Technical Aspects of Converting Extensible Films
by Fred Gum, AET Technical Service Engineer

Most flexible packaging films are elastic, some are more stretchable than others. The extensibility of these films poses challenges to the converter with respect to web handling and equipment maintenance so that quality converted webs can be made. Based on extensive OPP film experience, the fundamentals of film extensibility are discussed with respect to cause and effect. Web tension and web temperature can impact print repeat and lamination curl due to web snap back, depending on how much stress/strain the web experiences. Nip roll pressures and misaligned rollers also have significant potential for impacting the quality of a converted web, whether mono-web or lamination.

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Polyester, polypropylene, and polyethylene are the most frequent flexible packaging films used to make mono-web and laminate converted structures for use in snack food, bakery, label, and other markets.

Polyethylene is preferred for its hand and as the inside sealant film in laminations requiring good sealability, caulkable seals, and tear resistance. Polyester, a significantly stronger film with a high melt temperature, has naturally high dynes. Oriented polypropylene film is intermediate in strength and melting temperature; the many grades of BOPP and OPP make these ideal films for excellent printing, sealability, machinability, high barrier, etc. Because we have extensive experience with OPP films this paper is based on converting OPP films; however, the fundamental concepts discussed herein apply to polyethylene and polyester, though to different degrees.

Things you should know . . .

- Films do stretch,
- Temperature is not your friend,
- Tension creates stress,
- Nip pressure induces distortion.

Why is it important to understand that OPP film is elastic?

- Moving OPP film through a press or laminator will stretch the film.
- Some (usually most) of the stress will relax out of the film when the tension is relieved, causing the film to return to its original length.
- The industry terms for this include “snap back” and “memory”.
- If the film is stretched too much,
  - The recovery toward the original length may not be complete.
  - The web width may narrow.
- Some converters design their plates slightly long, based on their experience with the snap back of a specific film type/thickness, so that the finished impression length will be correct. They do this to avoid the problem in the following figure.
Drying temperatures can make the film stretch more.

Printing inks (and adhesives) require the solvent (or water) to be removed from the liquid coating on the film. Warm air will absorb more liquid (whether solvent or water) than cool air; general industry experience has shown that a high volume of fresh air (containing low levels of solvent or water) is more effective than increasing the temperature. This is important because if the film temperature gets too high, even low web tensions can significantly stretch the film. The following graph shows the combined effects of web tension and web temperature on film stretching.

![Graph showing the combined effects of web tension and web temperature on film stretching.](image)

Nip rollers can distort films and laminations

Pressing two films together is important to ensure intimate contact so the adhesive will more effectively bond the two webs to each other. Sometimes the nips are heated to “kick off” (activate) the adhesive. High nip forces between a steel roller and a rubber covered roller, especially when one is hot, can twist and contort segments of one or both films causing unwanted curl. Imagine what an extensible film experiences when exposed to the forces evident in the sketch at the right.
Guidelines for converting extensible films

- *Print web tension* – used to control print repeat length.
- *Overlaminate “non-printed” web tension* – used to control curl.
- *Excessive drying oven temperature* – can cause too much stretch.
- *Excessive laminating nip pressure* – can cause curl.
- Two webs at different temperatures can result in curl.

Pointers for good film tracking

- When web tension is too low
  - Film may wander from side to side (TD registration)
  - Web may be difficult to slit and rewind roll quality may be poor
- Ensure consistent tension through press and laminator
  - Extremely tight tension zones can stretch film too much
  - Slack zones can let film wander
- Other considerations
  - Too much span between idlers can let film wander
  - Herringbone rollers help align film
  - Mis-aligned rollers can cause . . .
    - Film wandering
    - The appearance of poor flatness
    - Wrinkles

In summary . . .

- Films stretch.
- Temperature and tension must be controlled, and usually minimized.
- The right (not too much), uniform nip pressure is important in laminating.
- Proper, well-informed converting practices are critically important.
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