

# Compositions and Methods Related Functionalized Cellulose Nanofibrils

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## ABSTRACT

Researchers at the University of California, Davis have developed a one-pot synthesis process for producing hydrophobic, bromine-esterified nanocellulose (Br-CNF) that is dispersible in organic solvents, enabling the creation of enhanced polyurethane composites and serving as a versatile platform for precision polymer functionalization.

## FULL DESCRIPTION

This technology features a one-pot method producing Br-CNF directly from cellulose in organic media followed by ultrasonication. By targeting cellulose hydroxyl groups on crystalline surfaces and converting them into organic-compatible 2-bromopropionyl esters, the process renders the material inherently hydrophobic. The resulting Br-CNF features nanoscale dimensions (~4.6 nm thickness, 29.3 nm width, 1 micron length) and maintains high crystallinity (~48%). Its ability to disperse (>25%) in solvents like DMF, DMSO, chloroform, THF, and toluene unlocks new potential for material science, acting as both a mechanical reinforcement and a site-specific macroinitiator for SI-ATRP (Surface-Initiated Atom Transfer Radical Polymerization).

## APPLICATIONS

- ▶ High-performance polyurethane composites with potentially superior durability that could be useful in automotive and aerospace settings.
- ▶ Hydrophobic surfaces and films with tunable wettability for packaging, sensors, and protective layers.
- ▶ Rheology modifiers and viscosity enhancers in organic solvent-based formulations and lubricants.
- ▶ Biobased polymer brushes for advanced functional materials via SI-ATRP grafting.
- ▶ Sustainable, environmentally-friendly, and renewable nanomaterial supply for composites, adhesives, and coatings markets.

## FEATURES/BENEFITS

- ▶ Enhances polyurethane tensile modulus (up to 3.2×), strength (up to 3.9×), and strain-to-failure (up to 1.5×).
- ▶ Enables covalent incorporation into polyurethane matrices as a chain extender or polyol.
- ▶ Integrates esterification and disintegration into a one-pot, solvent-compatible process.
- ▶ Overcomes the traditional incompatibility of hydrophilic nanocellulose with non-polar and organic material.
- ▶ Offers tunable rheological properties for effective viscosity modification in organic fluids.
- ▶ Reduces high toxic diisocyanate (MDI) loading required for polyurethane synthesis.

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## INVENTORS

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## OTHER INFORMATION

### KEYWORDS

atom transfer radical  
 polymerization, bromine  
 esterification, cellulose  
 nanofibrils, dispersion,  
 organic media  
 compatibility, polymer  
 composites, polyurethane  
 synthesis, rheology  
 modifier, surface  
 functionalization,  
 ultrasonication

### CATEGORIZED AS

- ▶ **Materials & Chemicals**
  - ▶ Biological
  - ▶ Nanomaterials
  - ▶ Polymers

▶ Provides a renewable, high-performance alternative to traditional petrochemical filters and modifiers.

## RELATED CASES

2022-556-0

## PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Published Application	<a href="#">20250188196</a>	06/12/2025	2022-556

## ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ [Ultra Light Amphiphilic and Resilient Nanocellulose Aerogels and Foams](#)
- ▶ [Conductive and Elastic Nanocellulose Aerogels](#)
- ▶ [Nanocellulose-Assisted Exfoliation of Graphite to Few Layer Graphene](#)
- ▶ [Direct Production of Sulfated Cellulose Nanofibrils](#)
- ▶ [Nanocellulose-based Aerogel Fibers as Insulation](#)
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