ADVANCED ADHESIVES REPORT

Your corrugating adhesives newsletter from Harper/Love Adhesives Corporation

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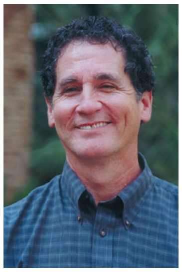
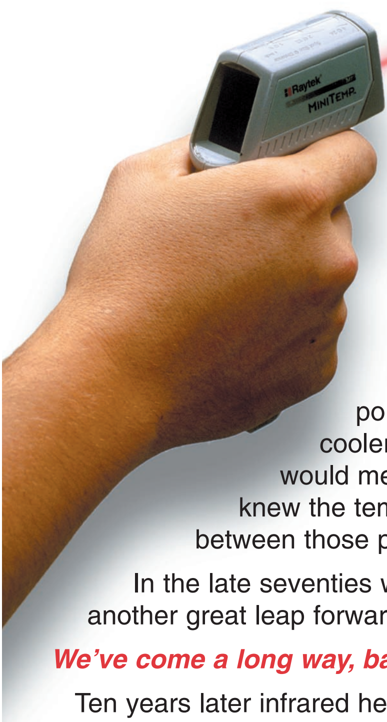


Be careful where you point that thing!

Monitoring temperatures with an infrared heat-sensing gun

by Jack Herrick

Thirty years ago we didn't have the benefits of IR technology; we relied on SST – *Semiscientific Spit Technique*. We spit on the roll. If the spit bounced off fast, the roll was hot enough; if it just kinda lay there and sizzled, it wasn't. In those days we weren't concerned with liner or medium temperature; we cared about preheater, hot plates, and machine temperatures.



Later came wax sticks, which were more accurate than spit, and a great boon to saliva-challenged operators. Rated at different temperatures, wax sticks were applied to heated surfaces. If a stick melted, we knew the surface temperature was at or above the stick's melt point. If it didn't melt, we knew it was cooler. For example, if a 250°F stick would melt but a 275°F stick wouldn't, we knew the temperature was somewhere between those points.

In the late seventies we used a contact pyrometer– another great leap forward but it took longer to use.

We've come a long way, baby

Ten years later infrared heat-sensing guns became available. The latest models have a laser targeting beam that is a great help in locating the exact spot you wish to measure. The accuracy of the reading depends on the surface. For best results, surfaces should be painted flat; shiny surfaces do not give accurate readings.

Today we are seeing permanently mounted infrared heat sensors installed in various places on the corrugator to monitor paper temperatures. Sophisticated systems tie these sensors into automatic control units that regulate temperatures by increasing or decreasing wraps.

Temperatures today

Liner and medium have gone through significant changes in the past 10 years. Among other things, caliper is generally less for a given basis weight; the sheet is denser and transfers heat faster. This puts great importance on monitoring liner temperatures because too much heat causes surface bonds, cracked scores, warp, and other problems.

Our target paper temperatures at all test locations will range from 180°F to 220°F. When recording these temperatures, note paper grade, speed and temperature. Before starting your audit, make sure the order is long enough to maintain a constant speed until you're done.

Where to measure temperatures

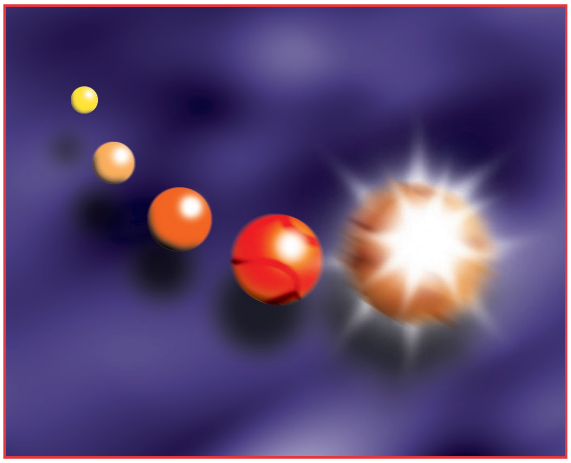
1. Check the liner coming off the preheater. Measure the temperature about 5 inches in from the edge of the web on both drive side and operator side. Temperatures on both sides should be within 15% of each other. Greater differences can cause twist warp. If your measurements vary greatly, check for an out-of-parallel wrap arm on the preheater.
2. Check the liner entering the single facer at the pressure roll, and as it comes out of the pressure roll-corrugator roll nip. Measure both sides, as with the preheater. These two checks are critical to ensure proper bonding, especially with high ring crush liners.
3. The medium is checked coming off the preconditioner on both sides of the web.
4. If you do not have a medium preconditioner, the entrance to and exit from the corrugating rolls will be your checkpoints.
5. Single-face web temperatures are checked on both the medium and the liner surfaces. Check just after the preheater and just before entry to the hot plates.
6. Check the double-backer liner as you did the single facer liner-coming off the preheater—and again just before it enters the hot plates.

For additional information, call Jack Herrick at 800-438-3066, extension 521, or e-mail at jherrick@harperlove.com

What is the real gel point of your adhesive? Why does it matter?

by Bill Nikkel

The conventional method of determining the temperature at which a starch corrugating adhesive gels does not accurately predict the actual temperature at which this adhesive gels on the corrugator. The actual gel point on the machine is, in fact, much higher than the one established with the conventional method.



The conventional method of establishing a gel point is to heat slowly a relatively large volume of adhesive over a period of several minutes. On the corrugator, a small volume (glue line) has to gel during a very short dwell time. In the case of the double facer, this dwell time, at high speeds, is just a matter of a few seconds. At the single facer this dwell time is only a fraction of a second.

The gelling of a thin film of starch (like a glue line) can be clearly observed under a microscope while this starch is being rapidly heated, closely simulating conditions on a corrugator. Tests conducted in this manner show that to gel such a small quantity of starch in just a few seconds, a temperature in the range of 190° F to 210° F is needed when using a starch adhesive which has a conventional gel point of 150° F.

This tells us the gelling process depends on time as well as temperature: It takes a certain amount of heat energy to gel the starch and this amount of energy can be applied at a low temperature over a long period of time—or at a high temperature for a short period of time. (An analogy would be what happens in a pressure cooker, where cooking time can be reduced by increasing the cooking temperature.)

Test results show not only that shorter heating times require higher temperatures to achieve gelation, but also that initial conventional gel point values have little effect on the actual short-term gel point on the machine. Adhesives with conventional gel points ranging from 140° F to 155° F all gel at about the same much higher temperature when subjected to the same short heating period.

There is an important message in these findings related to the length of a double facer heating section.

There has been a tendency to shorten double facers to reduce space requirements. A result of such shortening is a reduction in dwell time (heating time). This means the real gel point will be higher. The problem becomes one of having less time to reach a higher temperature to gel the starch.

To achieve high running speeds it is necessary to have a rapid rate of heat transfer, which requires elevated heating vessel temperatures and intimate contact between the paper and the heating surfaces. In addition, it becomes necessary to use stronger adhesive mixes with higher solids and performance enhancing additives.

So think twice before shortening your double facer. It will result in continuing higher adhesive and energy costs and reduce potential running speed.

How Does an Infrared (IR) Heat-Sensing Gun Work?

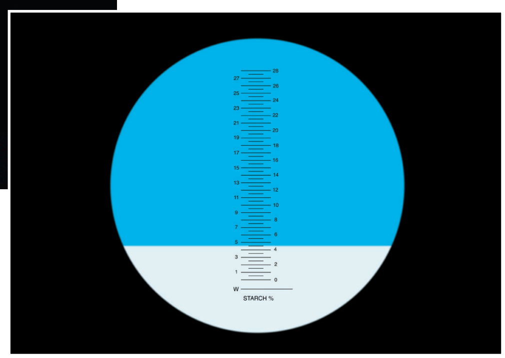
An IR gun does not measure temperature, it measures IR radiation. All materials radiate infrared energy, some is emitted some is reflected. The hotter the object the more energy it gives off. Infrared is a type of light not visible to human beings (below 750 nm).

The amount of radiation given off by an object depends on its emissivity and will vary with its color and surface type. Dark rough surfaces will radiate more than shiny light surfaces. Surfaces such as kraft paper or anything painted with flat black paint will have an approximate emissivity of 95%. Coincidentally, most guns have this as a preset or default value. New guns like the Raytek MiniTemp are nonadjustable and come preset to 95%. This is why it is recommended that preheaters and hotplates be painted with flat black paint prior to using an IR gun on them; if left shiny they will radiate less IR and appear to be much colder than they really are.

Rex Woodville-Price

Calculating starch adhesive percent solids

Think pounds, not gallons



by Peter Snyder

The total percent solids of starch-based corrugating adhesive is the ratio of so-called dry material to total batch weight. There was a time when only the carrier starch and the slurry starch were included in the calculation. Today, all ingredients are used to generate percent solids; the dry material may include liquid caustic soda, performance enhancers, or resin ingredients.

For box plants with newer starch kitchens, the percent solids of the adhesive in use may be available on the computer touch screen or on a print-out of the batch histories. For those box plants making adhesives manually or in semiautomatic systems, the following calculations may be useful.

The most common error in calculating the percent solids is that water is typically measured in *gallons* and everything else is measured in *pounds*.

Second, for plants located in colder climates, steam dilution water can add a significant amount of extra water to a batch, thus lowering the percent solids, especially in winter. Steam dilution water is added by the action of the steam during the heating steps of the primary and/or secondary mixers. The only way to know for certain how much extra water is being added to the adhesive by the steam is by obtaining a gallons-per-inch volume chart for both mixers and measuring the *inches down* both before and after the heating steps. You may find the *after* measurement is an inch or two higher, which means there is additional water present. Use the volume charts to determine how much water is being added for each heating step.

To calculate percent solids of a typical adhesive, we first need to determine total dry weight and total batch weight:

	Solids wt.	Water wt.	Batch wt.
Carrier starch	300 lb.		300 lb.
Slurry starch	1,400 lb.		1,700 lb.
Caustic soda	36 lb.		1,736 lb.
Borax (5 mol)	24 lb.		1,760 lb.
Total solids	**1,760 lb.**		
Primary mixer water*		1,834 lb.	3,594 lb.
Primarary steam dilution*		125 lb.	3,719 lb.
Secondary mixer water*		3,044 lb.	6,763 lb.
		Total batch	**6,763 lb.**

** Water weight is calculated at 8.34 lb. per gallon*

Percent solids calculation:

1,760 lb. dry weight

6,763 lb. batch weight

= 26.023% solids

A refractometer (photographs) is a helpful tool for measuring the percentage of dissolved starch in a solution. Since the only dissolved starch in your batch is in the carrier portion, you are actually measuring the ratio of your carrier starch solids to the total amount of water in your formulation.