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## Multi-Layer Films

# Adhesive Tie-Layer for Multi-Layer Films

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Laminar flow is required and resins with the requisite flow properties need to be chosen appropriately. This in turn also ensures an even layer thickness. After this, the film is passed over chill rolls following which it is wound on the take-off roller. Extruder output, chill roll speed and web profile are the main factors controlling the film thickness.

## Blown Film Co-Extrusion

In the blown film co-extrusion technique, the polymer melt is extruded vertically via an annular slit die to form a thin walled tube. The tube gets blown up like a balloon through a hole located at the center of the annular die. The film is cooled through air, which is blown onto the hot film by means of a high-speed air ring that is mounted on top of the die. The film tube then passes vertically upwards after which it traverses nip rolls. The tube is flattened or collapsed at the nip roll and is known as a lay-flat tube.

This collapsed tube is then brought down the vertical blow extruder unit through rollers. The lay-flat

tube can then be kept as it is or it can be formed into two flat film sheets and wound up on to reels. The film tube stored in the 'as is' condition can be converted into a bag by sealing across its width and then cutting it. This process can happen either immediately as an adjoining process after the blown film extrusion or as a separate process when required later.

## How to Achieve Up to Ten Layers

The blown extrusion technique can provide films with up to ten or more layers. Compared to the cast extrusion process, the rheology match between the extruded layers is not as significant here since the layers stay apart until they reach the die tips. This makes blown extrusion a more flexible process with respect to material selection. But due to the complex geometry and cost, the co-extrusion dies are designed typically for a limited thickness ratio range. A blown film extrusion can cover different reel widths than the cast extrusion type.



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Besides the film thickness and width, other parameters predicating the choice between the two would be:

- **The type of polymer used** – PE is usually better processed by blown extrusion, while PP, polyethylene terephthalate (PET) and PA are better suited for processing via the cast extrusion method.
- **Thickness** – Blown film extrusion has limitation on the film thickness, which can be obtained. This is typically in the range of 30  $\mu\text{m}$  to 200  $\mu\text{m}$ .
- **The characteristic properties** – The properties of materials obtained by the two processes are different in terms of crystallinity, orientation, film opacity, gloss, etc.

Multi-layer films have opened up a plethora of packaging options for various industries, especially food, pharma, agri-business, etc. Binding the multi-layer structure is the key to meet their purpose and adhesive tie-layers act as an ideal solution in ensuring it.

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