

PhD position in Self-Reinforced Poly(Lactic Acid) Composites Strengthened with Nanocellulose Interfaces

Sustainable Materials Lab
 KU Leuven

4 Year fully funded PhD position, starting October 2023

Workplace

The Sustainable Materials Lab (SUSMAT) – Prof. Wim Thielemans, Department of Chemical Engineering, KU Leuven Campus Kulak Kortrijk, Kortrijk, Belgium

Work Environment

The PhD research work will be carried out within the SUSMAT group (Department of Chemical Engineering) of Prof. Wim Thielemans located on the Kulak Kortrijk campus of KU Leuven. The research group combines fundamental research with the development of applied materials from sustainable sources. The SUSMAT group is interdisciplinary and combines knowledge from a molecular level over processing and characterization of the materials.

The SUSMAT group has fully equipped wet chemical labs, elemental analysis, size exclusion chromatography (SEC), light scattering, small and wide-angle x-ray scattering (S/WAXS), x-ray photo-electron spectroscopy (XPS), dynamic scanning and isothermal titration calorimeter (DSC and ITC), Instron Traction bench, fiber spinning equipment, and access to nuclear magnetic resonance (NMR) spectroscopy, electron microscopy facilities, heat molding equipment, and dynamic mechanical analysis. Our research group at current consists of 11 PhD students, 5 postdoctoral researchers, a Research and an Industrial Research Fund Manager as well as a technician, and we also have numerous international scientific collaborations and are a house partner of the Circular Materials Center at Kortrijk. More information on the group can be found through [this link](#).

Topic

In collaboration with [Prof. Bert Sels](#) (Sustainable Catalysis and Engineering, Faculty of Bioengineering), we received funding to develop new strategies to prepare poly(lactic acid) (PLA) self-reinforced composites. Self-reinforced composites are made by melting premade polymer fibers in a mold to make their outer surfaces interdiffuse and form the matrix phase, without melting the fiber core. We have previously shown that the addition of cellulose nanocrystals at the surface of the PLA fibers results in important improvements in mechanical and impact properties of self-reinforced composites made with these fibers. We now want to explore different strategies to improve on these results and use new PLA prepared in bioreactors at the Sustainable Catalysis and Engineering group.

Objectives of the PhD project

This PhD project will investigate new strategies to improve (thermo-)mechanical and impact properties of PLA self-reinforced composites using cellulose nanocrystals localized at specific locations in the composite. The addition of plasticizers or nanocellulose surface modifications will also be targeted to improve PLA interdiffusion and final composite properties. Models will be developed to describe composition-processing-structure-property relationships to be able to predict composite properties and to find optimal composition and processing parameter for targeted material properties.

Profile of the candidate

We seek an enthusiastic researcher with a Master's in Chemical Engineering/Materials Science/Bioengineering or related field with a proven experience composite manufacturing and materials testing. Knowledge in surface/cellulose chemistry and cellulose nanocrystal extraction is a plus. The candidate should also be motivated to combine both fundamental and applied research.

Application details

Please send a CV, a cover letter and the contact information for 2 references to Wim Thielemans (wim.thielemans@kuleuven.be). You can also contact Wim Thielemans to request additional information or with any questions you may have.