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Cellulose nanocrystal-based materials

Humanity is under sustained pressure to reduce energy consumption, reduce waste disposal and increase the use of renewable materials. Functional nanomaterials based on renewable resources have the potential to deliver a holistic solution by increasing activity, reducing the use of depletable resources, reducing CO₂ emissions, and reducing waste at their end-of-life. In our group we are developing a renewable nanoparticle technology platform based on cellulose nanowhiskers, rigid-rodlike single-crystal nanoparticles derived from native cellulose. We investigate a range of surface functionalization pathways to introduce ionic groups, small molecules and polymers as well as metal nanoparticles. The kinetics and thermodynamics of self-assembly of these nanoparticles is studied, on their own or with polymers or other nanoparticles, to make higher order structures such as organized films, membranes, hydrogels and aerogels. The combination of virtually unlimited surface functionality which can be introduced with our expertise in nanoparticle self-assembly enables the design and manufacture of highly functional structures with applications in for example supercapacitor electrode materials, sensors, flocculants, and catalysts. In this talk I will give an overview of the work we have carried out and show new developments we are currently working on.



Prof. dr.ir. Wim Thielemans

Wim Thielemans received his chemical engineering degree in 1999 from KU Leuven (Belgium) and his PhD in Chemical Engineering in 2004 from the University of Delaware (Newark, DE, USA). He then spent 2 years as a Marie Curie research fellow at the National Polytechnic Institute of Grenoble (France). In 2006 he moved to the University of Nottingham (Nottingham, UK) to set up his own research group where he was jointly appointed by the School of Chemistry and the Department of Chemical and Environmental Engineering. In 2013, he moved back to KU Leuven under the Odysseus program to continue his independent career. Since 2016 he is Chair of Advanced Materials, supported by the Provincial Development Agency of West-Flanders. He is also Affiliate Associate Professor at Auburn University (Auburn, AL, USA) and honorary professor at the University of Nottingham (UK).

In his research Wim has been leading work on the surface modification, self-assembly, and advanced materials manufacturing of cellulose, starch and chitin nanoparticles. Wim is a Fellow of the Royal Society of Chemistry, is the current Program Chair of the ACS Cellulose and Renewable Materials division, and is managing editor of the journal *Industrial Crops and Products* (Elsevier). He has 115 publications, 2 patents, and an h-index of 36. In 2007, he won the Silver Award for his research at the UK House of Commons Set for Britain event, and he was co-recipient of the US EPA Presidential Green Chemistry Challenge Award in 2013.