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CELLULOSE-BASED MATERIALS –
FROM SCIENCE TO TECHNOLOGY

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Understanding the behaviour of bio-based flame retardants on paper substrates

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Since halogen containing flame retardants cause to create toxic gases in case of fire and harm the environment through low biodegradability, the research of new flame retardant systems moved into focus. In this context, great potential is attributed to the intumescence approach, a strategy in which biomolecules containing nitrogen and phosphorus can easily be used as the material basis^[1,2]. When exposed to heat, an intumescent system develops an insulating foam of carbon. In addition to thermal shielding, this also reduces the access of oxygen to the substrate and the emission of volatile flammable substances. The operating principle of the intumescence systems on many substrates is well known^[3], but unlike the usual substrates, however, paper is a relatively thin and porous material. To verify the operating principle and efficiency of the intumescent system on paper substrates and especially on unbleached pulp, a basic knowledge must be acquired and analytical methods adapted.

References

- 1 Gu, Jun-wei, et al. "Study on preparation and fire-retardant mechanism analysis of intumescent flame-retardant coatings." *Surface and coatings technology* 201.18 (2007): 7835-7841.
- 2 Feng, Yajuan, et al. "A plant-based reactive ammonium phytate for use as a flame-retardant for cotton fabric." *Carbohydrate polymers* 175 (2017): 636-644.
- 3 Zhu, Ping, et al. "A study of pyrolysis and pyrolysis products of flame-retardant cotton fabrics by DSC, TGA, and PY-GC-MS." *Journal of Analytical and Applied Pyrolysis* 71.2 (2004): 645-655.



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Biography

Felix Schäfer was born on 06.03.1989 in Wiesbaden. In 2009 he took up his studies at the Technical University in Darmstadt in the Department of Chemistry. His bachelor thesis with the title "Cresol novolak, synthesis and characterization of resin components" he produced in 2013 at the company Cytec Surface Specialties Germany GmbH in the field of R&D Phenolic Resins under the supervision of Prof. Dr. M. Rehahn. He completed the following Master study partly during a one year's stay abroad in Finland and finished it in 2016 with the Degree Master of Science in chemistry. He wrote his master's thesis at the Fraunhofer-Institute for Structural Durability and System Reliability LBF about the "Controlled molecular weight modification of polyolefins by nitroxyl-radicals". Since October 2016 he is doing his doctorate at the faculty of Macromolecular Chemistry and Paper Chemistry at the TU Darmstadt with Prof. Dr. Markus Biesalski. He is working on the project "Building with paper" and is dedicated to the production of bio-based flame retardants for use on paper.