Cork Tech TalkNews

Manufacturers of Waterbase, UV+EB Curable Coatings, Varnishes and Adhesives

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FACTORS AFFECTING HEAT SEAL COATINGS

There are many variables to be considered and controlled, when using heat seal coatings. Understanding these factors is key to proper use. They may be summarized as follows:

Heat Sealing Coating Formulation

- Adhesive & cohesive strength
- Softness
- Hardness
- Activation temperature

Substrates

- Surface adhesion
- Wettability
- Dyne level
- Smoothness/roughness
- Paperboard fiber tear
- Filmic deformation temperature
- Heat transfer

Sealing Conditions

- Temperature
- Time (dwell)
- Pressure

Coating Application Factors

- Coating weight
- Retained solvent or water
- Humidity (ambient)
- Temperature (ambient)

Formulations

One key fact to know concerning heat seal coatings is that most are formulated to produce a seal at a relatively low temperature (activation temperature). This is influenced first of all by the desire for high heat-sealing production line speed. Secondly, the low deformation temperature of many plastic filmic substrates must be considered.

The formulator of heat seal coatings is faced with striking a balance of properties, depending on the conditions of use outlined by the user. Adhesion (bonding to a substrate) is always listed as a key to performance as is cohesion (internal strength of the heat seal coating). Activation temperature is another key to effective performance that is controlled by the basic formulation. Raw materials, such as low-molecular weight polymers and plasticizers, will contribute to making a soft coating formulation. High-molecular weight polymers and certain fillers can make a coating hard. Softer formulations have a tendency to bond better to substrates, but softness can also lead to blocking possibilities once a substrate is coated and stored in sheeted or roll form.

Substrates

Substrates are as important in the performance of heat seal packaging as is the heat seal coating. Substrate wettability is a necessity if the coating is to be applied uniformly, and dried to produce an effective heat-sealing medium. Paper and paperboard are usually not an issue, but plastic films and metallic substrates are. Smoothness/roughness is a factor, as a rougher surface will physically accept a coating better. A rougher surface allows bonding by physical means, as the coating anchors itself to the surfaces rough characteristics. Many plastic films, especially the polyolefin's, will require either corona or flame treatment to raise the substrates surface energy (dyne level). This will then allow effective coating bonding to occur. Heat seal coatings can also be formulated with specific additive materials that allow good adhesion to aluminum surfaces.

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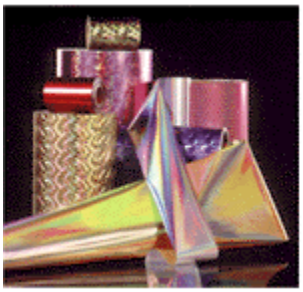
Cork Industries, Inc. 500 Kaiser Drive Folcroft, PA 19032 610.522.9550 F 610.522.9659
Elmer W. Griese, Jr. 440.353-0980 ewgriesecork@attbi.com
Website http://www.corkindustries.com

Blister packaging is a specific heat seal coating application where the substrate is vitally important to the functionality of the created package form. In blister packaging it is important that the blister paperboard be constructed of such density and fiber alignment strength, that integral paperboard fiber tear is inherent to destructive package opening. Paperboard not designed specifically for blister-packaging use, will fail in opening, as fibers too strong in one direction will cause poor fiber tear in a perpendicular direction. The insulation property of paperboard is also an issue because, during sealing, heat is conducted through the board thickness to activate the opposing heat seal coated surface.



Another specific heat seal coating application is hot foil stamping. Heat seal coatings are applied to the metallized side of a plastic carrier film. An engraved die and a heated press are used to heat seal transfer the thin metallized decorative film to an applicable substrate.

Sealing Conditions

Heat seals (bonds) occur when the correct combination of temperature, time, and pressure is applied. The result of subjecting a heat seal coated substrate to a target temperature, time (dwell) and pressure, causes the heat seal coating to soften. The applied pressure forces the softened heat seal coating to contact the secondary substrate surface, such that the heat seal coating flows onto it and bonds to it. The platen temperature is often far higher than the activation temperature of the heat seal coating, because the heat must be driven through a substrate. Most heat seal coatings have a critical minimum temperature beneath which they will not seal (bond). Usually the bond will become better as temperature is increased.

The time and temperature relationship is very important. For example, a high platen temperature combined with a short dwell time can produce the same sealing (bonding) result as a lower temperature and a longer dwell time. Consideration must be given to equipment capabilities and the limitations of substrates. A heat sensitive substrate will dictate the use of lower temperatures and longer dwell times. Ideally, one reaches a balance where the production operation is optimized for speed, high productivity and bond quality.

Pressure needs to be applied adequately to physically place the surfaces to be bonded in intimate contact, until a bond can form. There is always a minimum of force that will hold two surfaces in contact and better bonds will result when this minimum is exceeded.

Coating Application Factors

Proper applied coating weight is essential to the specified performance expected. Light coat weights can lead to bond failures if too little coating is present to effectively wet out and bond itself to the secondary substrate. Additionally, the coating must have adequate cohesive strength for the purpose intended, or adhesive failure will result.

Another detriment to achieving satisfactory bonds can be solvent or water that is retained in the heat seal coating after drying. These retains can act as softening or plasticizing agents, creating compromised bond strength.

High ambient temperatures acting on stored heat seal coated materials can cause blocking. High humidity, high temperature and high pressure are the enemy of heat seal coated substrates in storage, as these combinations of conditions emulate the conditions required to effectively heat seal the substrates.

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