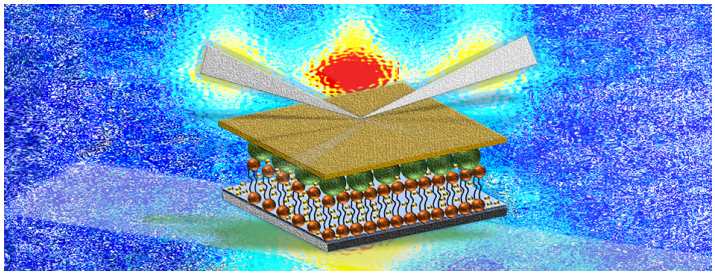

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Tuning cellulosic functional materials and processing using neutron techniques

Tuesday, October 8, 2024 1:30 PM (30 minutes)

Various engineering material concepts can be fabricated from cellulose. The starting point can be the cellulose polymer, nanoscale intermediates such as cellulose nanofibers (CNFs), and macroscopic cellulose fibres extracted from plants. The material concepts exhibit good mechanical performance, unique hierarchical structuring and various functional properties, making them suitable for various applications, such as barrier coatings in organic electronics and substrates for functional layers. Neutron-based characterisation techniques offer a versatile toolbox for further developing these material concepts and a set of examples will be discussed.
In power transformers, pressboard made from pure, unbleached cellulose fibres offers superior dielectric and mechanical properties. The key to enhancing its performance and efficiency lies in optimising the manufacturing process. Neutron imaging can play a crucial role in investigating the industrial process and the changes induced by processing [1].
Neutron scattering techniques complement imaging by providing detailed insights into the nanostructure and porosity of cellulose films. These methods are particularly useful in studying the packing density and surface characteristics of spray-coated CNF films, which are essential for their application in conductive and transparent coatings. Understanding the relationship between CNF morphology and film porosity is crucial for developing functional coatings and optimising the embedding of functional layers [2].
In conclusion, neutron imaging and scattering techniques are invaluable tools for advancing the development of cellulose-based materials for energy-related applications. By offering a deeper understanding of the material properties and manufacturing processes, these techniques enable the optimisation of cellulose for high-performance electrical insulation and other energy storage and conversion applications, contributing to a more sustainable future.

[1] https://www.vinnova.se/globalassets/mikrosajter/storskalig-forskningsinfrastruktur/dokument/slutrapporter-ensidingar/2021-03818_hitachienergy.pdf
[2] C. J. Brett, O. K. Forslund, E. Nocerino, L. P. Kreuzer, T. Widmann, L. Porcar, N. L. Yamada, N. Matsubara, M. Månsson, P. Müller-Buschbaum, L. D. Söderberg, and S. V. Roth. Adv. Electron. Mater. 7, 2100137 (2021).

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