficult to apply. Specifically, we developed a unique method for adhesion of hydrogels by utilizing the electrophoretic phenomena of polycations and polyanions to form polyion complexes at the gel interface as an adhesive layer. Furthermore, we have succeeded in 3D hydrogel fabrication by adhesion of gel particles in a three-dimensional manner. Additionally, focusing on the microstructure of the adhesive interface, we have developed a hydrogel adhesion method driven by the formation of a wrinkle structure.
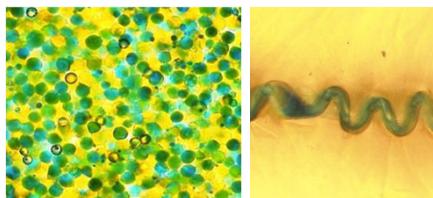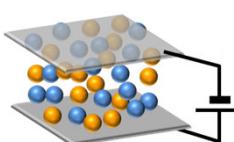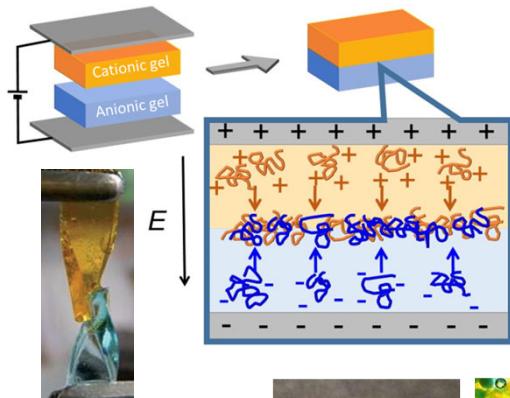
Comparison with conventional or competitive Technologies

· Successfully adhered hydrogels and organogels.
· Adhesion and detachment occur in a short time (on the order of seconds).

Expected Applications

· Adhesion of biological tissues
· Easily disassemblable Materials
· 3D fabrication
· Repair of soft materials

Challenges in Implementation

· Applications as biomaterials have not been investigated.
· Materials other than gels have not been investigated.

Message to Companies

· Assessing Market Needs
· Exploring Product or Service Potential

Points
· Gel adhesion without adhesives
· 3D fabrication by adhesion
· Reversible Adhesion

Future Developments

· Expansion of gel adhesion techniques to elastomers
· Adhesive solutions for dissimilar and hard-to-bond materials

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