TillQUIST

PLASTICS INDUSTRY SOLUTIONS

Plastics Industry

Processing and Manufacturing

Raytek noncontact infrared thermometers are designed for use in plastics industries where monitoring and controlling temperature is critical to productivity and product quality.

Raytek thermometers measure temperatures of fast moving processes quickly and efficiently. They measure the temperature of the product directly, instead of the oven or the dryer. You can quickly adjust process parameters to ensure top product quality. Raytek infrared sensors are

- Non-destructive - the product is never touched or contaminated.
- Fast and reliable - moving objects are measured accurately and quickly.
- Flexible - temperature measurements can be made of a large area or a small spot.

Raytek infrared sensors take temperature measurement one step further. A wide range of optics, including a remote-controlled, motorized, variable focus in the Marathon MM, covers an enormeous variety of applications. This is supported by integrated through-the-lens sighting, plus either laser or video sighting for correct target location.

Simultaneous analog and digital output allows temperature data to be integrated into a closed loop control system for remote temperature monitoring and analysis. All Raytek smart sensors, with digital electronics and 2-way communications, can be configured remotely. The results are

- Higher quality products
- Increased productivity
- Reduced energy costs
- Enhanced worker safety
- Reduced downtime
- Easy data recording

Noncontact Temperature Measurement Solutions

Major Applications

- **Extrusion Coating**
- **Thermoforming**
- **Blown Film Extrusion**
- **Cast Film Extrusion**
- **Biaxially-oriented Film Extrusion**
- **Sheet Extrusion**
- **Laminating and Embossing**

Raytek®

A Fluke Company

Accurate ongoing temperature measurement is crucial to any plastic industry process where temperature is a factor. The following are examples of different types of process lines and how Raytek noncontact infrared sensors can increase productivity and product quality.

Blown Film Extrusion

In a blown film extrusion process (similar to Figure 1), film is extruded as a continuous tube, air cooled, collapsed, and wound onto rolls as bags or slit into single layer widths.

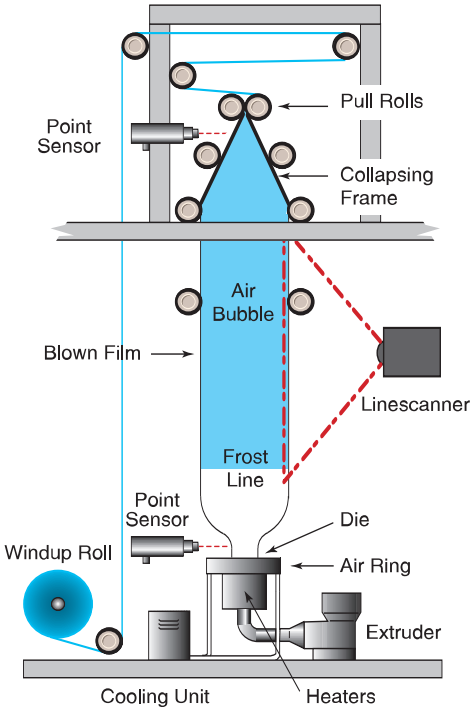


Figure 1: Blown Film Extrusion Process

Accurate temperature monitoring coupled with the ability to adjust heating and cooling helps maintain the plastic's tensile integrity and thickness. The results: better quality products and higher levels of productivity.

Raytek point sensors can take spot measurements at the die and the collapsing frame, and MP linescanners can take temperature profiles between the frost line and collapsing frame.

Benefits:

- Early detection of die bolt problems
- Realtime monitoring of air ring efficiency
- Elimination of gauge bands
- More consistent lay-flat width
- Better runnability and less breaks
- Reduced scrap rate

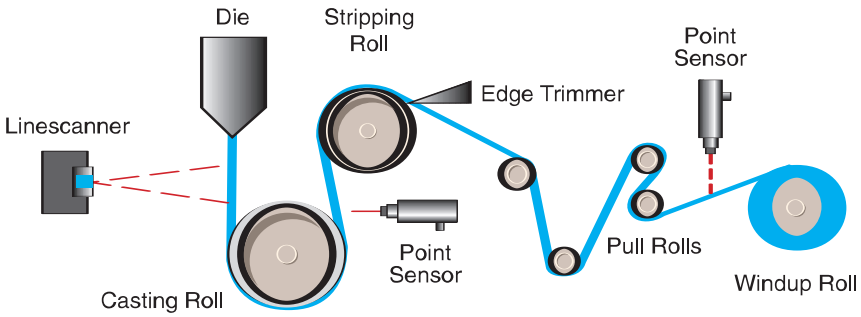


Figure 2: Cast Film Extrusion Process

Cast Film Extrusion

In the cast film extrusion process (similar to Figure 2), the melt is extruded through a wide die as a thin web and is cooled on a polished metal casting roll. Infrared point sensors help control temperatures so that proper thickness and finish uniformity are maintained.

An MP linescanner mounted after the die can give early detection of die bolt heater problems or plugged dies.

Benefits:

- Early detection of die bolt heater problems and/or plugged die
- Greater film thickness uniformity
- Enhanced surface finish uniformity
- Improved final film shape stability
- Less breaks and machine downtime
- Increased productivity

Sheet Extrusion

Figure 3 is an example of a typical sheet extrusion process. Note that material thicknesses determine the type of sensor and the type of optical resolution needed for optimum noncontact temperature measurement.

Installing an MP linescanner before the three roll finisher allows the operator to monitor the sheet temperature and adjust the die heater and/or the roll cooling so product quality is consistent. A linescanner mounted before the pull rolls helps safeguard against tear and irregularities.

Benefits:

- Melt temperature profile for die bolt heater control
- Increased sheet thickness uniformity
- Sheet temperature profile feedback for more effective chill roll control
- Uniform cooling prevents curl and twist
- Faster grade changes and reduced scrap
- Increased productivity

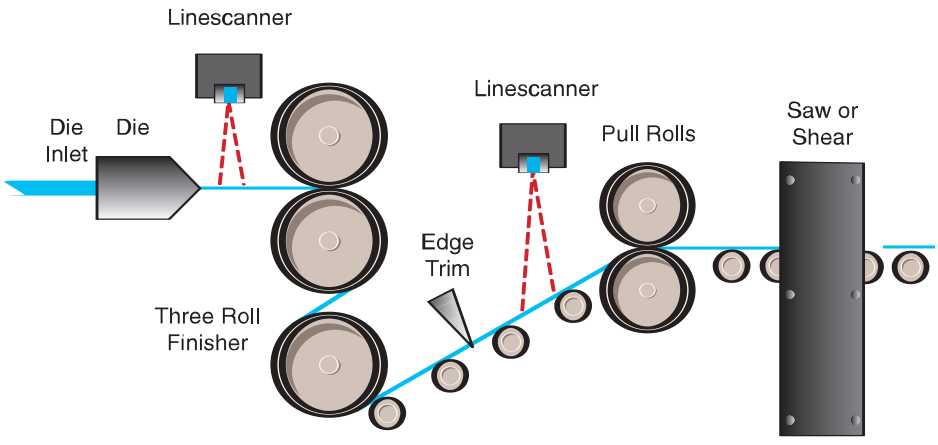


Figure 3: Sheet Extrusion Process

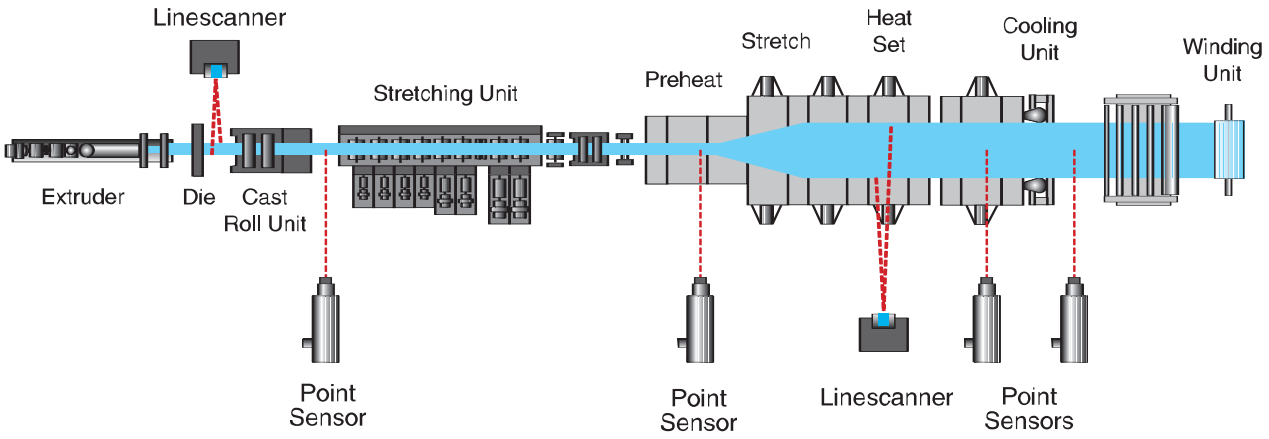


Figure 4: Biaxially-oriented Film Extrusion Process

Biaxially-oriented Film Extrusion

In a biaxially-oriented film extrusion process (similar to Figure 4), MP linescanners can be mounted at the die, to monitor the die bolt heater and take a melt temperature profile, and at the heat set.

Thermalert sensors can be mounted at the cast roll unit for chill roll control and at the preheater and cooling units, for heating and cooling control. A sensor mounted after the cooling unit helps determine if the product is cool enough for finishing.

Benefits:

- Early detection of die problems
- Realtime feedback for rapid zone temperature adjustments
- Greater thickness and tensile strength uniformity
- Less breaks and downtime
- Reduced scrap rate

Extrusion Coating

A molten web from a die is applied to paper, film, or foil in an extrusion coating process similar to Figure 5.

The distance between the die and the pressure and chill rolls is usually 75 to 125 mm. The resin temperature at this location must be very hot for the melt to adhere to the substrate. The narrow and often difficult to access measurement area is not a problem when using Raytek sensors. The operator can monitor and adjust the die heater and the chill roll temperatures either manually or automatically.

For adhesion to smooth surfaces, such as aluminum foil, other processes include heating the substrate, increasing melt temperatures, and adding chemical primers.

Thermalert sensors mounted after a preheater can monitor exit temperature and automatically adjust heating elements.

Another MP linescanner mounted after the chill roll or after the edge trimmer can help detect tear or irregularities before the product is cut or rolled.

Benefits:

- Enhanced surface finish uniformity
- Early detection of die bolt heater or cooler problems
- Better runnability and roll building
- Less breaks and machine downtime
- Increased productivity
- Reduced scrap rate

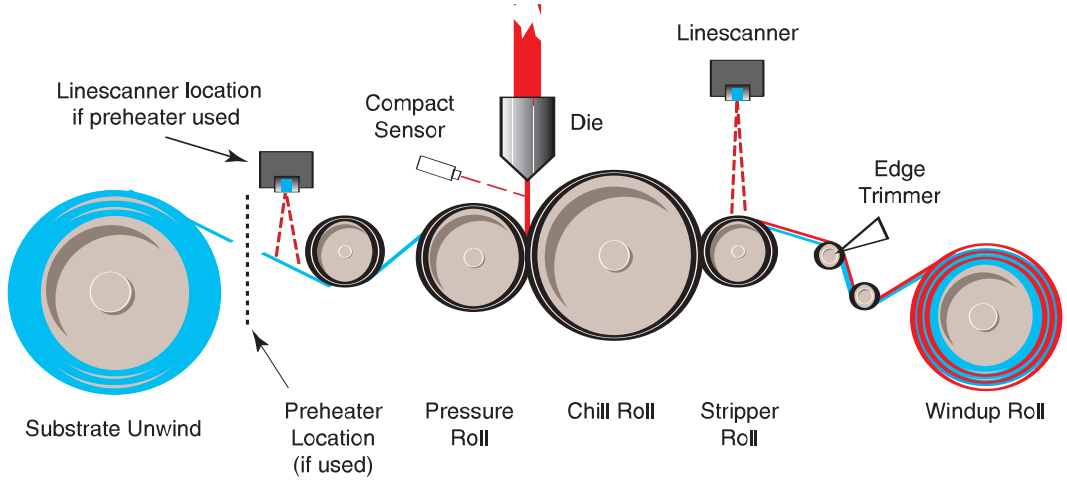


Figure 5: Extrusion Coating Process

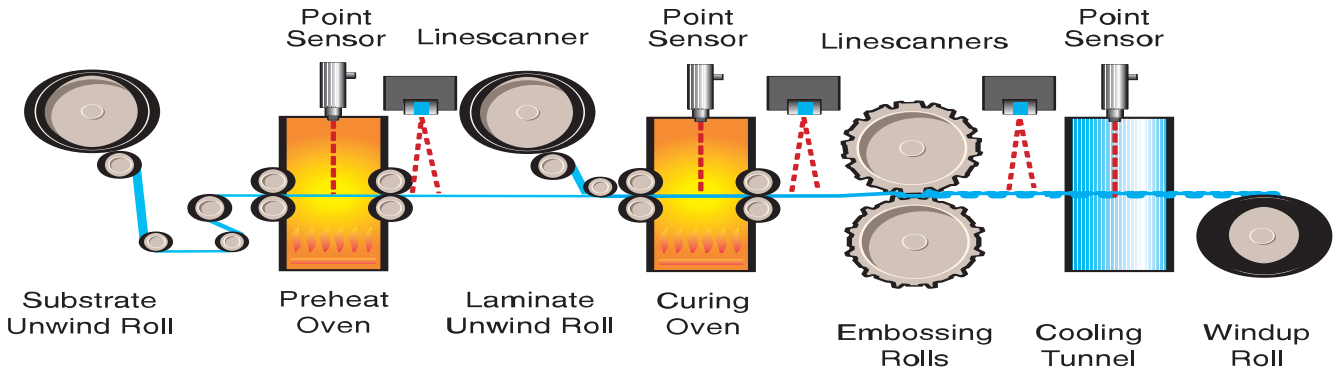


Figure 6: Laminating and Embossing Process

Laminating and Embossing

Figure 6 illustrates where sensors can be located so the laminating and embossing process runs smoothly and efficiently and produces a quality product. MP linescanners can be mounted at the preheat and curing ovens. At these points the linescanner can monitor cross-web temperatures and help in the control of adjustments to heating elements. At the cooling tunnel, the linescanner can monitor cooling efficiency. At the windup roll, the linescanner checks for tear or breaks in the material.

Benefits:

- Early detection of heater or cooler problems
- Help in heating and cooling control
- Less breaks and machine downtime
- Increased productivity
- Reduced scrap rate

Thermoforming

Figure 7 shows an example of sensor locations for a thermoforming process. If laminating is part of the process, a Raytek infrared sensor can ensure proper temperatures for laminating a multilayer product for subsequent forming.

An MP linescanner or Raytek point sensors positioned between the heater and the forming machine, or mounted as an integral part of the heater, can help monitor the material's temperature distribution at its proper level prior to entering the thermoformer.

Benefits:

- Improved quality and part uniformity
- Early detection of heater and cooler problems
- Better runnability of thermoformer
- Increased productivity
- Reduced scrap rate
- Energy savings

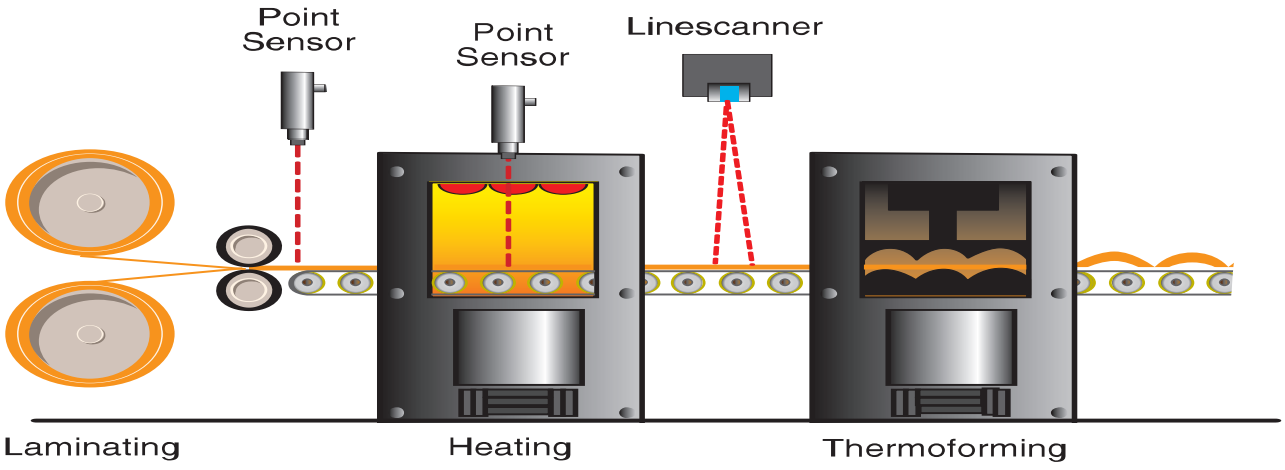


Figure 7: Thermoforming Process

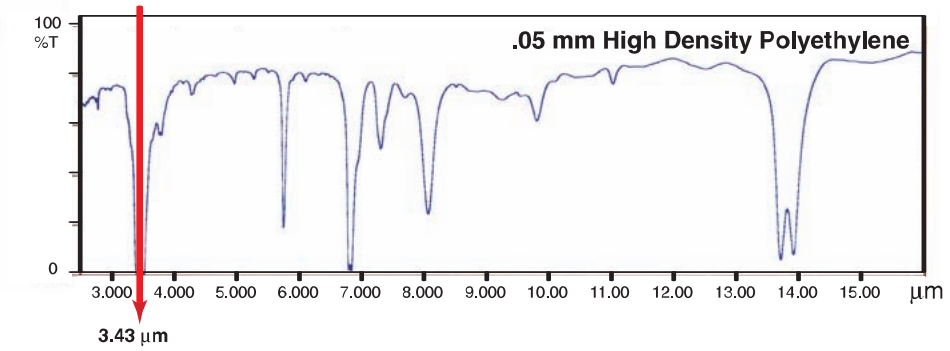
Solutions for Plastics Applications

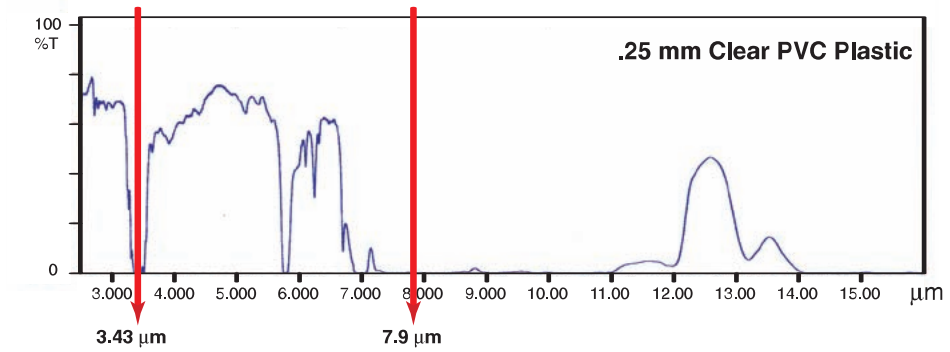
Raytek offers a wide variety of sensor types that can be used in plastics manufacturing processes. The infrared characteristics of plastics are governed by material type, thickness, and sometimes additives or applied coatings. Measuring thin film requires a specific narrow band spectral response, while thicker film or sheet can generally be measured by a broad band spectral response.

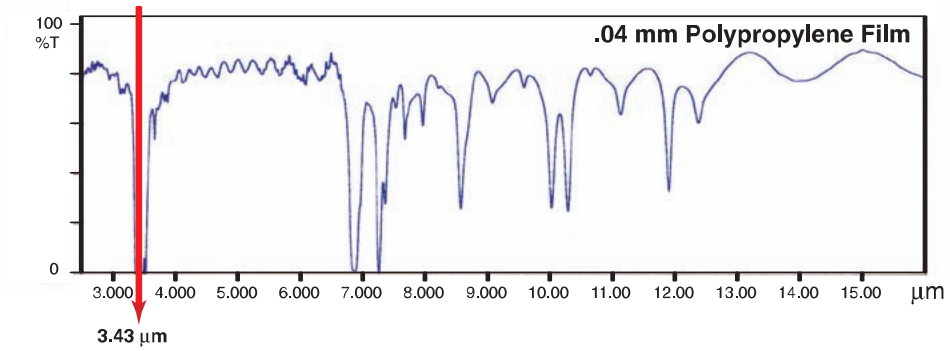
An infrared sensor is able to accurately measure a target's surface temperature through a narrow absorption band on the infrared spectrum. For measuring thin films, the sensor's "window" must coincide with the plastic's absorption band. Infrared wavelengths are measured in microns (µm). The following graphs are spectrophotometer readings of different types and thicknesses of plastics. The red arrows indicate where an infrared sensor can take accurate readings. All three types have absorption bands in the 3.43 micron range, but notice that the 0.25 mm clear PVC plastic also has a larger absorption band at 7.9 microns. Solid or coated PVC may only have an absorption band at 7.9 microns.

Other examples with a 7.9 micron absorption band can be film or thin sheets such as polyester, Teflon® acrylic, and polyurethane. Nylon can be measured by 3.43, 7.9, or 8-14 micron, depending on thickness. Thicker plastics and coated materials may fall in the 8 to 14 micron range.

Our application specialists can help you decide on the correct spectral response for each Raytek infrared sensor you need for your process. By sending them a small sample (approximately 10 x 10 cm), or samples of material at different stages of production, they can determine its optical characteristics and what wavelength is required.







Selecting an IR Thermometer for Plastic Films					
Thin Film Plastic Type*	Absorption Band 3.43 μ	Absorption Band 7.9 μ	TX / XR P7 Models	Linescanner P3 Models	Linescanner P7 Models
Acrylic	√	√	√	√	√
Cellulose Acetate	√**	√	√	√**	√
Fluoroplastic (FEP)		√	√		√
Polyester (PET)	√**	√	√	√	√
Polyimide		√	√		√
Teflon		√	√		√
Polyurethane	√	√	√	√	√
Polyvinyl Chloride (PVC)	√	√	√	√	√
Polycarbonate	√	√	√	√	√
Polyamide (Nylon)	√	√	√	√	√
Polypropylene	√			√	
Polyethylene	√			√	
Polystyrene	√			√	
Ionomer	√			√	
Polybutylene	√			√	
Glassine	√			√	

* **Plastics greater than 0.38 mm thickness, and highly pigmented films can be measured accurately using standard general purpose low-temp (LT) sensors, which have a spectral response of 8 to 14 microns.**

** **For films 0.25 mm.**

Other Processes

Raytek has temperature measurement solutions for every aspect of the plastic manufacturing process – from the melt to the packaging, from raw material to the finished goods.

If your process is not listed here, check with our applications specialists to see what Raytek product is best suited for you.

Raytek Solutions for Plastics Industries

Raytek manufactures a wide range of infrared products for the plastics industries: a value-priced linescanner that measures 256 individual points on each cross-section scan; miniature, low-cost sensors for accurate temperature measurement in hard-to-reach locations; and smart two-wire integrated sensors that can merge into existing process control systems. All sensors are easily customized to fit your application. (See above table.)

Raytek Point Sensors – a full line of compact and miniature sensing heads in two-piece (sensor and monitor) and integrated configurations as well as smart 2-wire noncontact infrared temperature sensors with remote online addressability. Measure temperatures of hot, moving, or inaccessible materials safely, accurately, and with repeatability you can count on.

MP50 Linescanner – the cost-effective way to measure edge-to-edge temperatures for control of product uniformity. Provides data for up to 256 points per scan, 48 scans per second, in a 90° field-of-view. And with DataTemp DP Windows software for the linescanner, remote temperature monitoring, remote scanner configuration, and data analysis is at your fingertips. View real-time and saved thermal images, and correct process irregularities before they become problems. Based on the MP50 unit we provide special application solutions.

TF100 System - Thermoforming: Thermal imaging and analysis to reduce scrap, improve product quality and operating economy of thermoforming processes.

EC100/ES100 Systems - Extrusion, Coating, Lamination: Thermal imaging and analysis for real-time defect detection and quality improvement of plastic extrusion, coating, and lamination processes.

Raytek Know-how and Service

With over 40 years experience, Raytek knows infrared temperature measurement. Our application specialists are located around the world to help answer your technical questions. In addition, maintenance, training, calibration and other customized services are available to ensure that you receive the maximum benefits from your Raytek infrared, noncontact thermometer. For more information on Raytek infrared temperature measurement solutions, contact us today.

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