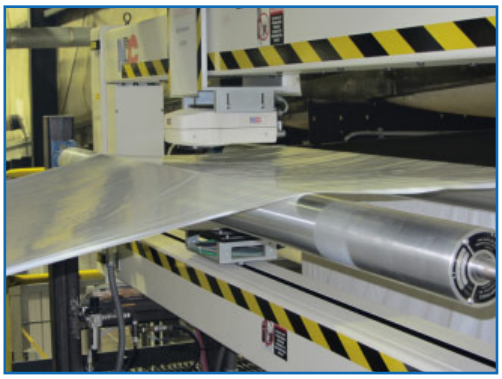
8110-BF Blown Film Web Gauging System

- NDC's precise single-film measurement and control from the double layflat product using:

- Double Layflat Separation Algorithm (DLSA)

- Advanced Profile Control (APC)

Blown Film Measurement and Control Results: Berry Plastics



NDC's FG710S infrared sensor scanning double layflat blown film

The NDC Web Gauging system installed at Berry Plastics, Indiana, USA represents a new generation of blown film gauging system designed for complex, multilayer blown film products.

The significance of this measurement configuration is its ability to quickly determine both the profile shape and the average web thickness. Typically this is accomplished in four scans or less, which provides responsive measurement, excellent process visibility and exceptional product quality.

In order to achieve faster measurement and tighter control response, a MiniTrak™ O-Frame scanner is installed following the collapser that measures the double layflat film thickness using an FG710S infrared sensor. This sensor provides co-extrusion thickness measurement for up to 4 components and component-specific control for product quality assurance and cost savings.

This advanced blown film system incorporates three key features that provide significant performance benefits compared to conventional blown film configurations which simply measure the thickness of the film on the bubble. They are:

High-Speed Near Infrared Barrier Component Measurement.

NDC is the industry leader in Infrared measurement of coextruded structures. The flagship product in this line is the FG710, which can measure not only total film thickness but also critical coextrusion components such as EVOH and Nylon content in the film structure.

Double Layflat Separation Algorithm (DLSA)

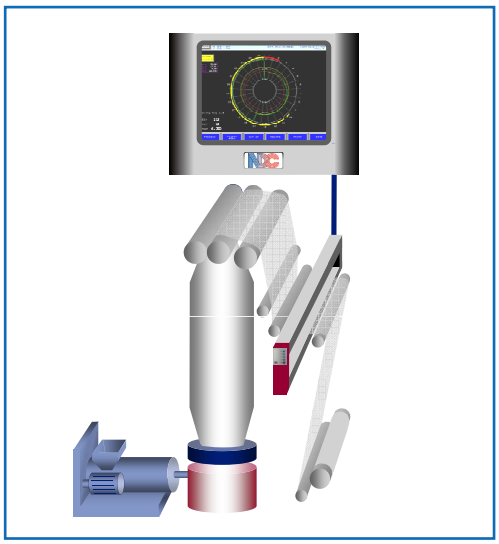
The system measures the double layflat film with a special algorithm that mathematically separates the top and bottom film layers to provide a continuous, full-width single layer thickness profile. The DLSA algorithm also includes Accumulator Modelling and Die Rotation Modelling that accurately maps the film against the die positions.

The DLSA uses the following elements as part of its control algorithm:

- Hauloff position
- Hauloff speed
- Hauloff direction of travel
- Bubble twist angle
- Diebolt positions

Automatic Profile Control (APC)

The APC control supervises the die bolt positions based on the DLSA profile measurement. The control also includes a 'smart' pulse alignment profile map.



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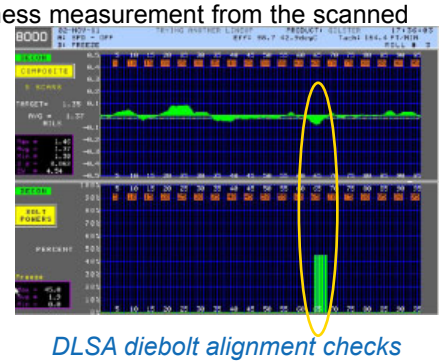
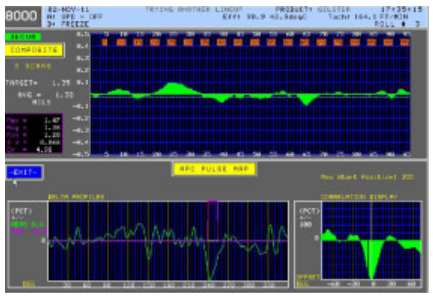
DLSA Results

NDC's double-layer deconvolution algorithm generates a valid single-layer thickness measurement from the scanned double layflat profile. The screenshot (right) shows bolts at 65, 66 and 67 set to 40% against a zero power profile. The measured profile shows a dip in the film thickness at exactly the same position across the web as the actuators that were adjusted. These experiments validated the performance of the DLSA algorithm.



DLSA diebolt alignment checks

This second example illustrates the response to a new rotating hauloff angle. This represented a change of machine speed from 140ft/min to 107ft/min and a hauloff angle change of 19° to 29°

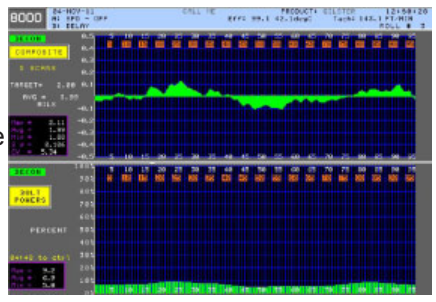


DLSA twist angle alignment response

The DLSA model dynamically adjusted to these changes while the controls continued to produce quality film without any change to the blown film setup parameters.

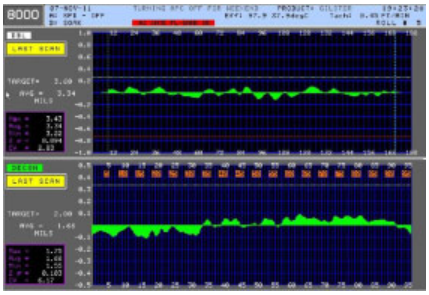
APC Results

Prior to initiating APC control, the 2-sigma deconvoluted composite profile variation is typically of the order of ±5.34%. The profile display (right) illustrates this situation.



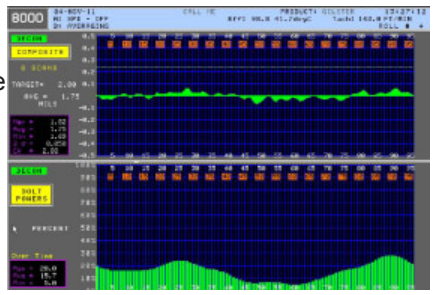
No APC control

This next example shows the initial APC control results of the last scan profiles without any gauge measurement filtering. The nominal thickness is 2.0mils (50 microns), with a 2-sigma cross direction spread of 0.1mils (2.5 microns) achieved during the initial tuning and validation of the APC controls.



Initial APC results

Once the DLSA and APC controls were fully validated, the next step involved fine tuning and performance documentation. Following the APC fine-tuning exercise, the profile variation dropped to around ±2.0%, or a 2-sigma value of ±0.05mils producing a profile spread improvement of 62.5% when compared to no control. This performance delivers a higher quality product and helps reduce downstream scrap due to profile-related winding and conversion problems. Also, because the quality variability is reduced, it provides an opportunity to downgauge the film and save raw material consumption.



Typical APC control performance

Berry installed their NDC system during mid-2011 and are satisfied with the results it has produced for them. Based on this performance, they have since purchased two similar NDC systems for other blown film lines within the Berry organization.

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