Advanced Core for Energetics, Hiroshima University Vol. 81

HU-ACE NEWS LETTER

Advanced Core for Energetics, Hiroshima University

Vol.81
2023.9

Activities of the Core

Sep. 8, 2023	Prof. Ichikawa gave an invited lecture at Takeda Junior High School.
Sep. 13, 2023	Prof. Mochizuki gave an invited lecture titled "Biomass Utilization in Carbon Cycle and Carbon Recycling" at the autumn meeting of the Society of Chemical Engineers, Japan.
Sep. 25, 2023	The 83rd HU-ACE Steering Committee Meeting
Sep.26, 2023	Prof. Ichikawa will give an invited lecture titled "Strategies to be adopted to reduce the cost of hydrogen production and storage, development of hydrogen storage materials, and application expansion" at the Japan Planning Institute.
Sep. 27, 2023	The 11th Biomass premium evening seminar (co-organized by HU-ACE).

“Higashihiroshima Energy-Eco Seminar” Now Being Held

The Higashihiroshima Energy-Eco Seminar, co-organized by HU-ACE, Higashihiroshima City, and the A-ESG Science and Technology Research Center, has been taking place since June. A total of nine programs will take place through February of next year, three of which have already been completed. This project is being held for members of the general public who are upper elementary school age or above with the aim of having fun learning about the environment and new energy technologies that are eco-friendly. Each program consists of a lecture with its own theme. The first lecture was "Global Warming," the second was "Biomass," the third was "Geothermal Heat," and the fourth is "Hydrogen Energy", which is to be held this month. In a space with a different atmosphere from a normal classroom, lecturers do not use a projector, but instead take part in a dialogue with participants by having them raise their hands and listening to their opinions. The questions from previous sessions were very exciting, and in the quiz competition, prizes were prepared for the top three people, which also aroused excitement from the participants.

Related Events

The 8th International Symposium on Fuels and Energy (ISFE2024) is scheduled on July 1-2, 2024.
Details will be announced later.

We have constructed a roadmap for the development of energy utilization technologies leading up to 2050 and an integration scenario called the “Hiroshima Scenario”. Please feel free to share your thoughts with us.
https://hu-ace.hiroshima-u.ac.jp/wp/wp-content/uploads/2022/10/220921-brochure.pdf

Research consultation and joint research are welcome.

Issued by Advanced Core for Energetics, Hiroshima University
HU-ACE Secretariat, URA Division, Office of Research and Academia-Government-Community Collaboration, Hiroshima University 1-3-2 Kagamiyama, Higashi-Hiroshima, 739-8511 Japan
E-mail: hu-ace-info@ml.hiroshima-u.ac.jp, tel:+81-82-424-4425, URL: https://hu-ace.hiroshima-u.ac.jp/en/

HU-ACE NEWS LETTER
Advanced Core for Energetics, Hiroshima University Vol. 81

Member Introduction No.37

Takashi ENDO

Professor of Collaborative Research Laboratory

Research Fields：Cellulose Chemistry, Wood Chemistry, Polymer Chemistry
Keywords： Cellulose-based functional/composite materials, nanocellulose, biofuel

Abstract

Background

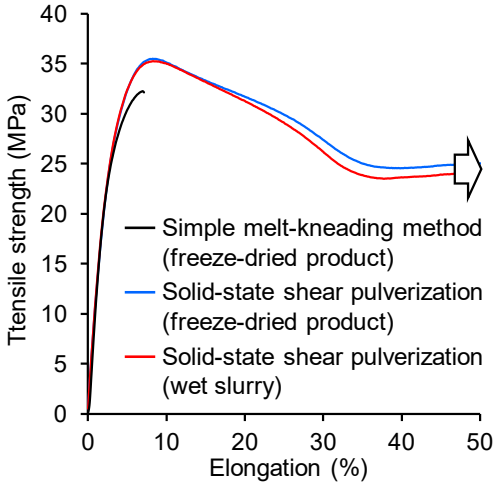
Cellulose is an important renewable natural polymer that is the main component of wood. It has been used as a material and energy resource since ancient times. Fossil resources have enriched society, but in recent years, their harmful effects have become a major problem. Nanocellulose (cellulose nanofiber/CNF, which can be produced from all plants), is mechanically made from woody fibers such as pulp and has great potential as a material due to its light weight, high strength, high elasticity, and special viscosity. Utilizing these characteristics, we are making progress in weight reduction, strength enhancement, and performance improvement of products by dispersing and compounding them into resin or rubber. In addition, nanocellulose has a large surface area and exhibits high enzymatic saccharification. This characteristic is effective as a pretreatment for bioethanol production.

Method

Nanocellulose (width ca. 20 nm) can be produced by mechanically wet defibrating (water content of 90% or more) wood or pulp. Water must be removed when compounding with a resin such as polypropylene (PP) as a reinforcing material. But if it is simply hot air dried, the nanocellulose will aggregate strongly and cannot be dispersed in the resin, and the reinforcing effect cannot be demonstrated. Therefore, by kneading wet nanocellulose and PP powder at 100℃ or less, an appropriate shearing force was applied to replace the water with the resin powder (solid-phase shear method). After that, melt-kneading was performed to obtain a nanocellulose composite material. The obtained composites were able to improve physical properties such as tensile strength while maintaining the elongation property.

Results

Using a kneading device, cypress-derived nanocelluloses (5wt%) were mixed with PP powder, and shear force was applied (under torque and temperature control). The resulting mixtures were melt-kneaded at 180 ℃ , and the resulting composites were injection-molded into test pieces to evaluate their tensile strength properties. As a result, the simple melt kneading of freeze-dried nanocelluloses resulted in a large decrease in elongation as well as tensile strength. On the other hand, the solid-phase shear method improved the tensile strength and elongation. These physical properties increased even when wet nanocelluloses were added. The high elongation indicates that the nanocelluloses are highly dispersed in the PP matrix and exhibit a reinforcing effect.



Strength test of nanocellulose composites (stress-strain curve)

Reference

S. Iwamoto, S. Yamamoto, SH. Lee, T. Endo, *Cellulose*, **21(3)**, 1573-1580 (2014).