



ZELLCHEMING-CONFERENCE

CELLULOSE-BASED MATERIALS –
FROM SCIENCE TO TECHNOLOGY

Mark Höfler¹, Joanna Mikolaj,² Annette Andrieu-Brunsen,² Markus Gallei³
and Torsten Gutmann¹

Investigation of the linkage between cellulose substrates and a grafted component by magic angle spinning solid-state NMR

1 Technical University of Darmstadt, Eduard-Zintl-Institute of Inorganic and Physical Chemistry, Alarich-Weiss-Straße 4, 64287 Darmstadt, Darmstadt, e-Mail: gutmann@chemie.tu-darmstadt.de

2 Technical University of Darmstadt, Ernst-Berl-Institute for Technical and Macromolecular Chemistry, Alarich-Weiss-Straße 12, 64287 Darmstadt

3 Saarland University, Organic Macromolecular Chemistry, Campus Build. C4.2, 66123 Saarbrücken

Abstract

In the past few years, functionalized paper substrates have become an increasing interest especially for the design of fluid transport devices and sensor materials. Although, a rising number of examples have been recently proposed,^[1,2] structural details of these materials at the nanoscale are still rare due to their high complexity. This work systematically investigates the chemical structure of silica coated cellulose/paper materials, as well as of the surface functionalization of paper substrates with multi-nuclear solid-state nuclear magnetic resonance (ssNMR) techniques to gain a deeper understanding of the functionalization process and to correlate macroscopic properties such as wetting with the structure at the nanoscale. To address also paper substrates containing a low degree of surface sites, ssNMR is combined with selective dynamic nuclear polarization (DNP) enhancement.

References

- 1 Dubois, C., Herzog, N., Rüttiger, C., Geissler, A., Grange, E., Kunz, U., Kleebe, H.-J., Biesalski, M., Meckel, T., Gutmann, T., Gallei, M., Andrieu-Brunsen, A.: Fluid Flow Programming in Paper-Derived Silica-Polymer Hybrids, *Langmuir* **33** (2017), 332–339.
- 2 Kumar, A. A.; Hennek, J. W.; Smith, B. S.; Kumar, S.; Beattie, P.; Jain, S.; Rolland, J. P.; Stossel, T. P.; Chunda-Liyoka, C.; Whitesides, G. M.: From the Bench to the Field in Low-Cost Diagnostics: Two Case Studies. *Angew. Chem., Int. Ed.* **54** (2015), 5835–5852.



ZELLCHEMING-CONFERENCE

CELLULOSE-BASED MATERIALS –
FROM SCIENCE TO TECHNOLOGY

KEYWORDS:

Solid-state NMR
Dynamic Nuclear Polarization
Functionalized Paper Substrate
Silica Coating
Surface Sites

Biography

Mark Höfler graduated from the Technical University of Darmstadt with a master degree in physics in January 2020. Since February 2020, he is doing his Ph.D. studies under the supervision of PD Dr. Torsten Gutmann at the Eduard-Zintl-Institute of Inorganic and Physical Chemistry at the Technical University of Darmstadt, where he is currently doing scientific research in the field of development and application of nuclear magnetic resonance techniques for functionalized paper substrates.

