Electronic materials and components-Film processes for polymers

Laminating

Laminating is a process that involves pressing together two or more layers of resin-impregnated fabric, paper, or fibre under heat and pressure to cure and consolidate the stack. The resin is the binding material, and can be thermoplastic or thermoset, although thermosets are usual for electronic applications. The reinforcement can be cotton, paper, glass, synthetic organic fibres, graphite fabric, and other inorganic fibres.

Laminating can be considered a special case of compression moulding. The process starts by impregnating the reinforcement with liquid resin (in solvent, melted, or a 100% solids liquid resin) and passing the impregnated web through a drying oven to remove the solvent and partially polymerise the resin. A schematic of the impregnation process is shown in Figure 1.

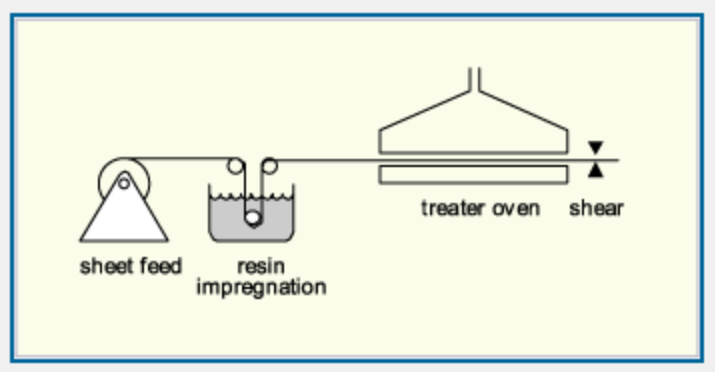

Figure 1: Horizontal treater tower for impregnation

The dried impregnated fabric, which can range from very flexible to very rigid, is cut, stacked and pressed. A typical cycle is 35 bar/175°C for 1 hour, but pressures can range as high as 200 bar, with temperatures to 300°C. The process is inexpensive, production is rapid, and the product can be made to close tolerances.

Autoclave moulding

In autoclave moulding, heat (up to 300°C) and pressure (up to 70 bar) are applied to a part made by other methods (lay-up, winding, wrapping) to compact and cure it. An autoclave applies direct heat and pressure, but a transfer medium can be used: variants include ‘hydroclaving’, where water is the pressure-transfer medium, and ‘thermoclaving’, employing powdered silicone rubber which acts as a fluid under heat and pressure.

Advantages of autoclaving are that high pressures give good laminate consolidation and improved removal of volatiles for high-strength parts. Disadvantages are that capital and operating costs are high and that the size of the part is limited to the cavity of the autoclave. The process can be applied to most thermosets and some thermoplastics, and is in common use in making multilayer PCBs.

Thermoforming

Thermoforming involves forming a hot thermoplastic sheet into the desired shape by applying heat and pressure or vacuum to force it against a mould face (Figure 2).

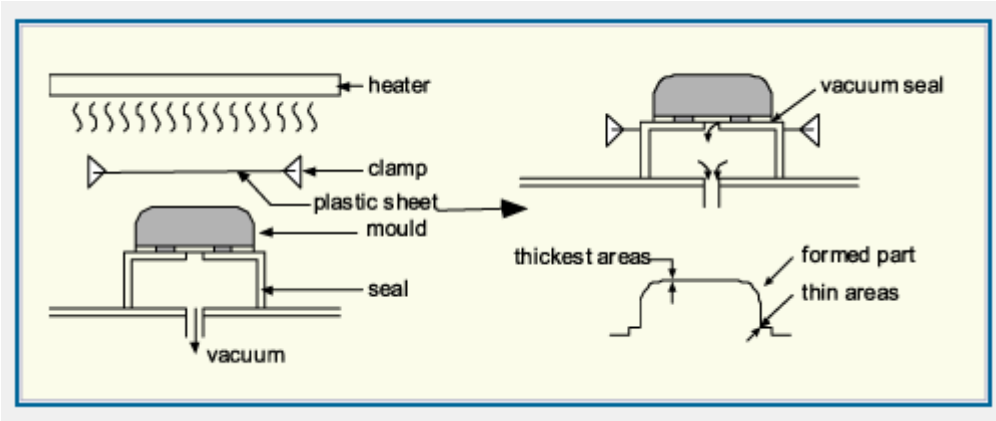

Figure 2: Thermoforming

There are many variations of the process: plug-assisted, straight forming, mechanical drawing, drape forming, matched-mould forming, snap-back forming, etc. Thermoforming enjoys low tooling costs, and large parts with thin sections can be produced, but is limited to parts of simple configuration, and produces high scrap. Amorphous polystyrene and PVC are typical materials used in thermoforming, a process commonly used to produce items such as packaging trays.

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Source: http://www.ami.ac.uk/courses/topics/0212_fpp/index.html