Chapter 2
Wood and Fiber Panel Technology

Antonio Pizzi
Lorraine University, Epinal, France & King Abdulaziz University, Jeddah, Saudi Arabia

ABSTRACT
The influence on the preparation of wood and fiber panels of adhesives and wood, with concepts such as surface wettability, wood plasticization, glass transition temperature, and models of cell walls buckling are presented and discussed. Parameters of manufacturing at the industrial level are presented, and the relationship between panel properties and a number of manufacturing parameters such as press temperature, type of pressing cycle, maximum pressure, and relative surface/core moisture content are discussed. The scanning electron microscopy showing the appearance of the adhesive/wood interface is briefly presented. The concept of density profile in relation to panel properties and how to influence it is discussed. Different manufacturing equipment is presented, in particular fundamental differences between single daylight, multi-daylight, and continuous panel presses and their effect on panel properties and performance.

INTRODUCTION
Because wood-based panels are used in very large quantities in furniture, construction, housing for decorative and structural panels, adhesives for the wood panels industry constitute approximately 60% by volume of all the adhesives produced in the world. Considering the great volumes of adhesives used the technology involved in obtaining optimal performance of both adhesive and panel is extraordinarily well

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developed. It must be stated immediately that the secret of good bonding in wood panels is equally apportioned to the technology of the adhesive and to the technology of manufacturing the panels. It is a well known say in this industry that one can make very poor panels using an excellent adhesive, and still make good panels when using a much poorer adhesive. In short, the conditions of applications of the adhesive and of manufacturing of the panel are often predominant in obtaining a good result. A good adhesive used correctly, of course, will almost always give a much better result than a poorer adhesive used equally well. This chapter concentrates on panels manufacturing technology, a technology very varied and at times very complex, the knowledge of which is indeed vital to anyone that intends preparing adhesives for this application.

WOOD AS A SUBSTRATE

Wood is a natural composite made of approximately 60-65% carbohydrate fibers, 25-30% of a random polyphenolic branched polymer, lignin, functioning as a binder, and 10% of residues, extractible or cellular waste infiltrates (oleoresins, tannins, starches, some imorganic salts, etc.) coating the porous cellular surfaces. The carbohydrates fraction is composed of linear cellulose homopolymers (40-45%) interspersed and intertwined with heterogeneous short-chain polysaccharides called hemicelluloses (20-25%). As much as cellulose and lignin present specific gravities of 1.4 and 1.5 respectively, wood itself presents much lower density due to its porous, honeycomb structure in which the longitudinally-aligned intracellular matrix cellulose fibers, or tracheides, have inner open spaces having diameters of 4 to 25 μm. Depending on the type of wood species the fiber cells may present open or closed ends as well as interconnected pits, each of roughly 200 nm diameter, which may or may not allow liquids and air to penetrate from one fiber to another (Kollmann et al., 1975).

Wood is then volumetrically of much lower density than its own fibers and of synthetic resins and fibers. The cellulose fibers are polar and shrink and swell on drying or wetting, and are useful in adhesion to wood.

In hardwoods, morphological structural elements in longitudinal series comprise the segmented structure termed “vessel.” Vessels, which are exposed in transverse section constitute about 10 to 46% of the stem volume in deciduous hardwoods and are cells of relatively large diameters (50 to 300 μm). Vessels have in short the appearance of open vertical, tubes within the wood structure because their end walls have partially dissolved. By comparison, the vessel diameter can be as much a 10 times the diameter of a softwood fiber.
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