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Research area: Process aims

Converting // Coating

Key words:

Surface treatment, Coating, Polymer brushes, Polymer grafting, Antimicrobial equipment

Title:

Development of a procedural approach to functionalize paper surfaces using the example of antimicrobial finishing

Background/Problem area

This new procedural approach enables the covalent attachment of stable polymer layers on paper surfaces. The surface is modified to prevent microbial infestation on paper (wallpaper, tissue, packaging paper, document paper). The antimicrobial activity can be enhanced by stimuli-responsive induced changes (switch) in functional surface properties caused by a so-called polymer brush layer. Biocidal molecules are chemically introduced into the polymer brush structure and attached on-to paper surfaces.

Antimicrobial substances in/on paper, like silver nanoparticles, stannic organyles, triclosan or antibiotics, are already known. Because of their toxicity and danger of developing bacterial resistances, these substances have disadvantages. In addition, they are not tightly bound and can be released or consumed. Accordingly, there are concerns about possible health-damaging effects, which provided the starting point of this project.

Objectives/Research results

The aim of this project is to develop a generally applicable process to covalently bind switchable polymers to paper surfaces via grafting-to polymerization. The functionalization is intended to be permanent, without release of active ingredients to the environment. This new paper surface treatment by the grafting-to process of polymer brushes would avoid common problems of conventional antimicrobial functionalization such as toxicity of active substances or development of bacterial resistances. In addition, the antimicrobial effect will only be induced in case of need.

Important results achieved until now are:

- Development of a model substrate, for which Si-wafers have been spin-coated with cellulose derivatives to perform grafting-to polymerizations and evaluate the polymer brush structures,
- Synthesis of an antifouling polymer,
- Procurement of different industrial paper samples which will later be surface-treated to prove the concept.

Application/Economic benefits

As a result of this research project specifications will be formulated for novel or improved paper surfaces enabling for example switchable antimicrobial properties. Such new functionalization should lead to new possibilities in paper and tissue finishing as well as to more versatile and innovative applications beyond antimicrobial finishing.

Until now it has not been possible to provide paper with switchable antimicrobial activity by means of a grafting-to process. This leads to the assumption that the project will arouse great market interest.

The project results can be expected to benefit mainly small and medium sized enterprises in the tissue, technical paper and wallpaper industry.

Period of time: 01.04.2015 – 30.09.2017

Remarks

The research project IGF-Koop 18696 BR is being funded by the Federal Ministry of Economic Affairs and Energy (BMWi).