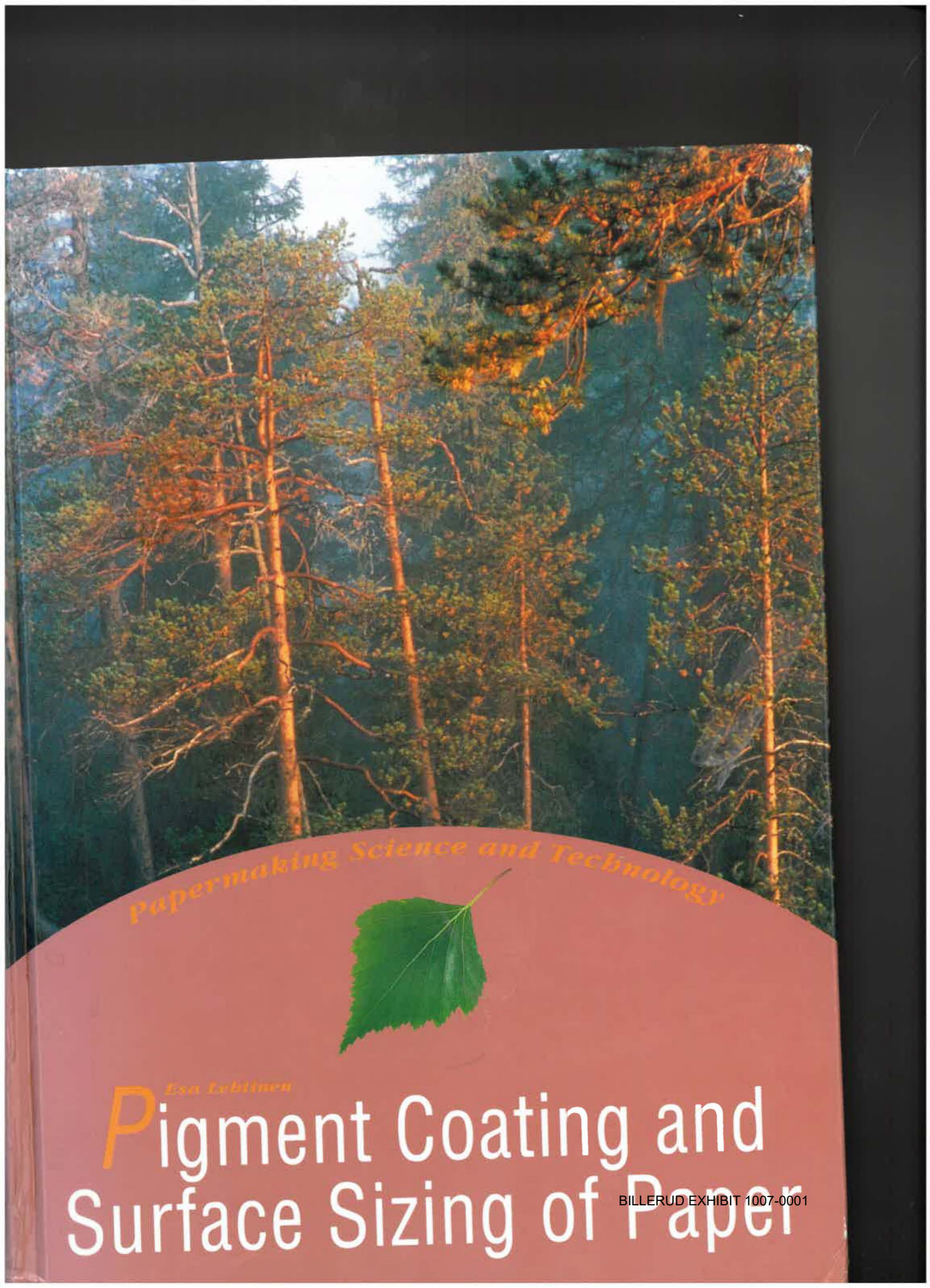




papermaking Science and Technology



Esa Lublinen

*P*igment Coating and Surface Sizing of Paper

BILLERUD EXHIBIT 1007-0001

Papermaking Science and Technology

a series of 19 books

covering the latest

technology and

future trends

Book 11

Pigment Coating and Surface Sizing of Paper

Series editors

Johan Gullichsen, Helsinki University of Technology

Hannu Paulapuro, Helsinki University of Technology

Book editor

Esa Lehtinen, Helsinki University of Technology

Series reviewer

Brian Attwood, St. Anne's Paper and Paperboard Developments Ltd.

Book reviewers

Charles P. Klass, Klass Associates Inc.



Published in cooperation with the Finnish Paper Engineers' Association and
TAPPI

ISBN 952-5216-00-4 (the series)
ISBN 952-5216-11-X (book 11)

Published by Fapet Oy
(Fapet Oy, PO BOX 146, FIN-00171 HELSINKI, FINLAND)

Copyright © 2000 by Fapet Oy. All rights reserved.

Printed by Gummerus Printing, Jyväskylä, Finland 2000



Printed on LumiMatt 100 g/m², Stora Enso Fine Papers Oy, Imatra Mill

Certain figures in this publication have been reprinted by permission of TAPPI.

- Plate and tray
- Fast-food carton
- Ovenable packages.

1.2 Containerboards

Containerboards are used to produce corrugating board, which is then converted into corrugated shipping containers (boxes).

The basis weight range of containerboards is typically 100–300 g/m².

1.2.1 Linerboard

Linerboard is used for the outer plies of the corrugated board. According to the used fiber raw material, board is classified into:

- Kraftliner, which is made of unbleached chemical pulp. The top ply of white top kraftliner is made of bleached pulp. Kraftliner typically consists of two plies, top and back plies.
- Testliner is made of recycled fibers and consists, in the United States and in Europe, typically of two plies but, in Asia and Far East, even of three or four plies.

Traditionally this board grade is uncoated but, in recent years, coated grades are also used in the most demanding end-use purposes.

2 Introduction to board coating

The basis weight of the coated board varies typically between 150 and 500 g/m², and the speed of the machine is in the range of 100–800 m/min. The wide basis weight range might be produced on the same machine so that the production speed of the machine depends on the basis weight produced. This means that the process and equipment used must be very flexible to allow big changes in the production speed of the machine.

Figures 1–3 show typical layouts of different coated board machines³.

Fiber mix may vary a lot depending on the market area, country, and end use of the board. There are no official standards for board fiber composition.

Coated board is usually on machine coated, topside of the board with two or three coating layers. The total coatweight on topside is 20–25 g/m².

The target of the first coating (pre-coating) is to improve opacity and fill the small pores of the uncoated fiber surface. Top coating produces the final smoothness, absorption properties, and gloss for the board surface. Different printing processes set different requirements for the board surface; for example, absorption properties are important for offset printing and micro smoothness (measured on PPS tester) for rotogravure printing.

However, it must always be kept in mind that faults made in earlier processes – especially in sheet forming – cannot be corrected in the coating operation. On the contrary, all faults made on the forming section will be highlighted in the coating and calender-

ing operations. In cases where the highest quality level (smoothness and visual appearance) is produced, there might even be three coating layers on the topside of the board.

Today more and more demand is being placed on grades that are also coated on the backside. In these cases, generally one single coating is enough to meet the quality requirements. Coating of the symmetric board grades is similar on both sides of the sheet. Coatweight is 8–10 g/m². A coating unit for the backside can be utilized for curl control purposes. If there is coating only on the topside of the board, it has a tendency to curl toward the topside. To eliminate this, water or low-consistency starch can be applied on the backside in cases of one-side coated grades.

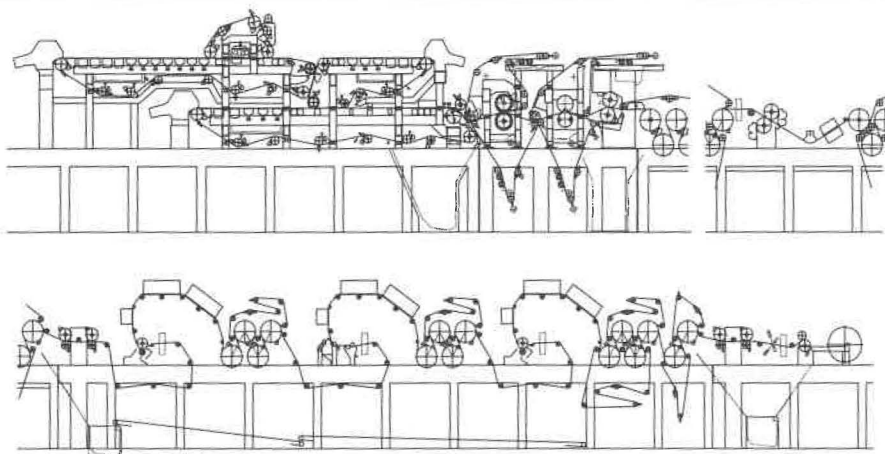


Figure 1. SBS machine (even sided).

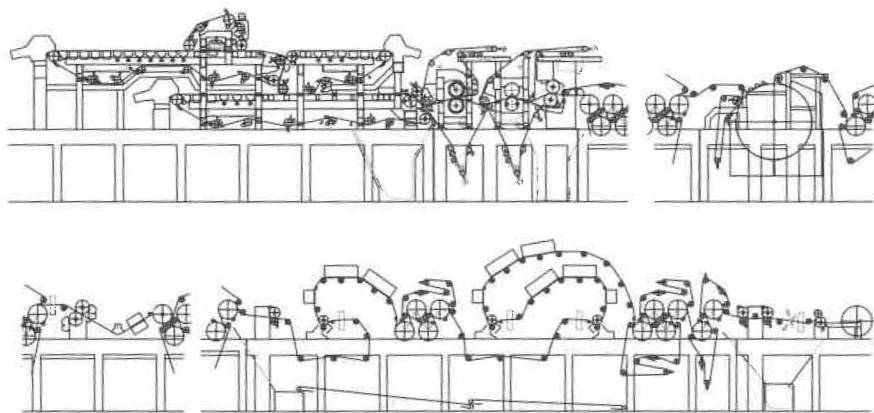


Figure 2. Folding boxboard machine (Scandinavian type).

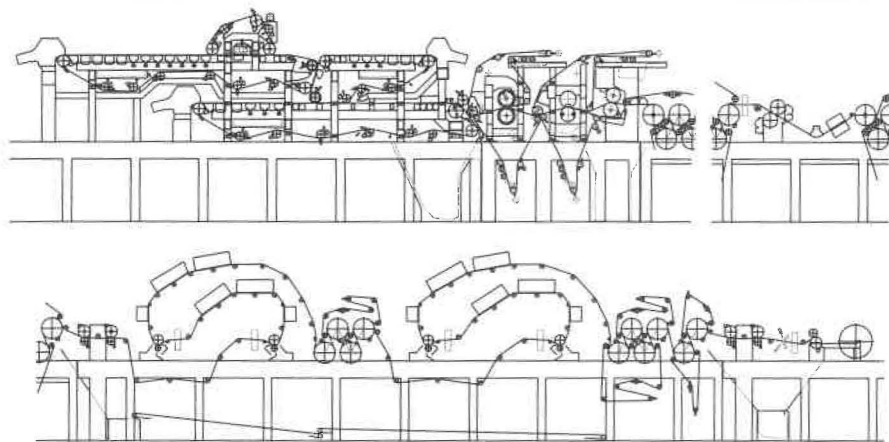


Figure 3. Carrier board machine (and liquid board machine).

2.1 Surface sizing

In many cases, there is a size press before coating. Low-consistency starch is applied on the board surface. The main purpose of the size press treatment is to improve stiffness and surface strength of the board before coating. Surface sizing also seals the board surface and evens out the sizing variations of the baseboard for the constant coating color pickup.

Traditionally a so-called "pond size press" is used. Consistency of the low viscosity surface size starch varies between 5% and 8%, and the total dry starch pickup is 2.5–5 g/m² depending on the solid content of the size and the wet pickup of the size press. In a bond size press, starch penetrates through the sheet improving internal ply bonding of the board and also ply bonding between plies of the multi-ply board. Because of fiber swelling, the roughness of the surface can increase during the pond size press operation.

In a pond size press, a large amount of water is applied in the board. This increases the drying energy consumption, decreases the efficiency of the machine and, as mentioned earlier, can increase the roughness of the board surface.

To eliminate disadvantages of the pond type of size press, it can be replaced with a film transfer size press which is also called metered size press (MSP). In a film transfer size press, the thin layer of surface size is first applied with blade or rod-blade (the principle is similar to coating) on the size press rolls and the film is transferred on the board surface in the size press nip.

Surface sizing can be applied on one or both sides of the board. The consistency and composition of the starch and amount applied can be the same or different on each side of the board. Typically the starch consistency is 10%–15% or even higher in some cases. Total dry pickup of the starch can be significantly lower (even <1 g/m²) than with pond size press, and it can be adjusted with the solids content of the size and the film thickness applied on the roll surface.