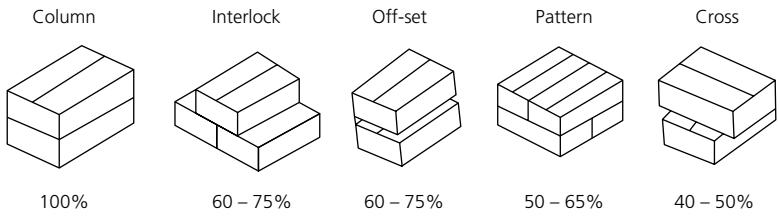

Figure 26.15 Relative strength of different stacking patterns.

inside the box take the load? Most of the corrugated case strength is in the corners and the majority of the fluting should be in the vertical position to maximise case strength. Column stacking in the pallet provides maximum load strength, however, this produces an unstable load. Therefore, pattern stacking is commonly used with cases interlocking to produce a stable load in transit. An approximate guide to the relative stacking strengths is shown in Figure 26.15.

The traditional method of printing is an integral part of the process of corrugate manufacture, which is followed by creasing and slotting. This results in a poor quality of reproduction by modern standards. Changeable information can be applied at the last moment using the actual corrugating equipment.

High-quality print methods such as rotogravure or offset lithography can be applied to single-web paper or board, but not to formed corrugate because they would break down its structure. There is an increasing tendency to preprint the outer liner before it is formed into corrugate. This enables the use of more sophisticated printing, giving much better decoration, and illustrations can be achieved by the use of halftones. One advantage of micro-flute is that it can be printed directly to give high-quality graphics.

26.4.3 Regenerated cellulose film

Until the late 1970s and 1980s regenerated cellulose film (RCF) dominated the flexible packaging field. Like paper and board it is made from wood pulp, although generally of a higher quality: a high proportion comes from eucalyptus grown especially for the purpose. A chemical process is used in which, as in papermaking, individual fibres are put into solution. Instead of being spread out in layers, they are then chemically regenerated and passed through a slot to form a transparent film. Glycerol and various glycols are used as plasticisers to add flexibility to the film.

In its natural state RCF has few characteristic properties other than transparency, flexibility, dead-fold and the ability to form a barrier to oxygen, provided it is dry. It cannot be sealed and it is very susceptible to moisture, expanding or contracting with changes in atmospheric humidity. In order to make RCF a practicable proposition it has to be coated. Initially it was made heat sealable and given some barrier properties by the application of a nitrocellulose coating. This material (MS) is perfectly adequate for most confectionery purposes. Where

extra protection is required, a polyvinylidene chloride (PVdC) coating is used and the film is then characterised as MXXT, with the suffix "S" for solvent applied or "A" for aqueous dispersion coated. Although it is more effective and avoids the problem of disposal of residual solvents, the reactivity of RCF to moisture makes the aqueous method of coating much more difficult. MXXT films generally have more sparkle than MS and more resistance to abrasion.

Other coatings or treatments can be used to make RCF permeable to some gases and not to others. This enables the atmosphere inside to be controlled to a certain extent for the benefit of some products. It can also be made extra flexible (PF) for twist wrapping, supplied uncoated where moisture pick-up is not a problem (e.g. most chocolate-covered sweets) and can be coloured either intrinsically or in the coating.

Coated RCF is an ideal film for automatic packaging because it is not subject to structural alteration as a result of temperature; however, it cannot be thermoformed. It offers a combination of rigidity with elasticity – it will stretch before it breaks – and it avoids problems associated with static electricity (such as attracting dirt and upsetting wrapping machines). It's tensile and burst strengths are good; a tear, once made, propagates easily, but this is actually an advantage when a tear strip is required. The heat-seal temperature is not critical, as coated film has a relatively wide sealing range. It can be obtained in various thicknesses and, in general, the thicker the film, the stronger it is; barrier properties, however, do not vary with overall thickness since the coating weight (expressed in gsm equivalent units) remains the same. RCF, unlike most plastic films, is biodegradable so it appeals to environmentalists.

On the debit side, RCF, even when coated, does not have the shelf life of plastic materials. It requires carefully controlled storage conditions, but even so will deteriorate with time. As with paper and board packaging, it is essential to place the RCF in the packaging hall at least 24 h before use to allow the material to equilibrate with the atmosphere in the room to prevent curling of the material.

NatureFlex™ cellulose films have been specifically developed for enhanced compostable performance that is certified to EU (EN13432), US (ASTM D6-400) and Australian (AS4736) norms.

In recent years, RCF production has been deemed environmentally un-friendly due to some of the chemicals used in its manufacture. Therefore, the number of producers of RCF is now very limited, which has in turn led to the film becoming expensive in comparison to plastic films.

26.4.4 Plastic films

Despite all its properties, plastics films for flexible packaging have largely supplanted RCF. PVdC, used to coat RCF, is itself a plastic and can be obtained in film form, as well as in coating form. The range of plastics materials available for packaging is very wide and increasing, however this chapter is confined to those that play a significant part in the packaging of chocolate products.