CHAPTER 12

WOOD-BASED PANELS: PARTICLEBOARD,
FIBREBOARDS AND ORIENTED STRAND BOARD

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1. INTRODUCTION

Wood-based panels have become an important component in the wood processing chain. From a materials viewpoint wood-based panels provide a way of realising value from materials that are not suitable for other uses, or that are residue streams from other processes. However these panels are now an integral part of the wood products market, meeting requirements that were once met by solid wood. The ability to produce panels of larger sizes reduces the number of components needed while the uniformity of panel properties give a more consistent performance. The panels are used extensively in construction and in the furniture, cabinet and joinery industries, while the ability to ‘engineer’ these products to meet specific performance requirements has been a significant factor in their growth. The technology for producing these panels has developed significantly, in particular with the introduction of continuous pressing providing new levels of product uniformity.

2. OVERVIEW

Particleboard, (PB), medium density fibreboard (MDF) and oriented strand board (OSB) developed in the latter half of the 20th century from technologies first applied to plywood manufacture, but required new approaches to particle preparation and drying, faster setting adhesives and press design. Particles, being smaller than veneer sheets used to manufacture plywood, allow a much wider range of raw material to be used. In fact these panels use raw material that is either a waste stream from other processes or a wood resource that cannot be used for other purposes: increasingly wood from urban waste streams is being used, particularly for particleboard. Another precursor to these panels was the wet-formed fibreboard panel known as hardboard, where a fibre mat was pressed to a high density (950-1200 kg/m³). This panel, also known as ‘Masonite’, was self-bonded: this being achieved by reaching a temperature in the hot press (205-215°C) that caused thermal decomposition of the wood to produce an adhesive. Panel thickness was limited to about 6 mm by the necessity to achieve this temperature in the centre of the panel during pressing.

A wide range of adhesives are used. For the three panel types that are the focus of this discussion synthetic adhesives are used, although tannins extracted from bark
have been used. However other binders such as gypsum and cement can be used with particles and with fibres. In this case the binder levels are much higher so that these products might be described as a wood-reinforced gypsum or cement matrix.

In general these products are pressed to consolidate the mat and to cure the thermoset adhesive. Whereas in plywood pressing the main object is to achieve good contact between the veneer layers with as little increase in density as possible, in the case of these products the average density is one of the key variables in determining panel properties and will normally be 30-100% greater than the bulk density of the wood from which the panels are made. A major advance in all these products is the ability to control the density profile through the thickness of the panel.

It is possible to characterise wood-based panels in terms of a plot of panel density against the major length dimension of the wood-elements used. In theory there is an infinite range of adhesive bonded products that can be defined within the range of particle size and density covered in Figure 12.1. In practice the range is limited by commercial requirements although the range indicated is by no means definitive, either for particle size or for density range.

![Figure 12.1. Classification of wood-based panels according to density of the panel and the size of the wood elements.]

3. MARKET

Wood-based panels such as particleboard, MDF and OSB are a significant component in the wood industry. They satisfied performance requirements that are increasingly difficult to meet from solid wood sources and are able to meet these by using residues from other wood processing operations, or in the case of OSB, from small diameter logs from species that otherwise have limited potential, and at competitive prices. The technology to produce these panels has advanced to the