Description

Image

Image caption

(1) GBC Photo A4 Laminator © Granta Design (2) Plastic batch holder © Granta Design

The process

The simplest of all welding processes for polymers is the one that you can use in your kitchen to seal food into freezer-bags: HOT BAR WELDING. In this process, overlapping thermoplastic polymer films are pinched between electrically heated, PTFE coated, bars. One bar is hinged to allow the films to be inserted and removed. Mechanical or pneumatic actuators close the bar and exert the pinch force. The joint itself is heated by conduction though the film, limiting the film thickness to less than 0.5mm. A typical weld in a 100 micron thermoplastic film takes 1 - 3 seconds. Impulse welding is a modification of hot bar welding in which the bars are pulse-heated, giving an additional control of quality.

Process schematic

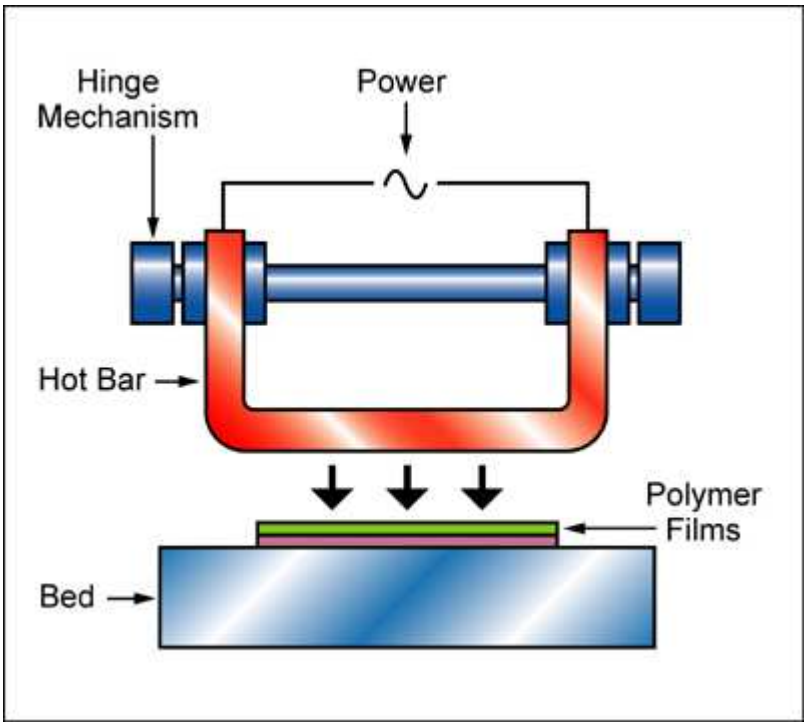

Figure caption

Hot bar welding of thermoplastics.

Material compatibility

Polymers - thermoplastics	✓

Function compatibility

Electrically conductive	✗
Thermally conductive	✗
Watertight/airtight	✓
Demountable	✗

Joint geometry compatibility

Lap	✓

Load compatibility

Tension	✓
Compression	✓
Shear	✓
Bending	✓
Peeling	✓

Economic compatibility

Relative tooling cost	low
Relative equipment cost	low
Labor intensity	low

Physical and quality attributes

Range of section thickness	1.97	-	19.7	mil
Unequal thicknesses	✓			
Processing temperature	368	-	548	°F

Process characteristics

Discrete	✓

Supporting information

Design guidelines

The process is limited to thermoplastics and to lap joints between sheets, both of them thin. But it is fast, cheap and clean, lending itself to the sealing of food, packaging, drugs and medical equipment. The shape of the weld is defined by the shape of the bar, which can have a complex surface profile.

Technical notes

Control of time, temperature and pinch-pressure are essential for a good joint - impulse welding is one way of controlling the first two of these. The time, t, to form a bond varies inversely with the thermal diffusivity, a, of the polymer, and is proportional to the square of the thickness, x, of the sheet (t = x^2/2a), so adjustments are needed when material or thickness are changed.

Typical uses

Hot bar and impulse welding are widely used for sealing of polymer packaging for the food industry, for shrink-wrapped packs, for medical and general packaging. They are used to bond polymer films to polymer moldings, to make transparent file pockets, and may other similar applications.

The economics

The process is cheap, fast, and uses low cost equipment and tooling.

The environment

The process is clean, involves no chemicals, generates no fumes, and consumes little energy; it is - in a word - eco-benign.

Links

MaterialUniverse

Reference