Building Materials
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Lecture
Ceiling Materials

FIBREBOARDS

INTRODUCTION

Part-1

- The term fibreboard includes hardboard, medium density fibreboard (MDF), and insulation board.
- Several things differentiate fibreboard from particleboard, most notably the physical configuration of the comminuted material.
- Fibers can be made from many lignocellulosics and form the raw materials form any composites, most notably fibreboard. Fibers are typically produced by the refining process.
- To make fibres for composites, bonds between the wood fibers must be broken. In its simplest form, this is accomplished by attrition milling (refiner).

INTRODUCTION

Part-2

- Attrition milling, or refining as it is commonly called, can be augmented by water soaking, steam cooking, or chemical treatments.
- Steaming the lignocellulosic weakens the lignin bonds between the cellulosic fibers. As a result, the fibers are more readily separated and usually are less damaged than fibers processed by dry processing methods.
- Chemical treatments, usually alkali, are also used to weaken the lignin bonds.

CLASSIFICATION

- Fibreboard is normally classified by density and can be made by either dry or wet processes.
- Dry processes are applicable to boards with *high density (hardboard)* and *medium density (MDF)*.
- Wet processes are applicable to both *high-density hardboard* and *low-density insulation board*.

DRY-PROCESS FIBREBOARD

- Dry-process fibreboard is made in a similar fashion to particleboard.
- Resin (UF, PF) and other additives may be applied to the fibers by spraying in short retention blenders
- The adhesive-coated fibers are then air-laid into a mat for subsequent pressing, much the same as mat formation for particleboard.

HARDBOARD

- The term "hardboard," originally coined by the Masonite Corp. of Laurel, Miss., has now become generic and describes a cellulosic fibrous product made in one of three ways (wet, semidry, or dry processes), having a specific gravity from 0.8 to 1.2 and surfaces either wire marked on one side or smooth on two sides(S-2-S). The American Society for Testing Materials is now in the process of revising specifications for this product.
- The term "hardboard" is one of three constituting the category "wallboard." The other two are "insulating board" and "wallboard" (sheathing board).
- Semi-hardboard, with a specific gravity of 0.65 to 0.80, is a relatively new product

Wet-process hardboard

- Wet-process hardboards differ from dry-process fiberboards in several significant ways.
- First, water is used as the distribution medium for forming the fibers into a mat.
- As such, this technology is really an extension of paper manufacturing technology.
- Secondly, some wet-process boards are made without additional binders.
- If the lignocellulosic contains sufficient lignin and if lignin is retained during the refining operation, lignin can serve as the binder.
- Under heat and pressure, lignin will flow and act as a thermosetting adhesive, enhancing the naturally occurring hydrogen bonds.

RAW MATERIALS

For wet processes:

Sawdust is not a suitable raw material for wet formed hardboard.

Shavings will produce at best a marginal board.

The incorporation of bark will lower the strength and detract from the appearance of the board. When the bark content is not in excess of 15percent, the above factors may be disregarded, but regardless of *any* of these factors the bark content must be controlled to prevent a flaky, dusty wire-side surface.

Most woods and wood wastes, such as trim, edgings, slabs, and veneer scrap, are suitable raw material for hardboard. Considerable variation between various species has been observed, however.

For dry processes:

(1) Sawdust and shavings are suitable *raw materials* for dry-formed boards.

Removing bark

- Some hardboard manufacturers begin with round wood or logs. Others start "one step ahead" with saw mill wood residues (which need no "debarking"). Still others begin the manufacturing process "two steps ahead" by using pre-chipped wood from other sources.
- In all cases, the sequence is the same, regardless of the locations in which these preparatory processes occur.
- "Barking" of logs is usually desirable to insure quality control and uniformity of appearance in the finished product. It is achieved either (1) mechanically by cutting (2) hydraulically by high speed jets of water, or (3) by tumbling logs together in a large, rotating steel drum.

Reduction and preparation

- Debarked round wood or wood residues are next sent to the "chipper", where they are reduced by whirling knives into uniform chips about the size of a man's thumbnail. (A common chip size is 5/8" wide by 3/4" long.)
- Chips must be screened to prepare them for defibration.
- Oversized chips are returned for re-chipping. Sawdust and other fine particles are sifted and saved for use as
- fuel in the power plant. Acceptable chips (ready for defibration) are conveyed to storage bins.
- *Nothing* is wasted

Cooking

- Wood chips are cooked under heat and pressure to soften them and dissolve some of the natural resin in the wood. This allows the chips to be more easily reduced to fibers in the refining process.
- In the "explosion" method of digestion, the pressure is built up to high levels and then released through a quick release valve. The sudden change in pressure between the inside and the outside of the chip causes it to explode into fiber bundles. This reduces the need for further refining.

Refining

- The softened chips are fed into refiners where opposite rotating grinding disks shred them into fibers. Small amounts of chemicals may be added at this stage to improve strength and impart improved moisture resistance to the finished product.
- Fiber leaving the refiners is conveyed by air or water depending on the type of forming that is used.

Forming hardboard

- The formation of felting of the fibers to form a mat can be achieved by either a *wet* or a *dry* process.
- The *wet* process employs a continuously traveling mesh screen, onto which the soupy pulp flows rapidly and smoothly.
- Water is drawn off through the screen and then through a series of press rolls with wringing action similar to that of an old fashioned washing machine.
- In the *dry* felting process, comparatively dry fibers are laid out in much the same way but using air instead of a water medium.
- Air-formed mats emerge much thicker and softer than wet formed ones, and require more care in loading them into the press.

Pressing in hydraulic presses

- From this point on, *wet* and *dry* process production procedures are virtually identical. Pressing under heat (380°-550° F.) and pressure (500-1500 P.S.I.) puts the "hard" in hardboard. Multiple hydraulic presses are heated by hot water, hot oil or steam. The combination of applied heat and pressure welds the fibers back together and produces properties unattainable in natural wood. The amount of press time, temperatures and pressures vary widely, depending on the process and physical properties of the board being produced. "Smooth one side" board is delivered to the presses on a wire mesh screen (hence the familiar "weave" pattern found on the reverse side of theS1S hardboard). "Smooth two sides" board(S2S) is hot-pressed between two smooth plates. All boards emerge from the hot presses with an extremely low moisture content. Some are next tempered-roll coated with oil, and baked at 290°-340° F.
- Tempering increases hardboard's hardness, strength and water resistance.

Humidifying

- To prevent post-press warping or buckling, the boards are conveyed through a humidifier or stored on racks in a humidity chamber.
- This raises the moisture content to approximate atmospheric humidity.
- Although hardboards are humidified, they should be allowed to adjust to local atmospheric conditions before being installed.

Trimming

- Tungsten carbide tipped saws trim boards to standard sizes. (True to the hardboard industry's “No Waste” philosophy, even these trimmings are recycled for useful purpose.)
- Sheets may be cut to any size a customer wants. Also, hardboard can be fabricated and finished in a variety of ways.
- After all operations and final inspection have been completed, the boards are wrapped and sent to the warehouse for shipment to customers.

TESTING

- It is required to build consumer's confidence on the product and to make sure that it conforms to the specification
- For routine inspection and testing of the quality of hardboard, Indian Standard Specifications give the tests to be carried out, sampling techniques, the number of samples to be chosen from a given lot, the procedure to be followed, etc.

PROPERTIES

AS PER IS: 1658 – 2006

- Density (kg/m³)800 -1025
- Moisture content (%)5 -15
- Thickness swelling (%)25 (Max)
- Water absorption (%)45 (Max)
- Tensile strength perpendicular to the plane (IBS) (N/mm²) 1 (Min)
- Modulus of rupture (N/mm²):Average 30 (Min) Individual 27 (Min)
- Modulus of elasticity (N/mm²)a) Average 3000(Min) Individual 2700 (Min)