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Research area: Product aims

Raw materials // Chemical additives

Key words:

Mass and Surface treatment, Coating, switchable Polymers, improvement in drying efficiency

Title:

Improvement of the energy efficiency during the drying process of paper and paper coatings via intelligent, switchable polymers

Background/Problem area

By reason of the increasing shortage of resources, rising raw material as well as product costs and due to the politically required sustainability of processes and products, industries like paper industry, which are using lots of raw materials and energy, have to reinvent their manufacturing process. One of the biggest parts of energy input in paper manufacturing can be located in the drying processes. Accordingly in the course of the energy revolution lots of procedural alternatives for energy saving, for example more efficient drying plants have been further optimized. However, the drying process is an enormous technical effort and proportional to the realized effect with a very high energetic input. For this reason new products, which can reduce the use of energy significantly are a promising possibility to optimize the drying process.

Economization of drying energy based on procedural arrangements is mostly exploiting in various sectors of the paper industry and offers hardly potential capacity therefore. Additional the unfavorable cost-value ratio do not enable positive mutually exclusive investment decisions for other technologies. But drying energy can be cut down on using new additives. One possibility are so called switchable polymers, which can be used as functional additives. In principle this materials have the ability to reduce the amount of combined water. During the drying process the function of the additives is activated by the temperature and that leads in an exchange of properties from hydrophilic to hydrophobic.

Objectives/Research results

The aim of this project is to develop a generally applicable process to covalently bind switchable polymers to paper surfaces and/or paper mass. There are rashes of polymers that show so called "miscibility gaps" at higher temperatures in solvents. That means the polymers collapse by rising temperatures and displace the molecules of the solvents. This water is existent as "free water" and is much easier to release with less drying energy than combined water. In the literature this polymers are known as LCST-polymers (LCST = Lower Critical Solution Temperature) and they can be designed differentially. Therefore, the macromolecules can be assembled to collapse from 30 degrees over 80 degrees. According to this the research project is a proof-of-concept study to use unmodified and modified LCST-polymers. Because of their intrinsic characteristics this polymers exhibit the potential to relieve desorption and release of water to save drying energy.

Important results to achieve:

- Selection of suitable polymers and attachment to exclusive paper products as well as coating colors ingredients
- Identification of the effectivity of the polymers added to paper surfaces
- Identification of the effectivity of the polymers added to coating colors ingredients
- Definition of the influence of the polymers on the end product properties and optimization
- Increase of the energy efficiency of drying processes in the paper industry

Application/Economic benefits

As a result of this research project specifications will be formulated for novel or improved paper surfaces and/or coating color ingredients enabling a more efficient drying process. Such new functionalization should lead to new possibilities in paper finishing as well as to more versatile and innovative applications. Including to this new approach for conservation of energy with direct economic benefits for paper industry is generated. The results can be used interbranch for different kinds of paper grades (e.g. graphical paper, packaging paper and board, tissue and specialty paper).

Period of time: 01.07.2016 – 31.12.2017

Remarks

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