Differences paper and paperboard

Definition of the term paperboard varies. According to the ISO standardisation body, a paper product with a grammage exceeding 200 g/m² is called paperboard; however the definition by the Confederation of European Paper Industries, CEPI, reads “paper is usually called board when it is heavier than 220 g/m²”. Paperboard can be made in a single ply or, more commonly, in several plies (multi-ply). For quality reasons paperboard usually requires a combination of several layers of fibre in the wet state. When studying the traditional paperboard market one can see that multi-ply paperboard is already made at 160 g/m².

Two clear features distinguish paperboard compared to paper:

- Paperboard contains a greater proportion of long fibre than paper.
- Paperboard does not normally contain fillers.

At Iggesund Paperboard we claim that paperboard is a heavier paper product of multi-ply construction.

The advantages of the multi-ply construction lie in the ability to optimise fibre characteristics in the different plies to reach certain functionalities. This is done by varying the content in each ply. The main features to vary are:

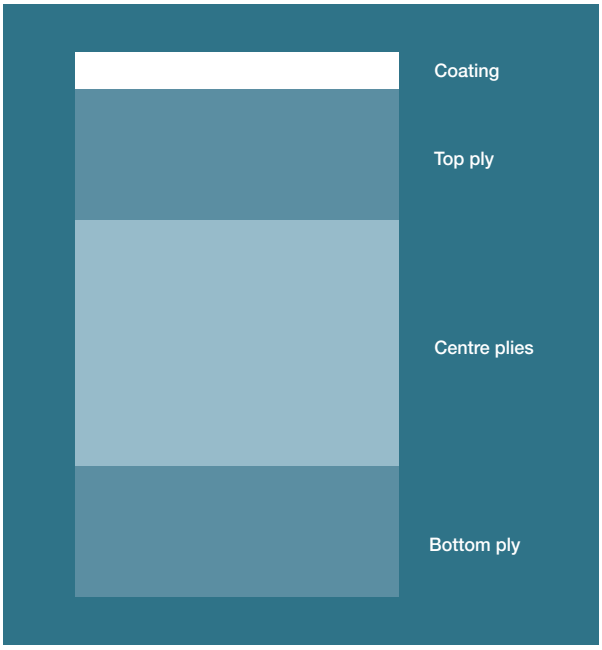
- proportion of long and short fibres in the respective plies
- type of pulping method
- treatment of pulp to improve strength or bulk quality and distribution of broke in the structure.

To be able to fully utilise the potential of optimising characteristics in the paperboard it is crucial that the multi-ply construction consist of at least three plies.

The existence of a middle ply enables the paperboard maker to optimise surface characteristics in the outer plies without losing stiffness and paperboard converting advantages which are built in to the middle ply. The dual-ply or single ply construction will always lead to one or more compromises. Features which are easier to optimise in a multi-ply construction than in a single ply construction without compromising are:

- bulk
- strength
- stiffness both through high thickness and strong outer plies
- surface smoothness in combination with desired strength or stiffness achievements
- functional features in the respective plies such as increased moisture resistance in surface or middle plies.

The ability to alter all these parameters has resulted in a wide range of products in the industry which target certain applications and end uses by tailoring features, as can be seen in the following pages. The advantage of a multi-ply construction in a paperboard mill is that the quality can be adapted to different end uses by utilising the possibilities of fine tuning the features mentioned above. This makes it possible for one supplier to manufacture and supply paperboard to meet the demands of several different end uses, whereas a single-ply or dual-ply producer has more limited possibilities.



Cross section of a multi-ply paperboard

Characteristics of paperboard manufacture

In the beginning of the 20th century the production and distribution of goods and food products increased and so did demands for better protection of these items. A cheap and easy solution was to use boxes made of thicker paper.

A change in the retail industry at this time from selling products in loose bulk to selling products that were pre-packed placed demands on packaging to be used not only for protection but also for display. It became more important to attract the consumer to recognise a product in the store and pick up a specific product for purchase.

Papermakers had to specialise in order to meet box converters' demands for strong and stiff boxes which protect the products from collapse during transport and which also provide good printing and display functions.

Traditional thick paper was no longer good enough. As a result, the first paperboard machines were developed in the United States.

Board machines are commonly built for optimum production between 200 g/m² and 1000 g/m² while paper machines have their optimum production grammage range from 70 to 200 g/m² depending on the intended application/end use.

From the layman's point of view, a paperboard machine and a paper machine can appear to be very similar. The differences lie in the details. To examine these, we must look at the different sections on the two machines' configurations.

Fibre selection and stock preparation

For a board maker, the selection and refining of fibres depend both on the specific surface properties required for printing and display and on the requirements for box converting and the subsequent protection of the box's contents.

Using strong and long chemical fibres from softwood in the outer layers of a board and more bulky fibres in the middle layer is ideal for achieving the relevant stiffness and strength properties.

Chalk is cheaper than fibre and is often used by papermakers to reduce cost, improve opacity and improve surface properties. However, chalk cannot be used by board makers because doing so results in a deterioration in the strength properties of the board. Both board and paper can be made from recycled fibres but the same issue of strength arises, because recycled fibres are weaker than virgin fibres.

Stock preparation for board makers must be optimised for stiffness, strength and surface properties. In contrast, papermakers can focus solely on surface properties.

In producing board and paper for packaging foods, fatty foods or liquids, manufacturers add chemicals to prevent the fibres absorbing grease or liquid from these contents. Chemicals used for this type of application must comply with regulations and directives from the EU and from the FDA in the United States.

The wet end

Paper and board are today produced both on a single wire machine and on a multi-wire machine.

A board manufacturer selects the multi-wire construction of the wet end to meet the required surface, stiffness and strength properties.

For a board maker with a multi-wire machine, the ideal method is to combine different types of chemical fibres in the outer layers to achieve strength and good surface properties, and then to use one or more centre layers made of more bulky fibres. Fibres produced by a mechanical pulping process provide more bulk and are often used by board makers in the centre layers.

Single-wire machines permit fewer possibilities to optimise bulk, and board makers must compromise more between stiffness, strength and surface properties.

Board manufacturers who use virgin fibre are able to specialise and optimise the sheet better, although board manufacturers who use recycled fibre will use similar techniques in how they select and refine the fibre.

The press section

Physically pressing out the water from the sheet in the press section uses less energy than evaporating the water in the drying section of the machine.

For a board maker, it is essential not to destroy the strength and bulk properties of the sheet (which have been built up in the wet end of the machine) in the press section. At the same time, it is important to press out as much water as possible so as not to lose economy of production.

Over the years, board manufacturers have developed press sections that are more forgiving and have a longer press nip in order to achieve a high dryness of the sheet before entering the drying section without compressing the sheet too much and destroying its bulk, stiffness and strength.

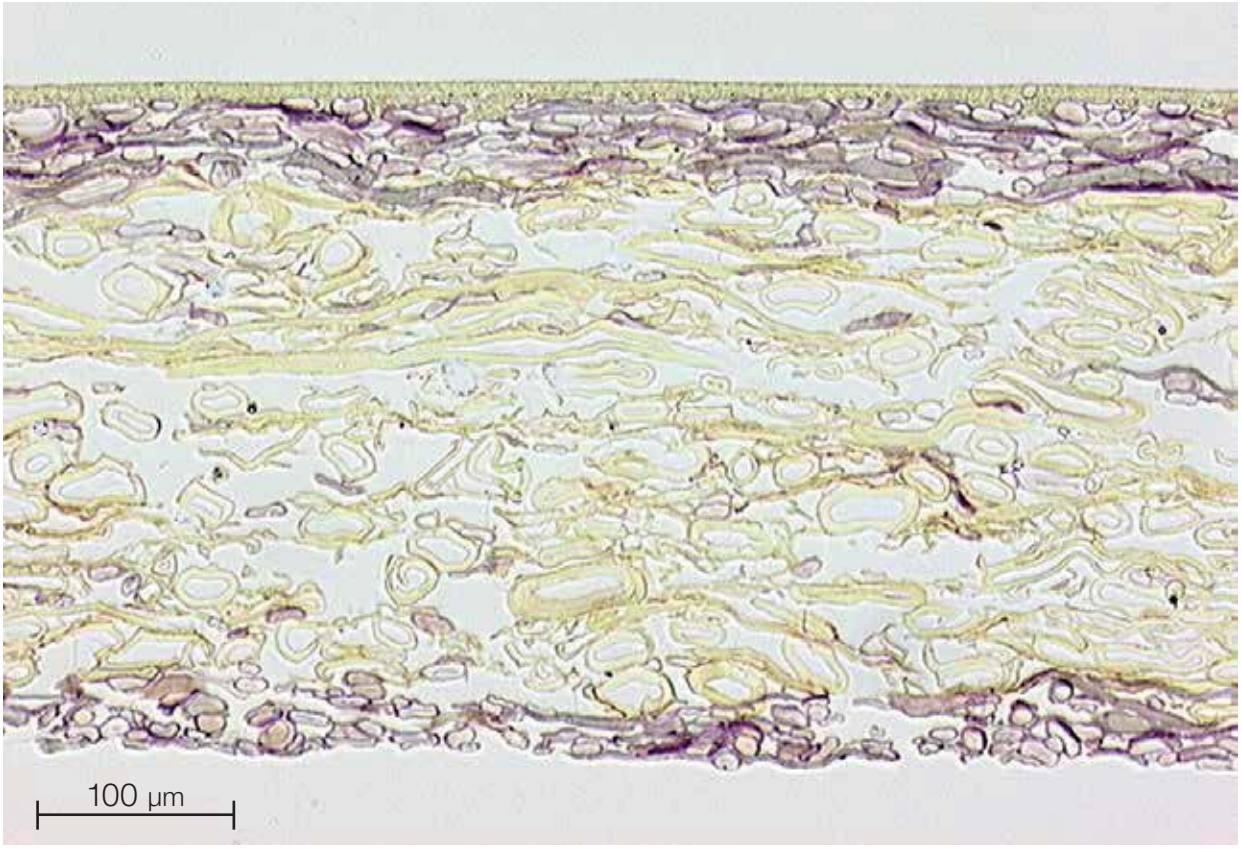
The drying section

There is no major difference between a board machine and a paper machine. The drying section will typically consist of a number of steam filled cylinders in contact with the paper or board; the number used will depend on the amount of water to be evaporated. The steam pressure in these cylinders will be adjustable to control the rate of evaporation and the final moisture content.

Calendering

Pre-calendering is used to make the surface of the uncoated base paper or board as smooth and even as possible so as to prepare the sheet for the subsequent coating operation.

Finish calendering or gloss calendering is used to improve the coated surface and/or increase the gloss of the paper.



Cross section of paperboard

Both paper- and board makers also use calendering techniques to achieve improved surface properties. However, excessively hard calendering can easily destroy the bulk of the sheet and thus the stiffness and strength properties of the board.

Various types of calendering techniques have been developed in the board industry such as soft nip, long nip and metal belt calenders. Using these techniques it is possible to improve the surface without reducing the bulk.

Coating

The coating operations for paper and board are basically the same. The difference lies in the coating recipes. Board manufacturers have different requirements than paper manufacturers, depending on the intended application.

Converting board into boxes carries specific demands, such as suitability for gluing functions. These must be taken into account when optimising the coating recipe and testing its suitability. Because one of the function of packaging is to protect and not to contaminate its contents, liquid board and board used to package food must be taint and odour neutral. Accordingly, the chemicals used in the coating must meet all the relevant safety requirements.

Winding, slitting and sheeting

There are no major differences between paper- and board makers with regard to the winding, slitting and sheeting operations. In order to provide the correct end user application and be able to guarantee that the paperboard has been produced under carefully controlled conditions, board makers must have a system of full traceability throughout the process.