September 2021 **EPNOE Newsletter**

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Editorial

Dear Readers,

EPNOE2021, our seventh International conference, starts in ten days! The conference is organized by a consortium of five institutions in France and, even with all challenges of the pandemics, has attracted more than 300 participants. The EPNOE Science Award and the EPNOE Technology Award will be presented in this conference to celebrate the outstanding contribution of scientists and technologists in our community. We are very grateful to Bernard Cathala, Johnny Beaugrand, Tatiana Budtova and Nicolas Le Moigne to have joined efforts for such a hard and wonderful work as Program Chairs of EPNOE2021. Organization of conferences by joint consortia is a way to promote cooperation and collaboration and it will be a common practice in EPNOE events from now on.
Twenty EPNOE scientists from 12 European countries are now finalizing two very important documents, the EPNOE Research Roadmap and the EPNOE Education Roadmap. These documents will shine a light on the future of polysaccharide research and education for the next 30 years. Our future has challenges and opportunities and scientists sometimes tend to look at the trees and forget about the whole forest. That is why interdisciplinary and intersectoral collaborations are so important to tackle climate change and the transition to more sustainable technologies. With motivation to promote thought-provoking events, EPNOE will organize together with the Brazilian National Center for Research in Energy and Materials (CNPEM) an online workshop about Challenges and Opportunities to Promote Circular Bioeconomy on November 23rd and 24th. In this event we will have scientists, policy makers and industry together to discuss out-of-the box approaches to Circular Bioeconomy.
We are also starting a series of interviews in EPNOE Talks to address great challenges and to hear the opinion of people outside of our polysaccharide community about their views concerning the transition to a low carbon society. We would like to invite you to follow our activities on our webpage and social media. We have a very attractive membership campaign and we will be delighted to welcome you as our new member.

Looking forward to seeing you in EPNOE.

Pedro Fardim
President of EPNOE

Follow us on

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News & Announcements

EPNOE CONFERENCE 2021

The **7th International Polysaccharide Conference**, in Nantes, France, 11-15 October 2021, is around the corner now . We look forward to this first presential event since the pandemic, it will be great to meet colleagues and friends again! The registrations are now closed. We have an exciting program set up for you.

Important points to take in consideration for attendees:

- The conference will take place **in 'La Cité' congress center**
- The registration desk will open on Monday 11th of October at 11:30 and the program will start with the opening ceremony at 13:30.
- Only participants having EU Digital COVID Certificate will be allowed to enter 'La Cité' as requested by the current French regulation. A security service from 'La Cité' will request this certificate at the entrance. Please check having this, otherwise it can compromise your access to the event.
- You can find the official information on the following French government web pages:
  - **https://www.diplomatie.gouv.fr/en/coming-to-france/coronavirus-advice-for-foreign-nationals-in-france/#sommaire_2**
  - **https://www.gouvernement.fr/en/coronavirus-covid-19**
- It will be compulsory to wear a mask inside 'La Cité' and hydroalcoholic gel will be available.

For the EPNOE Members attending the event, please note there will be a General Assembly Meeting on Thursday, October 14th, and a meeting for the EPNOE Junior representatives on Tuesday, October 12th. Look out for the invitations and register for these meetings.

We look forward to seeing you in Nantes!

Event Website

Thank you to the sponsors of the 7th International Polysaccharide Conference

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FLOWER

We are happy to welcome SEPPIC as a new EPNOE member!

SEPPIC

A company of Air Liquide Healthcare, Seppic has been designing, producing and distributing for more than 75 years a wide range of specialty ingredients for health and beauty. Among them, can be mentioned polysaccharides extracted from biomass used for topical applications, modified polysaccharides used in pharmaceutical coatings and alkyl polyglycoside surfactants developed from sugar chemistry expertise. Present in 100 countries through its subsidiaries and its network of distributors, Seppic employs more than 820 people worldwide, including 110 employees dedicated to innovation.

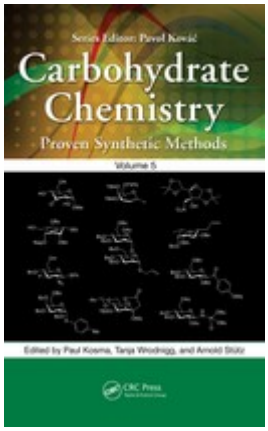
For more information, click here

14th Polymer Meeting at TU Graz

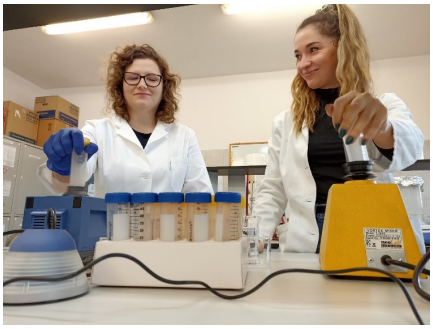
Representatives **Karin Stana Kleinschek** and **Rupert Kargl** from IBioSys were part of the organizing committee at the **PM14** held at TU Graz, one of the most important meetings in polymer science in Central Europe. IBioSys contributed to the conference with four posters and two lectures held by Tamilselvan Mohan and Rupert Kargl.

Book edited by TU Graz members

A new book **Carbohydrate Chemistry: *Proven Synthetic Methods*, Volume 5** was recently released. It was edited by Paul Kosma and the members from TU Graz **Arnold Stütz** and **Tanja M. Wrodnigg**. What makes it unique, among other literature in this field, are the tested and reproducible procedures.



PROM: a visit to Jan Dlugosz University in Czestochowa (Poland)



From left: Silvija and Ana-Marija

In the period between August 30th and September 19th two PhD students, Silvija Šafranko and Ana-Marija Cikoš from Faculty of Food Technology, University of Osijek, Croatia visited to Jan Dlugosz University in Czestochowa. During a 3-weeks stay, the students have worked on the production of dextrins from potato starch and they have performed analysis on the obtained samples. The analysis included both physical and chemical characterization of the dextrins. Moreover, Silvija and Ana-Marija had the chance to present their current research. They are currently working at the Faculty of Food Technology Osijek, University of Osijek.

Guests from Croatia with members of Janusz Kapusniak's Lab

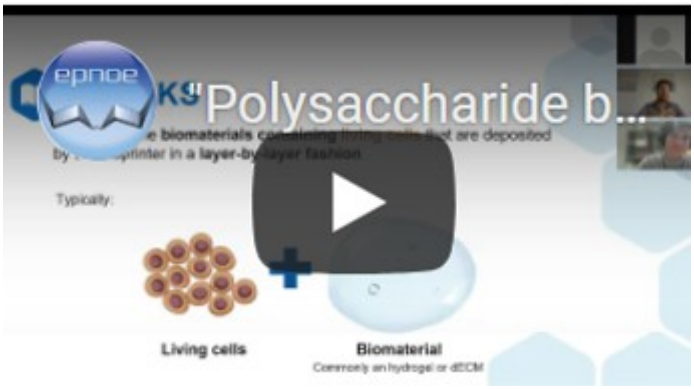
more info

For more information concerning this campaign, email: **contact@epnoe.eu**

EPNOE Webinar September - recordings available now!

Plenary lecture by Prof. João Mano, CICECO – University of Aveiro
"Blue polysaccharides in tissue engineering"

Research presentation by João Carvalho, CICECO – University of Aveiro
"Polysaccharide based bioinks for 3D-bioprinting applications"



Upcoming EPNOE Webinar – November 4th

Plenary lecture by Prof. Olli Ikkala, Aalto University, Finland
New functions for polysaccharides: From strain hardening to optical fiber

Research presentation - To be announced soon ***on the EPNOE website***

Attendance is free of charge and available to all, but registration is necessary.

Register here

For all past webinars and info about upcoming webinars, ***click here***

EPNOE Talks

In this video we have the pleasure to talk with Prof. Ofelia Araujo from the Federal University of Rio de Janeiro in Brazil. Prof. Araujo is a chemical engineer with expertise in oil refinery, environmental technologies and bioprocess engineering. In this talk Prof. Araujo speaks about challenges and opportunities in a complex scenario for the transition to a low-carbon future. Issues about liability in carbon capture, limitations and opportunities for carbon dioxide conversion to chemicals, sustainability of biofuels and timelines for implementation of fossil-free technologies are discussed. She invites young scientists to embrace science with questioning and evolving perspective. A chemical factory on Mars, why not? The future is exciting and we have to open our minds and be flexible to build sustainable solutions for our planet.

Prof. Petra Mischnick (retired recently from Technical University of Braunschweig) received the Hildegard-Hamm-Brücher Award for Equal Opportunities,

which was assigned for the first time by the German Chemical Society.

https://www.tu-braunschweig.de/en/chemistry/hildegard-hamm-bruecher-preis-fuer-petra-mischnick

Petra Mischnick is well known in the polysaccharide community for her scientific work over decades.

Petra Mischnick is the first awardee to receive the Hildegard Hamm-Brücher Award. The selection committee paid tribute to the Agnes Pockels student laboratory at the Technical University of Braunschweig, which was initiated by Petra Mischnick in 2002. The project was one of the first of its kind and, with its exemplary character, had a broad impact - there are now over 200 student laboratories across Germany.

But also beyond the Agnes Pockels school laboratory, Petra Mischnick distinguishes herself through her longstanding commitment to equal opportunities. She was one of the pioneers who made equality a central issue in the GDCh and was a founding member and first chairwoman of **the Working Group on Equal Opportunities in Chemistry** (AKCC) in 2000.

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Projects

Dispersion of cellulose nanocrystals (CNCs) into thermoplastic polymers

Mathieu Bugaut will start a phD in October 2021 supervised by Aurélie TAGUET and Nicolas LE MOIGNE at IMT Mines Alès (Polymers, Composites and Hybrids, PCH team)
start date: October 1, 2021
end date: September 30, 2024

To take advantage of the nanoscale of cellulose nanocrystals (CNCs), their dispersion in thermoplastic matrices remains a scientific and technological challenge. The objective of the present thesis is to study the operating conditions and parameters which would make it possible to disperse CNCs in polymers while ensuring the use of clean processes (melt-processing) and limiting the preparation steps.

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Events

Register here

TU Graz Science for Future - 2021: Climate and Energy

The 1st edition of Science for Future at TU Graz was held on 29th of September 2021.

Scientists at TU Graz discussed current research approaches and technologies. Amongst the presenters was also **Rupert Kargl (IBioSys)** who presented **Sustainable bio-based materials** and elucidated on how a careful utilization of nature given resources can contribute to sustainable developments.

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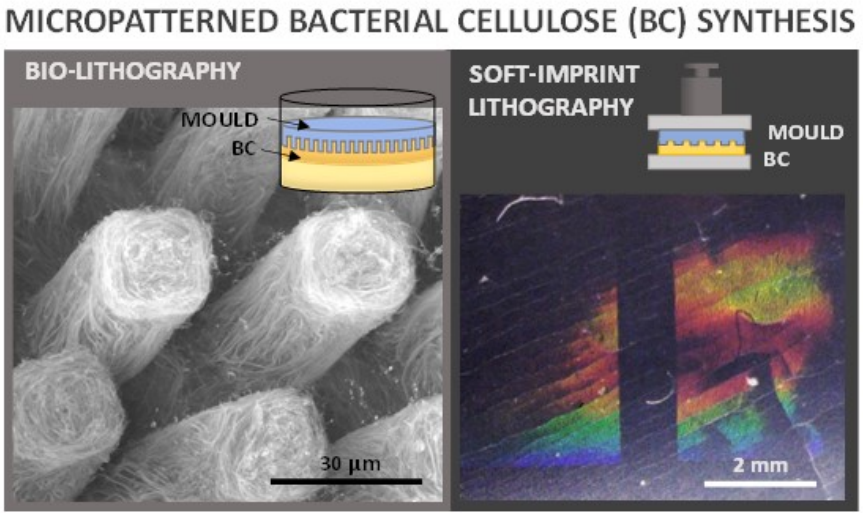
Research

Bio and soft-imprinting lithography on bacterial cellulose films

Soledad Roig-Sanchez, Cesar Fernández-Sánchez, Anna Laromaine, Anna Roig
Materials Today Chemistry 21 (2021) 100535
Group of Nanoparticles and Nanocomposites (NN Group)
Institut de Ciència de Materials de Barcelona (ICMAB-CSIC)

Bio-based polymers are fastening a place in non-traditional sectors by adapting processing approaches from the semiconductor and synthetic polymers technologies to find applicability in sectors such as transient devices, nanogenerators or microfluidics. Among them, bacterial cellulose (BC) is drawing attention due to its outstanding properties (Retegi et al., 2010; Wang et al., 2017; Zeng, Laromaine, & Roig, 2014) and capability to be surface patterned during its biosynthesis, a concept coined as bio-lithography. In general, patterned BC with channels and trenches as motifs have been studied as substrate for cellular guided growth, as fibrotic implant protection or in wound dressing, however, scarce information is found on BC with well or pillar motifs. In addition, aspects such as the size of the features patterned, more specific the height, how those features withstand post-processing steps or if large areas can be patterned remain unanswered.

In this study, we showed that bio-lithographed BC films present good quality micropatterned features for various motifs (wells, pillars and channels) in a wide range of sizes (from 200 to 5 μm) and areas as large as 70 cm^2 while keeping the x,y fidelity of the motifs and the fiber organization for wet, supercritically and oven-dried films. When wells and pillars were patterned, only wet and supercritically dried films afforded mould accuracy in the z-direction. Finally, we have compared bio-lithography with the conventional soft-imprint lithography, which resulted in a dramatically decreased of the motifs depth although the technique allowed to produce submicron features.



References:

- Retegi, A., Gabilondo, N., Peña, C., Zuluaga, R., Castro, C., Gañan, P., … Mondragon, I. (2010). Bacterial cellulose films with controlled microstructure-mechanical property relationships. *Cellulose*, *17*(3), 661–669. https://doi.org/10.1007/s10570-009-9389-7
- Wang, S.-S., Han, Y.-H., Ye, Y.-X., Shi, X.-X., Xiang, P., Chen, D.-L., & Li, M. (2017). Physicochemical characterization of high-quality bacterial cellulose produced by Komagataeibacter sp. strain W1 and identification of the associated genes in bacterial cellulose production. *RSC Advances*, *7*(71), 45145–45155. https://doi.org/10.1039/c7ra08391b

- Zeng, M., Laromaine, A., & Roig, A. (2014). Bacterial cellulose films: influence of bacterial strain and drying route on film properties. *Cellulose*, *21*(6), 4455–4469. https://doi.org/10.1007/s10570-014-0408-y

EFFECT OF CHITOSAN FILM SURFACE STRUCTURE ON THE CONTACT ANGLE

Sylwia Jagodzińska[1*], Beata Pałys[2], Dariusz Wawro[1]

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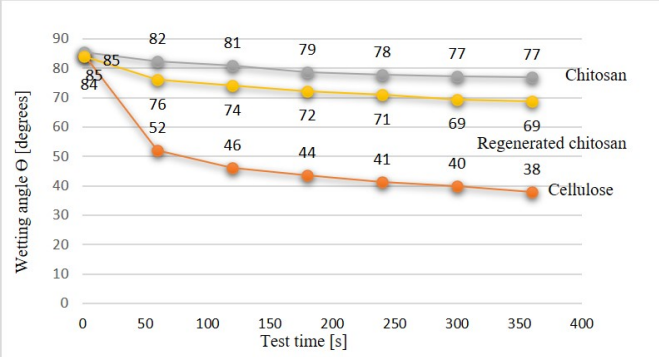
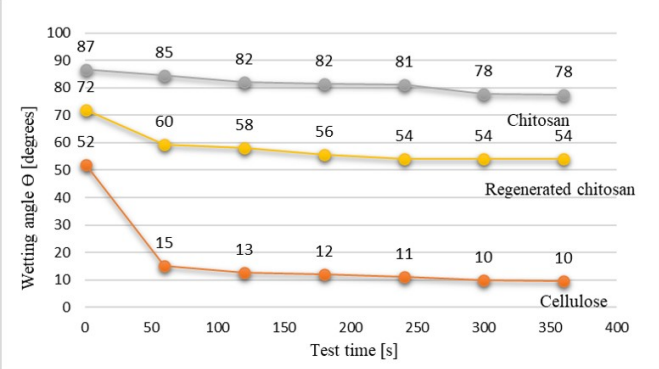
The main assumption of the research was to show the influence of the surface microstructure of a film made of natural polymers (chitosan, cellulose) on the value of the contact angle. The wetting angle Θ was determined according to the sitting droplet method based on the European Pharmacopoeia. To determine the wetting angle Θ, an STFI goniometer (AB Lorentzen-Wettre, Sweden) with an attached Optical Smart 5MP PRO microscope camera (Delta Optical, Poland) was used.
Due to the method of film manufacture the wetting angle measurements were performed on both the top and bottom layers of the film.

Figure 1: Spin coating deposition process (A). Chitosan thin film in schematic representation (B), on silicon wafer (C) and AFM topography 10 x 10μm^2 image (D).



Dynamics of the wetting angle of film samples in time (sample top)



Dynamics of the wetting angle of film samples in time (sample bottom)

In the case of chitosan film or regenerated chitosan film, the film forming conditions had little effect on the difference in wettability between the top layer and bottom of the film. In the case of cellulose films, however, wettability varies considerably depending on the side of the film (top, bottom).
Based on the research it can be concluded that the values of the wetting angles for the different materials were statisticallydifferent. Samples showing wetting angle values of 80^o and above are considered hydrophilic. Only regenerated chitosan film exhibits hydrophobic properties. It is characterised by the greatest stability and thus the lowest rate of change of the contact angle over time. The cellulose film shows the greatest decrease in the wetting angle, which is indicative of its hydrophilic properties.
The developed polymer films meet the basic functional requirements, with creates a potential possibility of using them as a packaging material for food, will not only constitute a physical barrier protecting the product against negative environmental factors, but also will not burden the environment after fulfilling its functions, because they are biodegradable.

The full text of the article will be published in XXV volume of the journal "Progress on Chemistry and Application of Chitin and its Derivatives", September 2021.

Water stable chitosan thin films

Tadeja Katan[1], Rupert Kargl[1], Tamilselvan Mohan[1], Tobias Alexander Steindorfer[1], Miran Mozetič[2], Janez Kovač[2], Karin Stana Kleinschek[1]

[1] Institute of Chemistry and Technology of Biobased Systems (IBioSys), Graz University of Technology, Austria
[2]Department of Surface Engineering, Jožef Stefan Institute (IJS), Slovenia

Non-toxicity, antimicrobial character, and biodegradability are some of the attractive properties of the unique and versatile polysaccharide chitosan. Those together with chitosan's availability make it a popular subject in many research fields, especially for biomedical uses including drug delivery systems, tissue engineering and wound healing. It is commonly found in the cell walls of fungi alongside chitin, out of which it is normally derived with a deacetylation process. In chitosan model surfaces its readily available hydroxyl and amino groups could be tailored to attain specific properties for different interaction studies.
Our goal was to produce uniform and stable chitosan coatings that could be further functionalized by coupling with amino acids.

Spin coating is used to produce thin films on silicon wafers, glass, or QCM-D gold-coated sensors (Figure 1A). Produced chitosan thin films are in the nanometre thickness range and a treatment with alkali solution after spin coating resulted in a water stable chitosan thin film (Figure 1). Coating stability and swelling behavior was studied with *in situ* QCM-D measurements. X-Ray Photoelectron Spectroscopy confirmed a successful deprotonation of the primary amines of the thin films. Further modifications offer a possibility of water and acid stable chitin-mimetic coatings.

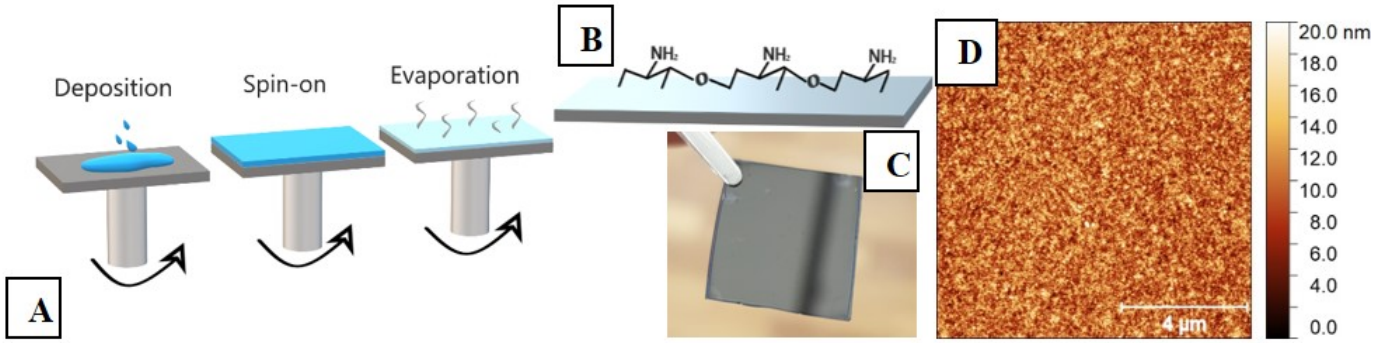


Figure 1: Spin coating deposition process (A). Chitosan thin film in schematic representation (B), on silicon wafer (C) and AFM topography 10 x 10µm^2 image (D).

3D printing and stabilization of nanofibrillated cellulose-alginate biostructures

Tamilselvan Mohan,[a,] Maximillian Novak,[a] Florian Lackner,[a] Günther Bochmann,[b] Gregor Franz Tegl,[c] Rupert Kargl,[a] Karin Stana Kleinschek,[a]

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[b]*ACIB GmbH, Konrad Lorenz Straße 20, 3430 Tulln, Austria.*
[c]*University of Natural Resources and Life Sciences, Konrad Lorenz Straße 20, 3430 Tulln, Austria*

The complex 3D biostructures built from biobased polymers have great potential for biomedical applications. For example, 3D structures printed from the combination of nanofibrillated cellulose (NFC) and alginate (Alg) have been shown to be suitable materials for tissue engineering. These 3D printed structures were often physically crosslinked with divalent or trivalent cations, such as ($CaCl_2$, $BaCl_2$, $Cu(NO_3)_2$, $FeCl_3$)[3] to increase their stability. However, long-term storage and stability in liquid environments, stability and mechanical strength are always an issue. To solve this, we have developed a simple one-step method for the first time to ionically crosslink NFC and Alg in sterile environment and increase their mechanical and dimensional stability in water. The inks designed from NFC/Alg/$CaCO_3$ were 3D printed with different strand orientations (x, y and x-y directions) and crosslinked in the presence of gluconolactone and in aqueous environment. Surprisingly, this new approach led to an improvement in the mechanical properties and dimensional stability of the printed structures (**Figure 1**) compared to casted-materials. These materials were also characterized in terms of morphology, structure and mechanical strength (tensile and compressive) in dry and wet states. The scaffold materials with different microstructure and tunable properties obtained by this new, simple and water-based cross-linking approach should be suitable for various applications, such as cell growth, biocatalysts, etc.

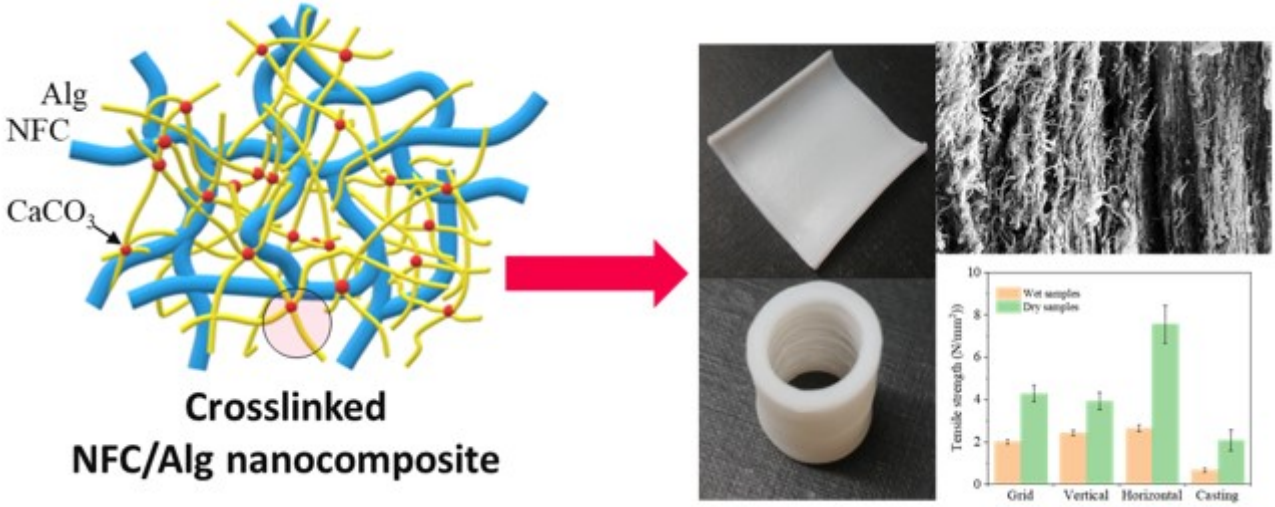

Figure 1. 3D printed structures from the ionically crosslinked nanocomposites (nanofibrillated cellulose/alginate/calcium carbonate nanoparticles).

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Education

Welcome to new students and researchers

University of Warwick, UK
Andrew P. Gibson Morales (PhD student) and **Dr Naresh Sanandiya** (Research Fellow) joined Dr Fengwei (David) Xie's research group to work on 3D-printable biopolymer composite hydrogels under Dr Xie's EPSRC Fellowship. Andrew is principally supervised by Dr Fengwei (David) Xie and co-supervised by Prof. Tony McNally and Prof. Remzi Becer.

INRAE, France
The Laboratory of Agro-Industrial Chemistry has a new member in its team:
Guadalupe VACA MEDINA started last September 1st as INRAE Researcher in the Laboratory of Agro-Industrial Chemistry. She will study the role of water in the development of agro-materials.

IMT Mines Alès, France
Mathieu Bugaut will start a phD on “Dispersion of cellulose nanocrystals (CNCs) into thermoplastic polymers” in October 2021 supervised by Aurélie TAGUET and Nicolas LE MOIGNE at IMT Mines Alès (Polymers, Composites and Hybrids, PCH team)

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Open Positions

3 year PhD position starting in spring 2022: Impacts of contaminant cocktails originating from plastics in soil ecosystems
Université Côte d’Azur, Institut de Chimie, Nice, France - Mines ParisTech, Center for Materials Forming (CEMEF) Sophia Antipolis, France. Apply before January 31, 2022
For more information, **click here**

Field Application Scientist
WYATT Belgium
For more information, **click here**

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Recent Scientific Publications of EPNOE Members

View List of Publications

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Call for Papers

MDPI Coatings | Special Issue **"** Polymer Coatings, Films, and Dyes**"** (open untill 30 September 2021) Guest editors: dr. Alenka Ojstršek and dr. Selestina Gorgieva, University of Maribor, Slovenia
https://www.mdpi.com/journal/coatings/special_issues/polymer_dyes

MDPI | Bio-Based Materials from Plant Cells: Strategies for Building Functional Bio-Assemblies and Composite Structures (open till January 21st, 2022)

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