YOSHIE LAB.

Dynamic Functional Polymer Materials

Department of Materials and Environmental Science

Environment-Conscious Polymeric Materials Science
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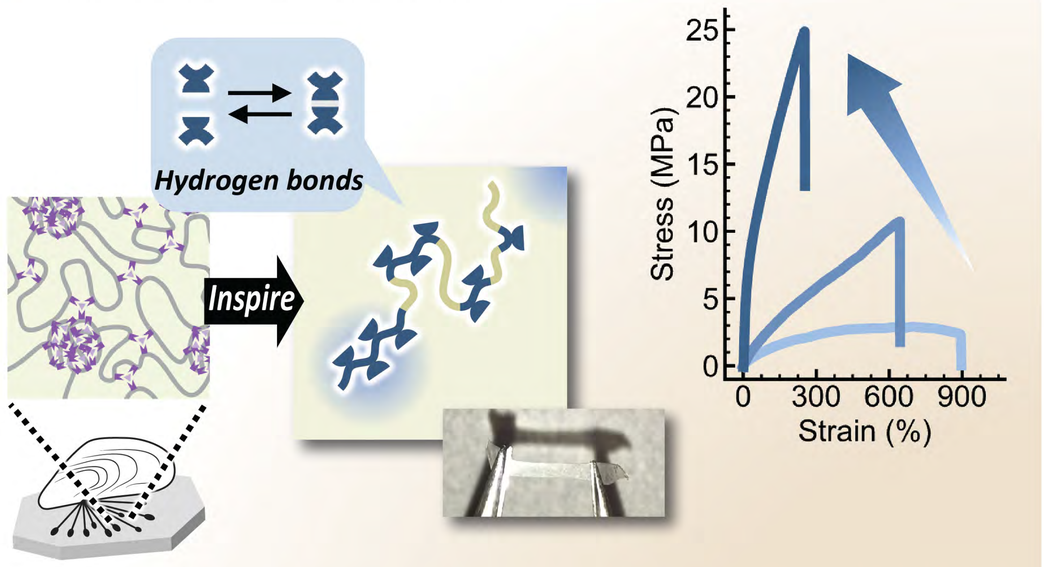
http://yoshielab.iis.u-tokyo.ac.jp/

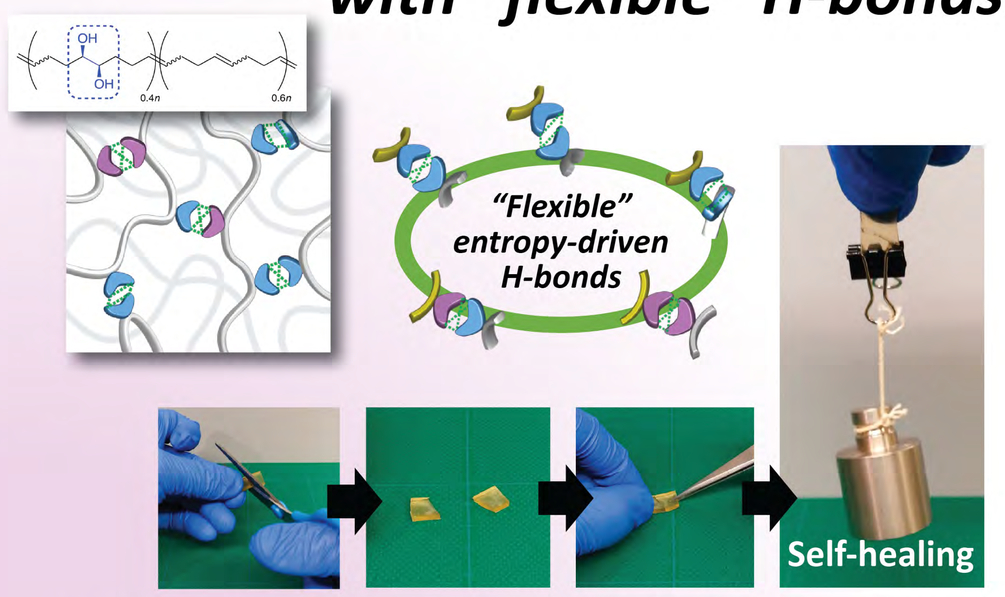
We create **unique high-performance materials** such as **tough self-healable elastomers** and environment-responsive **degradable polymers**, through the **dynamic control** of hierarchical structure of polymeric materials spanning from molecular to mesoscopic scales.

Tough polymer inspired by nature

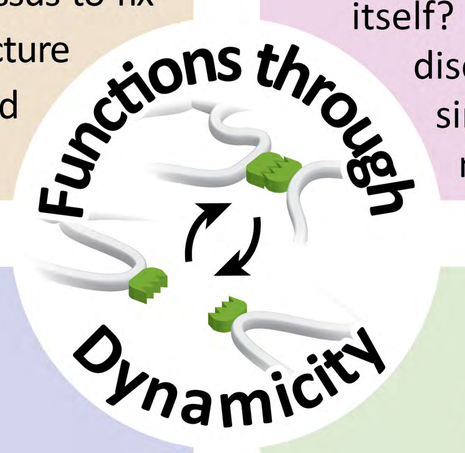


Mussels have a string-like tough organ called byssus to fix themselves to rocks. Inspired by the multiphase structure formed by dynamic crosslinks in byssus, we developed a new material with high mechanical toughness.

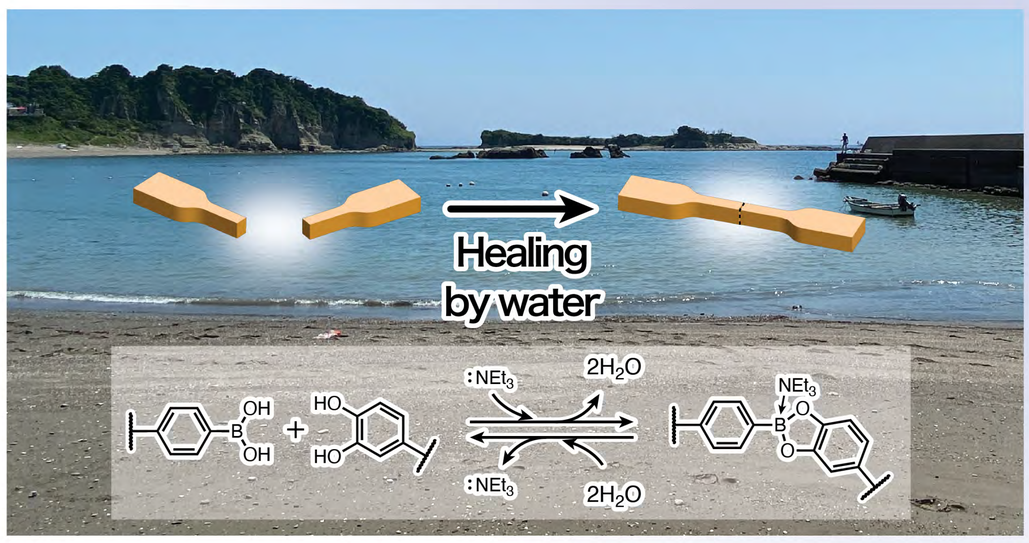
Self-healing rubber with "flexible" H-bonds



What if materials like rubber can heal their wounds by itself? It will greatly prolong the materials' lifetime. We discovered that hydrogen bonds between very simple chemical motifs (vicinal diols) make rubber mechanically tough and self-healable.

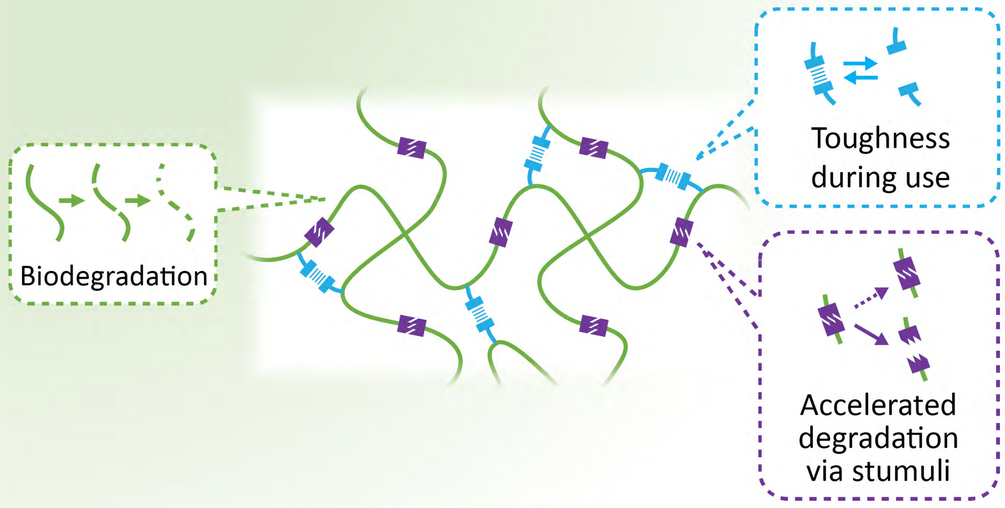


Water-triggered healing polymers



Water is a very attractive stimulus source that exist everywhere on earth. We have developed polymers that heals with the assistance of water. They absorb small amount of water molecules in air and in seawater, which heals the damage of the polymers with the collaboration of boronate esters in the polymer chain.

Polymer with toughness and degradability in nature



To tackle the global issue of plastic wastes, polymers that can degrade in environment are highly anticipated. We are developing polymer materials that keeps good toughness during use and can degrade rapidly by external stimuli in nature.