

# Hot Melt Pressure Sensitive Adhesives Benefit From Near Infrared (NIR) Measurements Throughout

## The PSA Supplier & Converting Process

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In packaging, converting, assembly, bookbinding, nonwovens, footwear and many other markets, hot melt glues and adhesives offer a critical advantage: fast processing. Unlike water-based or solvent-based adhesives, hot melt adhesives do not require drying. Hot melts begin bonding almost immediately after application, as they cool down to their solidification point.

This fast solidification is ideal for use on highly automated manufacturing lines that require rapid bond formation. While the moisture contained within pellets and glue pillows is very low, problems occur when surface moisture accumulates during the manufacturing process prior to packaging for shipment.

Near infrared (NIR) transmitters can measure moisture to insure product quality and avoid “crackling” in the melter. At the converter location, NIR meters can measure the hot melt thickness on film, paper, foam and other substrates for quality and process control. Mounting these transmitters on a scanning frame equipped with a position encoder, the web profile can be mapped on a PC to assist in maintaining a uniform profile across the web for coatings and moisture.

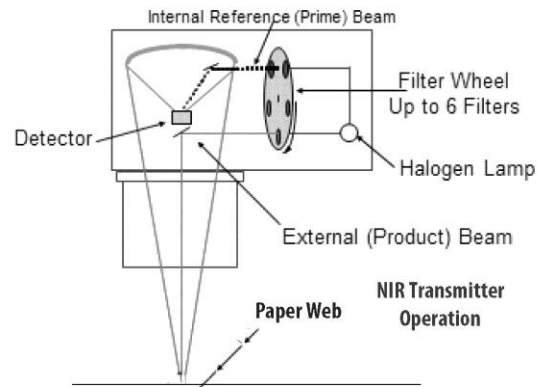
Die bolts, Doctor blades and other hot melt applicators can be optimized quickly to speed start up times, increase production and reduce scrap with the implementation of NIR hot melt thickness measurement transmitters.



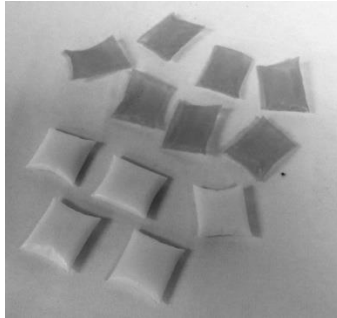
## Near Infrared Transmitters Are A Low Cost Highly Accurate Alternative to Nuclear and Microwave

Near Infrared (NIR) Transmitters operate in a normal light spectrum (1100 – 2400nm) and require no regulation such as Beta, Gamma, XRay and Microwave technological systems may require. NIR relies on overtones and focuses on moisture at 1.94 $\mu$  and 1.43 $\mu$  (H-O-H Bond), 2.34 $\mu$  Hydrocarbon bond, sometimes 1.72 $\mu$  oil bond or other selective wavelengths. NIR is well suited for moisture, residual moisture, hot melt thickness, wet end water based coatings, dry end organic coatings and film thickness on paper, non-woven, film, foil, metallic and other substrates. NIR is not suitable for 100% silicone coatings as there is not a strong enough absorption to make a reliable measurement at the Si bond/vibration at such a low thickness. NIR can measure water based silicone or siloxane by measuring the water band with constant liquids/solids ratio. NIR is also not suited to discriminate hydrocarbon co-extrusions as it is measuring broad absorption bands, unlike the sharp spikes in the higher mid-infrared region. NIR is an economical, accurate and reliable measurement for those applications that it is well suited.

Essentially NIR Transmitters shine light at a wavelength where either the hydrocarbon hot melt or moisture absorb and at one or two wavelengths where they do not absorb and ratio the resultant measurements generated by a lead sulfide (PbS) detector to supply a measurement of thickness or moisture.



# Hot Melt Resins and Pillows

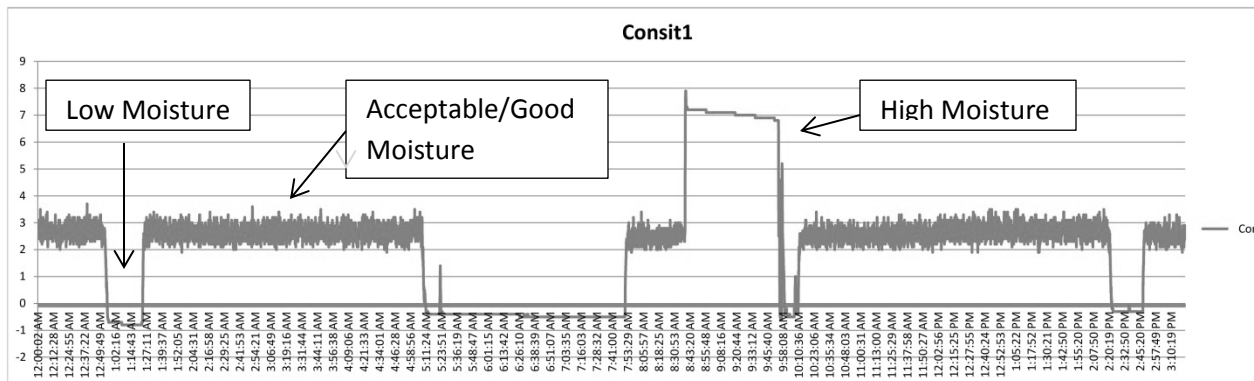


Hot melt manufacturing includes pellets, pillows and other delivery systems that benefit from moisture measurement. Glue pillow manufacturers report increasing demand as customers move from drums to returnable/recyclable containers. While the moisture contained within the glue pillow is very low, problems occur when surface moisture on the pillow exterior accumulates during the manufacturing process prior to packaging for shipment due to humidity in the manufacturing.

The Near IR moisture transmitter is mounted 8-18” above the conveyor where it scans product only, with few gaps between pillows. An angle wedge or diverter may be installed that insures constant glue pillow product under the transmitter without slowing the overall product flow. The intention of measuring moisture on the glue pillow is not to determine absolute moisture but to determine when the surface moisture is within acceptable limits.

Samples of low, acceptable and high moistures are presented to the transmitter and it is scaled appropriately. For example, low surface moisture is assigned a value of 0, acceptable 3 and high moisture 5. The transmitter typically supplies a large digital display, 4-20 mA proportional analog output and/or Ethernet connection.

Hot Melt Pillow Surface Moisture Trend Chart

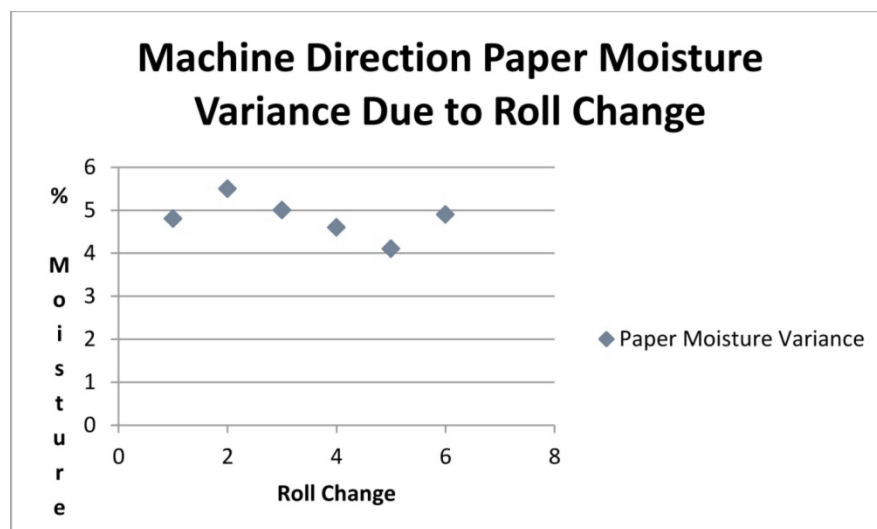


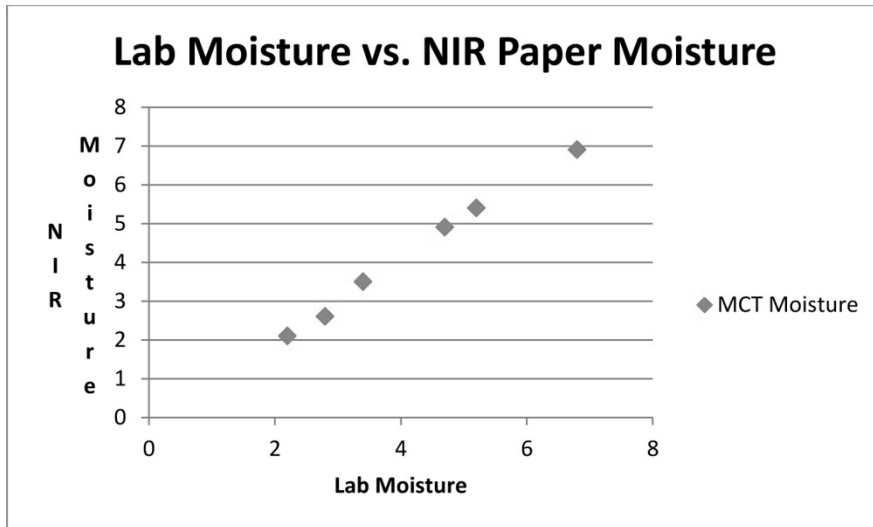
## Paper Moisture



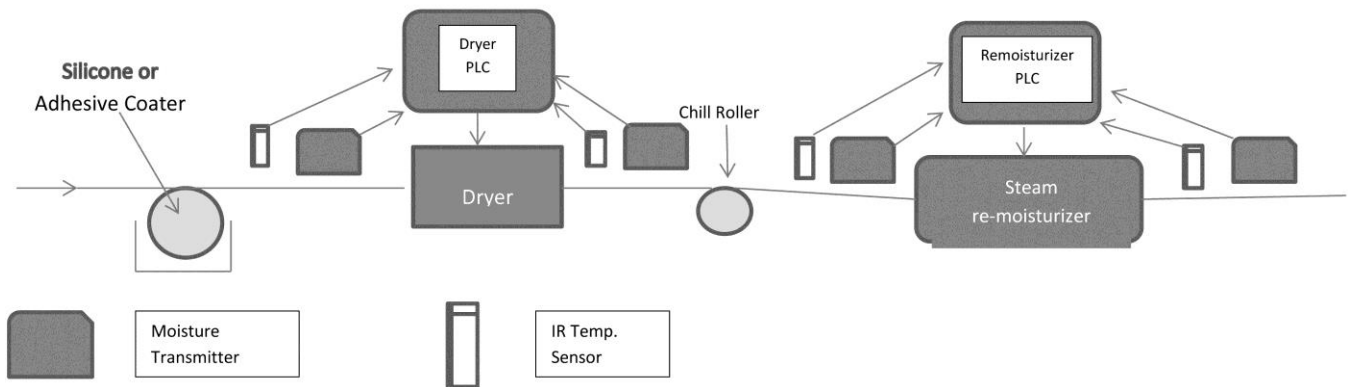
Edge curl and lay flat issues are often addressed with re-moisturizers in the label and converting manufacturing industry. Uneven moisture stratification can cause shrinkage or expansion of cellulose fibers as they equilibrate resulting in curl, especially at the paper web edges. Moisture variance in layers during the lamination process can also cause lay flat problems, especially when high temperatures are used for silicone coated release liners. Curled stock is a problem for printing and packaging operations that need consistent flat product for efficient operation and low maintenance. Label stock manufacturers often re-moisturize product after drying or curing to raise the moisture to the original level and thereby reduce or eliminate curl. Common methods of re-moisturizing include liquid application systems (LAS), water disks and sprays and steam curtains or applicators.

LAS 3 roll systems control the moisture profile with nip pressure and skew control. Steam curtains and water disks control moistures in zones across the web with pneumatic control. Employing NIR transmitters to measure moisture across the web allows for manual or automatic control through an HMI/PLC interface to maintain uniform moisture.





Measuring moisture at the Dryer Exit insures proper moisture and residual moisture and coatings to avoid problems in storage and shipping prior for the end user. For example, applying a water based coating on film with an uneven profile can lead to roll deformation over time as the moisture seeks to equilibrate. An example of a steam re-moisture is illustrated below.



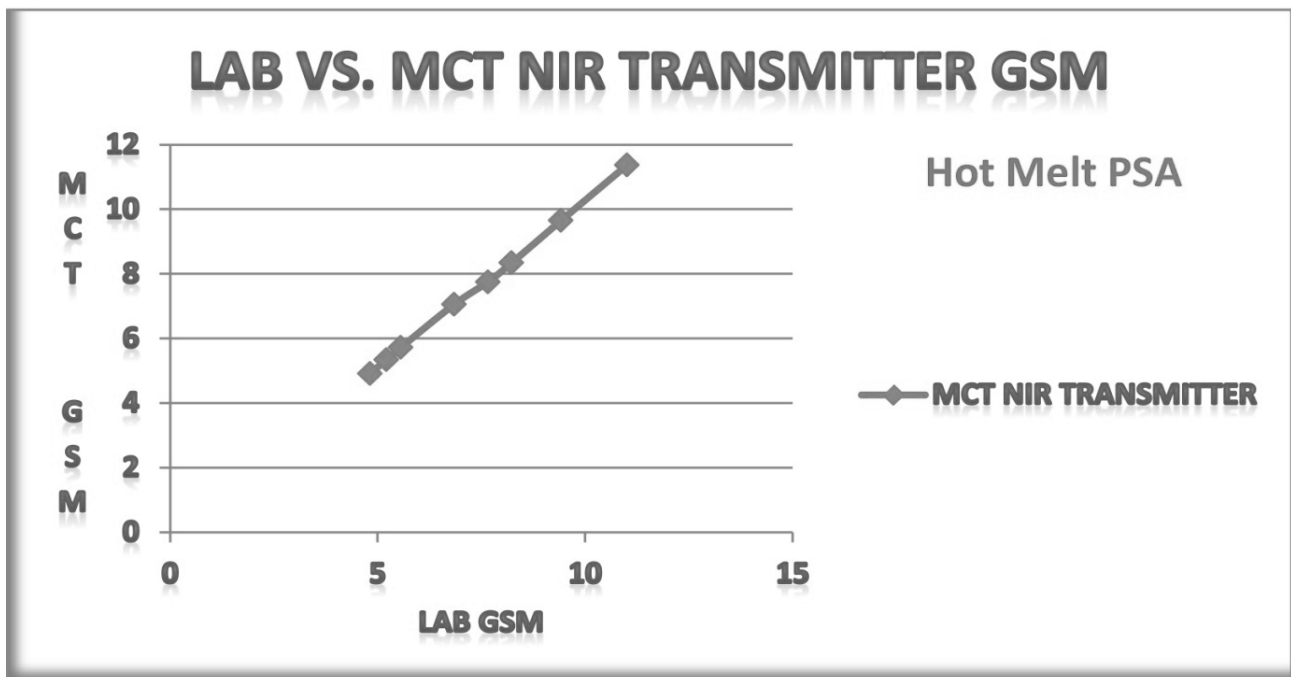
## Hot Melt Thickness

Hot Melt Measurements are typically measured with Near Infrared (NIR) transmitters that provide a digital display in engineering units, analog outputs and a digital interface. The NIR non-contacting Hot Melt measurement is extremely accurate and stable with no regulatory requirements. The measurement can be fixed point or scan across the web to provide a cross direction web profile so that die bolts, Doctor Blades and other applicators can be controlled to obtain uniform profile. Small and medium hot melt adhesive converters often have to stop the run, send a sample to the lab, await results, make adjustments and begin the process again. Employing NIR transmitters allow for quicker start up

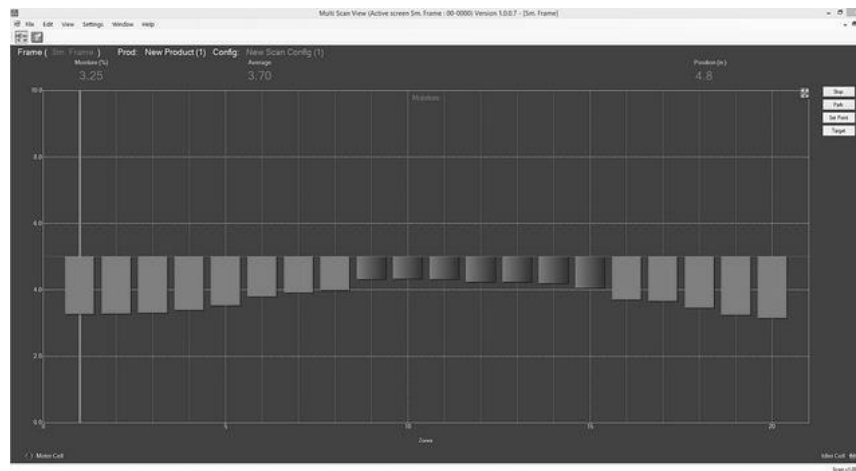
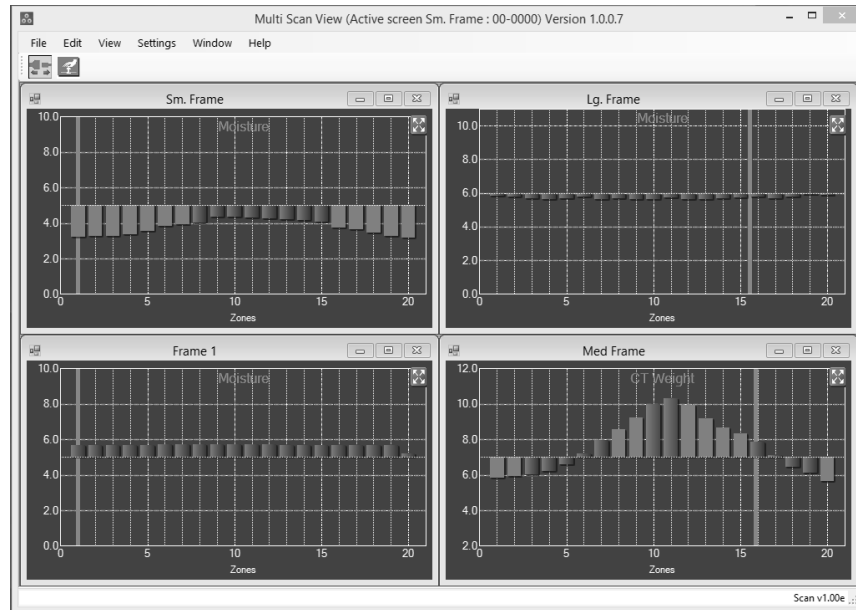
optimization increasing production and improving Quality Assurance. Roll reports can be archived to maintain customer roll data histories and determine the cause of root problems.

### Hot Melt Thickness

GSM	Lab	MCT NIR Transmitter
	4.82	4.91
	5.21	5.34
	5.56	5.72
	6.84	7.05
	7.66	7.75
	8.23	8.34
	9.42	9.65
	11.01	11.37



Cross Direction Web Profiles are shown below.



## Conclusion

Near Infrared Transmitters serve as an economical tool throughout the PSA Hot Melt manufacturing process and can be employed to optimize performance and cross direction web profiles for hot melt thickness, moisture and residual moisture.

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