26.4 Materials

26.4.1 Aluminium foil

Aluminium foil provides the best barrier available in a flexible format to water vapour, gas transmission and odour. Aluminium is generally defined as a fully annealed, soft temper metal of 99–99.5% purity, the remaining percentage being made up of silicon and iron with traces of other elements. Recent developments have reduced the percentage of aluminium by incorporating manganese to give added strength (so-called "special alloys").

The thickness can be 5–20 μm (0.20–0.79 × 10^{-3} in), but generally range within 6.5–17.0 μm (0.25–0.67 × 10^{-3} in) for confectionery purposes. Cost reduction has resulted in special alloys, rolled thinner on more efficient modern plant; so that, for example, 8 μm (0.31 × 10^{-3} in) foil can be obtained that is stronger than the old 9–10 μm (0.35–0.39 × 10^{-3} in) foil and, in some cases, than the traditional 12 μm (0.47 × 10^{-3} in). Thinner gauges of foil are rolled double, giving the characteristic shiny and matt sides that appeal to artists and designers in different ways – some prefer the bright side for display value, whereas others regard the matt face as conveying discreet quality.

For bar and tablet wrapping, foil can be specified in several forms, plain un-backed with or without embossing, backed with or without embossing or coated with or without embossing. In most cases, un-backed foil is used with the embossed versions providing additional decoration along with a slight increase in rigidity for transport through the wrapping machine. When added strength and crease resistance are required, for example when nuts protrude from the back of a bar, it may be necessary to laminate the foil to other materials.

The most popular backing material is paper because it is strong, easily printed and relatively inexpensive. Depending on the end use and whether it is laminated to the outside or inside of the foil, there is a wide choice of paper forms available, for example sulfite tissue, kraft (usually bleached) and glassine, with an equally wide range of adhesives, such as dextrin, polyethylene, wax and hot melt. A widely used combination, for example, is foil: 7 μm (0.28 × 10^{-3} in)/wax: 3 gsm (0.0098 oz/ft^2)/tissue paper: 20 gsm (0.0655 oz/ft^2) [gsm = grams per square metre].

In addition to adding strength to the foil, lamination [e.g. to 20 gsm (0.0655 oz/ft^2) tissue paper] can provide a cost reduction in material when compared to using higher gauge foils such as 17 μm (0.67 × 10^{-3} in).

Plastic films are used where extra barrier properties and puncture resistance are required and occasionally to provide a high gloss finish. In this instance, it is important to balance the relative gauges of material so that the "spring" of the film does not overcome the desirable dead fold properties of the foil. An example of such a structure is 9 μm (0.35 × 10^{-3} in) aluminium foil laminated to 12 μm (0.47 × 10^{-3} in) BOPP.

In general, the thinner the gauge of foil the more minute pinholes can be expected, for example 7 μm (0.28×10^{-3} in) foil will have more pinholes than 20 μm (0.79×10^{-3} in) foil. When foil is coated, usually with vinyl or PE in order to make it heat sealable, this has the additional effect of filling in the pinholes. Although research has shown that most pinholes have very little effect on the barrier properties of foil, such filling can only be beneficial.

Provided all traces of residual rolling oils (which could go rancid under certain conditions) are removed, unconverted foil is perhaps the material least likely to taint a sensitive product such as chocolate. Converted foil (i.e. foil converted by printing, coating or laminating) can create odour problems because of the coatings and adhesives as well as the printing inks. Therefore, it is important that full taint and residual solvent tests be carried out before such material is used.

Foil is most attractive when printed. All major printing processes, particularly gravure and flexography, can do this and foil is frequently over-lacquered with transparent colours to make full use of its metallic visual properties.

26.4.2 Paper and board

These are materials produced from the natural cellulose fibres found in trees. The production process broadly consists of taking the wood apart by pulping and subsequently re-joining the fibres, without their own binding materials, as an engineered matrix designed to perform a specific function. This pulping can be done chemically whereby the organic binding material holding the fibres together is dissolved away (e.g. solid bleached sulfite with all layers being chemical pulp; see Table 26.1). Alternatively, pulping can be done physically whereby the wood is “mechanically” broken up and the binding material washed away by water (e.g. coated chromo board with a centre layer of mechanical pulp; see Table 26.2). The former method produces strong, expensive paper or board with minimal odour and taint potential and is ideal for direct chocolate contact. The latter method produces relatively weak, cheaper material, which is perfectly adequate for many purposes, but can also produce tainting of chocolate due to the production of hexanal over time.

Table 26.1 Structure of solid bleached sulfite board.

Component	Thickness (g/m²)	Proportion (%)
White coating	20	6.7
Bleached cellulose: white covering	40	13.3
Bleached cellulose: white middle	200	66.7
Bleached cellulose: white back	40	13.3
Total	300	100