

PhD Graduate Student Opportunity

NC State University – College of Natural Resources

Department of Forest Biomaterials

Academic Supervisor: Nathalie Lavoine, PhD, MS

Research Group: <https://faculty.cnr.ncsu.edu/nathalielavoine/>

Research Area

Nature continues to be a powerful source of inspiration for both art and science, particularly in materials design and innovation. Over the past few decades, scientists have discovered **renewable nanomaterials**—tiny particles derived from abundant natural resources like wood and agricultural crops. These materials combine the benefits of advanced technology with sustainability, offering promising solutions to global challenges.

One such material is **cellulose nanocrystals (CNCs)**—rod-shaped particles known for their ability to self-assemble into highly ordered structures that can produce vivid, iridescent colors. These naturally occurring structural colors have exciting potential for use in coatings, textiles, and electronic devices. However, the fundamental mechanisms that govern CNC self-assembly and structural color formation are still not fully understood.

This PhD project will investigate how **substrate properties** influence **the anchoring, pinning, and assembly of CNCs**. A range of surfaces—from metals to polymers—will be studied to develop precise CNC deposition techniques and analyze the resulting structural coloration.

Beyond fundamental research, this project aims to engineer CNC-based materials with **tailored optical and mechanical properties**, with a particular focus on their application in **anticorrosion coatings**.

Qualifications

We are looking for a collaborative and enthusiastic individual who meets several (or all) of the following criteria:

- A Master's degree (or equivalent) in **(bio)physics, soft matter, nanotechnology, physical chemistry, materials science**, or a related field.
- A strong interest in interdisciplinary research and a willingness to explore new areas.
- Effective communication and presentation skills.
- Proficiency in English (written and spoken).
- Prior experience in any of the following is a plus: liquid crystals, microscopy/image analysis, or surface characterization techniques.

What We Offer

- A **fully funded 4-year PhD assistantship**, renewable annually based on satisfactory performance. The package includes a competitive stipend, tuition (in-state or out-of-state), and health insurance.
- A **balanced schedule**, including approximately 20 hours/week of research and 20 hours/week of coursework in accordance with NC State Graduate School requirements.
- A **structured and inclusive mentoring approach** that supports your personal and professional development. This includes the creation of an Individual Development Plan (IDP), weekly progress meetings, mentorship expectation setting, access to a diverse mentor network, coaching on research and writing, annual goal reviews, and tailored guidance to help you build scholarly independence and a strong professional identity.

About NC State University & The Department of Forest Biomaterials

North Carolina State University is a globally recognized leader in science, engineering, and technology, with more than 34,000 students and 7,000 faculty and staff. As one of the nation's premier land-grant institutions, NC State is dedicated to improving lives across North Carolina and around the world through education, research, and outreach.

The **Department of Forest Biomaterials** in the **College of Natural Resources** offers programs in Forest Biomaterials, Paper Science and Engineering, and Sustainable Materials and Technology. The department conducts cutting-edge research on forest-based materials, renewable energy, and sustainable manufacturing.

Learn more: <http://cnr.ncsu.edu/fb>

The **Lavoine Research Group**, based within the department, operates in three private lab spaces and regularly utilizes advanced instrumentation through NC State's Analytical Instrumentation Facility (AIF) and METRIC. The group also benefits from the outstanding support and resources offered by NC State Libraries.

Learn more: <https://faculty.cnr.ncsu.edu/nathalielavoine/>

Application Process

To apply:

1. Submit your **formal application** through NC State's Graduate School:
<https://grad.ncsu.edu/admissions>
2. Additionally, please send the following materials to **Dr. Nathalie Lavoine** at nmlavoin@ncsu.edu:
 - Your **CV**.
 - A **1-page cover** letter describing your motivation and how your background aligns with the position.
 - A list of **2–3 references** with contact information.

Applications will be reviewed on a rolling basis. Early submissions are strongly encouraged. Expected start date of the project: August 2025 (Fall semester).