Thermoforming is a manufacturing process where a plastic sheet is heated to a pliable forming temperature, formed to a specific shape in a mold, and trimmed to create a usable product. The sheet, or "film" when referring to thinner gauges and certain material types, is heated in an oven to a high-enough temperature that it can be stretched into or onto a mold and cooled to a finished shape.

The normal roll-fed machines consist of the roll station, upper and lower heating banks, form station, cooling station, and trim station.

Sheet thickness less than 1.5 mm (0.060 inches) is usually delivered to the thermoforming machine from rolls or from a sheet extruder. Thin-gauge roll-fed or inline extruded thermoforming applications are dominated by rigid or semi-rigid disposable packaging. In the most common method of high-volume, continuous thermoforming of thin-gauge products, plastic sheet is fed from a roll or from an extruder into a set of indexing chains that incorporate pins, or spikes, that pierce the sheet and transport it through an oven for heating to forming temperature. The heated sheet then indexes into a form station where a mating mold and pressure-box close on the sheet, with vacuum then applied to remove trapped air and to pull the material into or onto the mold along with pressurized air to form the plastic to the detailed shape of the mold.
Thermoforming: The Possibilities Are Endless

Above: A collection of flexible thermoformed applications by Flair Flexible Packaging.

**Flexible Thermoforming Applications**

- Sausage
- Fresh and Processed Meats, Bacon
- Cheese
- Bread (MAP, Modified Atmosphere Packaging)

**Semi-Rigid Thermoforming Applications**

- Pasta and Egg Rolls
- Syrups and Sauces
- MREs (Meals Ready to Eat), Rolled Tapes and Bandages
In the spring of 2011, Flair Flexible Packaging completed its transition from blown to cast co-extruded film production.

Up until then, Flair Flexible Packaging produced film through a co-extruded blown film process. This process vertically extrudes the melt of resin pellets in a tubular shape that cools, collapses and winds up as a thin film. In comparison, co-extruded cast film production improves on many important physical properties of the film, especially as they are applied to thermoforming and high barrier efficacy. As of May 2011, Flair Flexible Packaging has entirely shifted its film production method to cast co-extrusion.

H.I. Lee, VP of Technology for Flair, summarized some of the important benefits of cast coextruded film over blown film.

**Better Thermoformability**

Blown films are pre-stretched by virtue of their manufacturing process, which is somewhat more challenging to thermoform (stretch and mold) than cast films. Because cast film does not have orientation in MD (machine direction) and TD (transverse direction), cast films arrive at customers’ converting and packaging lines minimally stretched. Therefore, the depth of thermoforming, especially deep drawing (for a large cheese block or multiple layers of stacked hot dogs, for example) is significantly improved when using cast film instead of blown film.

This is especially obvious when a customer is deep drawing the thermoforming films around the bottom four corners of the aforementioned cheese block. These are the most critical points on the cheese block for hermetic packaging due to the weight of the cheese and the exposure to environmental stresses, including transport and handling. Thicker, more even distribution of the cast film’s structure makes this a better, more quality choice for deep drawing thermoforming applications.
Higher Barrier Efficiency for Gases, Moisture and Aromas

When high barrier films are required to prevent the transmission of gases, moisture and aromas, co-extruded cast films effectively extend product shelf life. Overall cast film thickness and the more evenly distributed layers of the polyolefines in cast film structures make them an optimal choice.

EVOH (ethyl vinyl alcohol copolymer) is the chemical resin that contributes these high gas barrier characteristics. EVOH is shown to be more effective when co-extruded in a cast versus blown film extrusion manufacturing process. The resin, while used in both cast and blown films, benefits from shorter periods of cooling and crystallinity formation when cast, thus increasing its effectiveness.

Positive Customer Feedback

According to H.I. Lee, feedback from customer trials of the cast film line has been very positive. “Customers appreciate the easier thermoforming, the improved appearance and better resistance to pinholes and punctures. We continue to seek resins and film manufacturing processes that result in the best cast coextruded film performance. Quality and performance are our most important goals, not just at the beginning, but as a continuous process.”