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Research area: Product aims
End products made of paper, paperboard and board // Carton products

Key words:
Deep-drawing, formability, formable, cellulose functionalization, hydrogel, extensibility

TITLE:

Controlling Fibre Web Bonding and Forming Process for Achieving Dimensional Stable and Complex Shaped Packaging Goods. (Intrinsische Steuerung des Bindungsverhaltens von Fasernetzwerken und deren Umformungsprozesse für formstabile und komplexe Packmittelgeometrien)

Background/Problem area

The packaging is one of the important steps in distribution of different produced goods. The goods are saved and labelled by the packaging and the distribution costs and the sustainability are influenced by the packaging material and the converting processes. Hence attractive packaging processes and a cost-saving use of recyclable materials are neccessary.

Within the last years deep-drawing has been proven as an efficient process for conversion of flat paperboard into three dimensional shapes. High quality cylindrical samples were produced within IGF 16578BR out of multilayered paperboard containing partly synthetic fibres. However more complex shapes were not accessible due to insufficient paper extensibility and the dimensional stability of formed products was generally low.

Objectives/Research results

This research project faces the above problems by means of improving paper extensibility that in turn should be generated via increased drying shrinkage and use of chemically modified pulp material. Different chemical modifications of pulp such as acetylation, stearoylation, hexanoylation or hydroxypropylation were realized yielding pulp materials partly suitable for papermaking. Increased drying shrinkage could be afforded via application of hydrogels such as agar, gelatin, carrageenan and gellan onto paper. Furthermore the effect of drying temperature has been investigated. It has been shown that particularly gellan allows a high temperature drying without loss of shrinking effect.

Therefore a cup format was developed, which causes defined stress in the material (strain, bending, compression) and thus facilitates a comparison of the materials with respect to their formability. New evaluation techniques for the properties of the molded cups were developed. There is now a defined method for analyzing the buckling strength and the shape deviation of the cups. A measurement procedure for the surface roughness was developed additionally.

Over 80 different types of paper were produced, tested and compared leading to promising samples that were transferred to a continuous pilot scale papermaking process. Those recyclable materials show good forming behavior and enhanced dimensional stability.

Application/Economic benefits

3D-shaped packaging products could be used for a wide range of applications. Currently most products are packed in folding boxes, composite cans or containers made from plastic. The production of folding boxes and composite cans needs many effortful production steps such as punching, embossing, folding, and gluing. The deep-drawing on the other hand is a direct 3D-shaping procedure with only one step but has the disadvantage that to this day only special paperboards can be used, most of which contain a significant amount of mineral oil-based components. The research aims at reducing these components while maintaining and even enhancing the material properties.

The deep-drawing technology together with newly designed paperboards has the ability to significantly decrease the amount of mineral oil-based materials in the packaging process and to enhance the product range of recyclable and sustainable paper based packaging.

Period of time: 01.10.2015 – 31.09.2018

Remarks

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