Tohoku Univ. Technology

Fabrication of cellulose hydrogels

High-strength hydrogels fabricated by precise control of cellulose nanofibrils

The left panel shows a photograph of the hydrogel (red box).

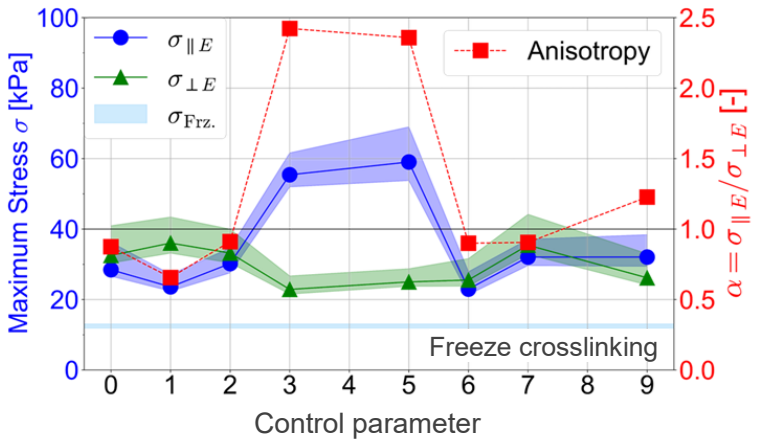
Overview

Cellulose nanofibril (CNF) is a highly crystalline microfibril derived from wood fiber. It is an environmentally friendly innovative material with excellent mechanical properties such as light weight, high strength, and low thermal expansion. Owing to these characteristics, it is expected to be applied to automotive components, electronic devices, gas barrier materials, and medical materials. A technology to fabricate single filaments composed of CNF has been also developed, and long filaments with high strength have been obtained.

Based on the previously obtained knowledges and established methodology, functional materials using CNF have been developed in various fields, including the present invention relates to the fabrication of hydrogels. There are several hydrogel fabrication methods such as using electrophoresis and freeze-crosslinking, however, they were not suitable for mass production, and a new method was anticipated.

As a result of intensive research, a method for precisely controlling the CNF orientation and the internal structure of hydrogels was developed, which realizes the contamination-free and high-strength hydrogels. It was found that the strength of gels can be designed from isotropic to anisotropic by tuning the fabrication conditions.

Strength



The figure shows that the strength of the hydrogel is controlled to be anisotropic depending on the control parameter.

Product Application

- ☐ Biomedical
- ☐ Sanitary products
- ☐ Wearable devices

Related Works

[1] H. Takana, R. Sato, and T. Usui, "Three-dimensional simulation on electric field assisted alignment of cellulose nanofibrils in focusing flow", International Journal of Multiphase Flow, Vol. 193 (2025), 105413.

[2] Y. Kaneko, Y. Mori, and H. Takana, "Electric field-assisted fabrication of cellulose hydrogels", 7th International Conference on Natural Fibers (ICNF2025), June 2025.

IP Data

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