VIPP VALUES CREATED IN FIBRE-BASED PROCESSES AND PRODUCTS

ARON TYSÉN

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THROUGH AIR DRYING - THE INFLUENCE OF FORMATION AND PULP TYPE ON NON-UNIFORM DRYING AND AIR FLOW

INNVENTIA

Knowledge Foundation

ARON TYSÉN

CONTACT INFORMATION

Mail: aron.tysen@innventia.com

Tel: +46 8 676 74 97

BIOGRAPHY

Aron Tysén is employed as a postgraduate researcher at Innventia, Stockholm. His work incorporates knowledge from different sources into the continuing understanding of the correlation between fibre morphology, formation and energy efficiency. Aron Tysén obtained a Master of Science in Materials Design and Engineering at KTH in 2011.

ABSTRACT
The removal of water is an integral part of tissue production. Through air drying (TAD) is used for premium tissue grade products. Improved product properties are obtained at the price of high energy demand. A better understanding of the TAD process may lower energy demand.

The objective of the work in this thesis was to investigate the influence of formation, grammage, and pulp type on drying and air flow through sheets. A method was developed, based on infrared thermography, to determine local drying time of laboratory sheets on a sub mm-scale, while monitoring air flow and pressure drop of the TAD process. Samples with good and bad formation and samples from different pulp types with grammages ranging between 15 and 60 g/m^2 were evaluated.

Modified permeability was used to evaluate air flow characteristics. Samples with lower grammages had significantly higher modified permeability. The permeability decreased as the grammage increased and approached a constant value for the highest grammages. The grammage-dependency at lower grammages was considered to be either an effect of a change in pore structure or an edge effect at the sheet surfaces. When comparing the permeability obtained for the different pulp types, it was found to be linearly decreasing with sheet density and increasing with the fibre wall thickness.

Almost all samples had a linear relationship between the amount of removed water and drying time. Thus, the area-specific drying rate was similar for most samples. A mass-specific drying rate was introduced, which for low grammages was independent of the modified permeability, i.e. the flow through the fibre network at a given grammage, of the different pulps. However, for higher grammages, the mass-specific drying rate became dependent on the modified permeability to an increasing extent. Despite a large variation in local grammage, i.e. formation, only relatively small differences in drying time non-uniformity were observed.

In conclusion, the properties of sheets, with a grammage typical for the industrial TAD-process for tissue manufacturing, differed significantly in terms of modified permeability and mass-specific drying rate, from those of sheets with higher grammages.

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LIST OF PUBLICATIONS

Publications Included in the Licentiate Thesis

I. Tysén, A., Vomhoff, H. (2015): Method for the quantification of in-plane drying non-uniformity, Nordic Pulp and Paper Research Journal, 30(2), 286-295.

II. Tysén, A., Vomhoff, H. (2014): The influence of formation on air flow through and non-uniform drying of low grammage sheets, Innventia Report 546.

III. Tysén, A., Vomhoff, H., Nilsson, L. (2014): The influence of pulp type on through air drying, Innventia Report 548.

Other publications

Tysén, A., Östlund, C., Vomhoff, H.: Investigation of non-uniform drying of paper using IR and NIR imaging, Poster presentation, The 15th Fundamental Research Symposium, Robinson College, Cambridge, England, 10th of September 2013.

Tysén, A., Vomhoff, H., Nilsson, L. (2015): The influence of grammage and pulp type on through air drying, Nordic Pulp and Paper Research Journal, 30(4), 651-659

MAIN SUPERVISOR
AND EXAMINER

Lars Nilsson
Professor at
Karlstad University

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