

NAKAGAWA LAB.

Unprecedented Property of Homogeneous Crosslinked Polymers

Department of Materials and Environmental Science



Macromolecular Network Science

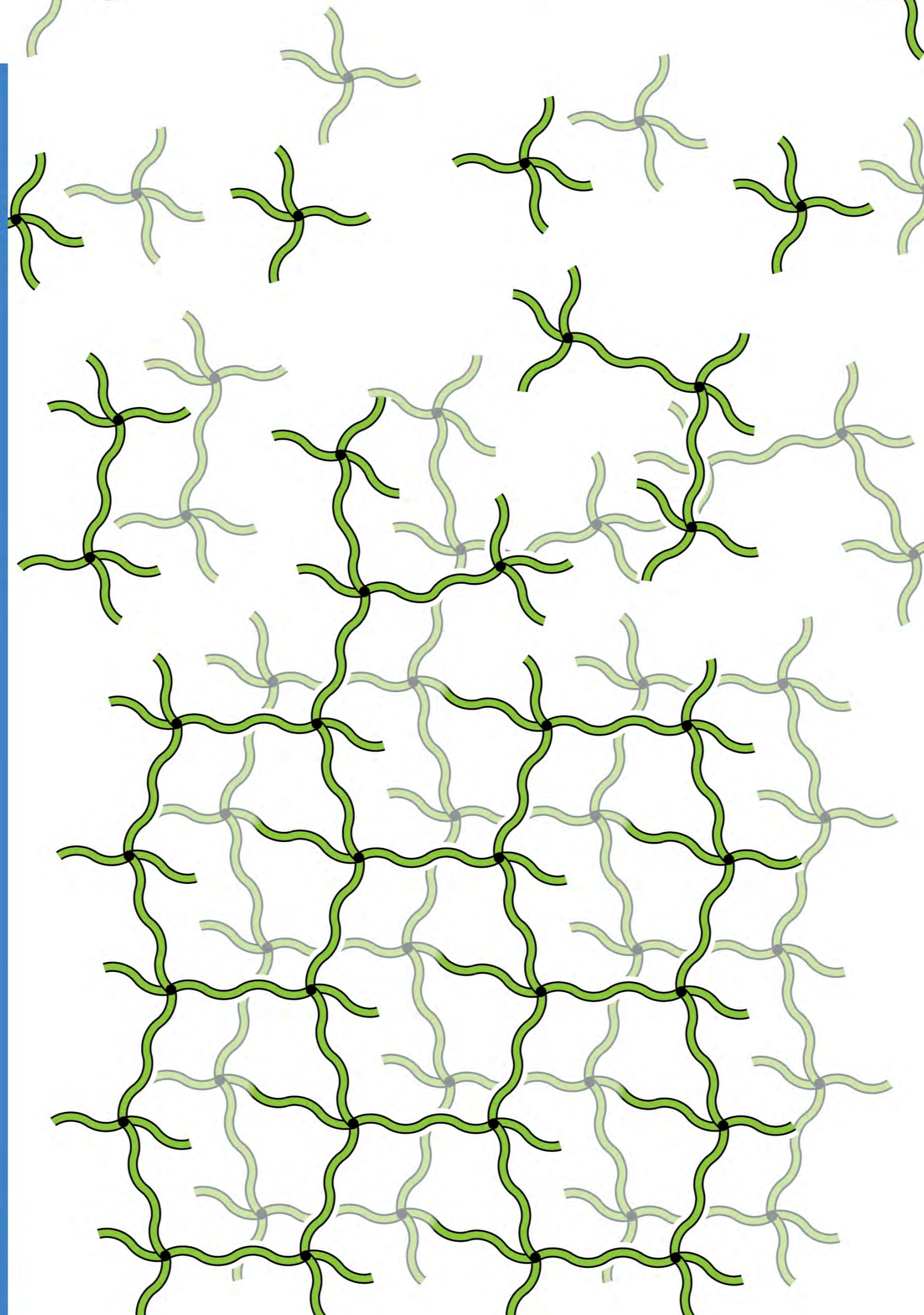
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Materials such as rubber and jelly are actually **crosslinked polymers** made of a 3d network of long string-like polymer chains. The performance and functions of crosslinked polymers strongly depend on the network structure, but the structure of conventional crosslinked polymers is highly inhomogeneous and difficult to control. We aim to develop **crosslinked polymers that outperform existing materials**, through the precise control of the network structure and various analysis techniques.

Simple & versatile synthetic method for homogeneous crosslinked polymers

We developed a novel method that enables an easy synthesis of homogeneous crosslinked polymers. This method can be applied to various kinds of polymer.



Homogeneous rubber that becomes 2,000x harder by stretching

We synthesized a rubber with a highly homogeneous network structure. This rubber showed not only excellent mechanical strength but also enormous strain-stiffening ability that overwhelms any other existing material.

Enormous Strain-stiffening

Application to variable stiffness actuator

Synthesis & structural analysis of homogeneous bottlebrush polymer network

We synthesized a homogeneous crosslinked bottlebrush polymer, which has a long side chains grafted onto a main chain. We revealed the relation between the main chain orientation and the macroscopic stress through in situ X-ray scattering analyses.

