



## Defence announcement

## Public Defence on 24 May 2023

# Structural color coatings from nanocellulose

**Title of the doctoral thesis** Long-range order in nanocellulose films and coatings for next generation materials

**Content of the doctoral thesis** Nature creates its most intense and vivid red, blue, green, golden and silver colors using tiny nanostructures. The shiny colors of peacock feathers, beetles, fish scales or butterfly wings are all examples of structural colors. Structural color is created from the interaction of light with a periodic nanostructure. Unfortunately, most attempts to recreate these effects rely on compounds that are harmful to our environment. The pigments associated with terms such as "glitter", "pearlescent", "holographic", "metallic", "luster" and "iridescent" are widely used in fashion, cosmetics, and plastic commodities. However, their production and use are also associated with issues, such as microplastics, child labor, genotoxicity and ecotoxicity.

What if we could transform a material created by nature into bright and vivid colors? The answer is using lignocellulosic biomass, such as wood, agricultural waste and algae. Nanosized particles known as nanocellulose are first chemically extracted from biomass, after which a nanocellulose dispersion is applied almost as a paint on a surface to create a structural color coating. The latter process, discovered in the 90s, involves the formation of a nanostructure. This step still requires further examination in order to implement the structural color in actual products.

This dissertation provides a detailed evaluation of the effect of the color creation steps on the optical properties of the color and the structural properties of the nanostructure. In addition, the thesis covers post-processing steps of the structural color coatings as well as their ageing behavior, both of which promote their implementation in both decorative and technical applications.

**Field of the doctoral thesis** Bioproduct Technology

**Doctoral candidate and contact information** M.Sc. (Tech.) Konrad Klockars  
konrad.klockars@hotmail.com

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**Remote defence** <https://aalto.zoom.us/j/64450180480>

**Place of public defence** Aalto University School of Chemical Engineering, Lecture hall Ke2 (Komppa-Sali), Kemistintie 1, (main door at Biologinkuja) Espoo

**Opponent(s)** Professor Jeffrey Youngblood, Purdue University, USA

**Custos** Professor Orlando Rojas, Aalto University School of Chemical Engineering

**Link to electronic thesis** <https://aaltodoc.aalto.fi/handle/123456789/51>

**Keywords** cellulose nanocrystals, structural color, chiral nematic, coatings