

Local Characterization of Adhesion at the Interface of (nano)Cellulosic layers via complementary techniques of microscopy

Job title: Postdoctoral Research Associate (less than two years experience after PhD)
Location: CERMAV (CEntre de Recherches sur les MACromolécules Végétales), Grenoble, France
Duration: 11 months
Closing date: Position will start November 2021. Applications are evaluated on the fly.
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Net salary: Around 2100 euros/month

Context

The CERMAV ('CEntre de Recherches sur les MACromolécules Végétales', <https://www.cermav.cnrs.fr>) is dedicated to the study of polysaccharides (natural sugar-based polymers), the (bio-)synthesis of biologically active oligosaccharides, the use of biomass and the production of nanocomposite materials or glycopolymers. Its team 'Structure and Properties of Glycomaterials' (SPG) is following a multi-scale approach for the investigation of polysaccharides in solid state (cellulose, starch, chitin, etc.) which extends from the atomistic description of natural or artificial glycomaterials to their structural and functional properties determination. SPG expertise covers a wide range of fields in materials science including crystallography, physico-chemistry of colloids and polymers and materials development. Different techniques of characterization are applied such as scanning probe and electron microscopies, X-ray and neutron scattering and reflectivity, solid state NMR.

Project description

Understanding and tuning the interactions between two (nano)cellulosic layers (MFC) during drying is a major challenge to promote and consolidate many adhesion processes used in industry concerning for instance the barrier properties or reinforcement of MFC-based materials. It has long been accepted that capillary forces and hydrogen bonds dominate this adhesion, but the importance of electrostatic and van der Waals forces has recently been highlighted. By identifying the forces present during drying and their relevance on a large scale, this PolyNat project will investigate the effect of the process on adhesion in relation to the intrinsic properties of the MFC layers and drying conditions. A microscopic approach will be applied by combining several experimental analyses. The CTP (paper technology center) and FCBA will first produce various cellulosic layers with different properties : size, composition, etc. The postdoctoral Researcher will participate in the analysis of these specimens via SEM/TEM electronic imaging (SEM/TEM) and X-ray tomography (at 3SR). As the main task, force spectroscopy for adhesion measurement under controlled environment will be setup at the Scanning Force Microscopy platform of the ICMG and performed after functionalization of the colloide probe with a cellulose layer. In parallel, effort will be done to compute program for SEM and SFM data analysis.

Candidate profile :

A PhD degree in Physical-chemistry or a related discipline is required.
The candidate should be motivated, have a good dexterity with a certain taste for making fine experiments. She/he must know how to take initiatives and like to communicate in order to be able to exchange with the different partners of the project. He/She should have experience in one or more of the following items:

- Near field microscopy, especially local adhesion measurement
- Electronic microscopy
- Computing for image analyzing and Data treatment