FORM VS. SUBSTANCE IN HOT MELT ADHESIVES

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Application:

Often the manufactured form of an adhesive creates not only significant value to the user but also provides commercial use and application.

Hot melt adhesives provide measurable value to end users. That value frequently comes as much from the form of the adhesive as from the adhesive performance. Some end use applications reviewed in this paper include hot melt adhesives used in case and carton sealing, lamination, container labeling, pressure sensitive tapes and labels, disposable nonwovens, and product assembly. Forms that often add value include pellets, powders, webs, extrusions, pre-applied coatings, "tack-free" forms, and others. The paper also explores methods for evaluating how to measure this value and additional potential value-added features to which the marketplace might attach value.

Hot melt adhesives are unique in many respects relating to supplied form and its importance to delivering measurable value to the application. Unlike hot melts, typical liquid adhesives are generally viscous yet flowable materials at room temperature. Although equipment selection is important, the form of the adhesive seldom varies except container size. Certainly, exceptions exist, but hot melt adhesives remain unique by the simple fact that they require melting before application. The form of a hot melt adhesive is therefore critical to its success or failure in a given application.

In many respects, hot melt adhesives are a classic example of trying to fit a square peg into a round hole. The adhesive must arrive at the end user in a form that not only meets all the technical requirements of the application in terms of adhesion, melt characteristics, etc., but also in a form that fits into, melts properly in, and can be ultimately supplied in melt form to the substrates for bonding or assembling. Understanding of these requirements is important to raw material suppliers, adhesive formulators, equipment suppliers, design engineers, packaging engineers, and virtually all downstream participants in the value chains.

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Hot Melt Adhesive Markets

Hot melt adhesives represent approximately 20% of the more than six billion dry pounds of adhesives consumed in the United States annually. They also comprise about 16% of the more than 4.9 billion pounds consumed in Western Europe. This is a significant and important category of the global adhesive industry. Participants must understand the important characteristics of the value chains in the ultimate market segments.

Focusing solely on the United States market, packaging applications represent the largest single use category for hot melt adhesives comprising almost 55% of domestic volume. The next two largest markets for hot melts in the United States are pressure sensitive hot melts and hot melts for the manufacture of disposable non-woven articles. Each category represents approximately 14%-16% of the total consumption of hot melts in the United States. Packaging applications include corrugated assembly, case and carton sealing, lidding, container labeling, double wall bag manufacture, pallet stabilization, aseptic packaging, straw bonding, and flexible packaging. Collectively, the packaging, non-woven, and pressure sensitive markets represent more than 75% of the total hot melt adhesive consumption in the United States.

Since non-wovens and tape and label applications use use pressure sensitive formulations, one would suspect many similarities. In reality, these are highly differentiated markets requiring vastly different performance and application characteristics. In the case of tape and label markets, more than 50% of the volume is produced captively and typically consumed at the point of formulation with no cooling or packaging occurring between formulation and application to the web. In such an instance, the form is very simple. It simply comes immediately from the extruder/mixer. Collectively, these three markets represent more than 75% of the United States hot melt adhesive consumption.

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Forms

Hot melt adhesives come in almost as many forms as crayon colors. Each adhesive form does have specific advantages and disadvantages for a specific application.

Perhaps the simplest form for hot melts is the use of bulk packaging such as drums. Commonly used in the merchant pressure sensitive tape and label markets, drums offer convenient use in tandem with the various drum unloaders on the market that can deliver adhesive to a large volume coating head safely and efficiently. Pressure sensitive hot melts offer unique challenges to the adhesive formulator, equipment supplier, and end user due to the tacky nature of the adhesives at room temperature. Melting equipment today minimize char and maximize efficiency. Multi-station unloaders often provide a continuous delivery of adhesive to the application. This form of delivery cannot compete economically with much captive production in that market where the adhesive is never cooled or packaged but delivered directly to the applicator from the mixer in a heated form.

Other applications require different forms to deliver hot melt adhesives to the application efficiently. Another important packaging market segment also uses the high room temperature tack of a pressure sensitive hot melt adhesive but unfortunately cannot justify bulk packaging in drums, etc. due to the smaller volumes consumed at a given application point. A prime example would be polyester bottle labeling where oriented polypropylene film labels are applied at very high speed to empty or filled bottles. In this instance, as little as 0.2 g of adhesive is applied to each container. The adhesive requires melting in a small efficient melter. The adhesive form must be capable of easy handling, placement into the relatively small opening of the melt tank, and melting at an efficient rate. Perhaps some creative and innovative packaging concepts for hot melt adhesives will find use for pressure sensitive hot melts. Since pressure sensitive hot melts are generally extremely tacky at room temperature, developing forms capable of easy handling when used in small melt tanks that will also melt at a reasonably functional rate has been challenging. Early pressure sensitive hot melt

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adhesive packaging used "blocks" or "bricks" lined with waxed or silicone treated paper. These are difficult to handle and are often sufficiently large that they melt slowly or cool the entire melt tank in use. More recently, easier to handle forms have become available. Many approaches use non-tacky polymer films or coatings to produce an easily handled and reasonably small "unit" that can very readily fit into most commercial melt tank systems. The amount of polymer in the protective coating is generally small and does not influence the performance of the applied adhesive.

Some successful products use a coextruded EVA to cover the normally tacky surface of the adhesive. Such products have gained the name "tack-free packaging" and have been very successful in the marketplace. Most suppliers do instruct end users to clean tanks as recommended to avoid the possibility of the tank becoming rich in EVA. This could change the properties of the applied adhesives. In practice, few problems exist. Patents for the coextrusion approach have recently expired, but the high capital cost of implementing such a package has limited its broad use except by large, well-established adhesive suppliers. Having such a convenient package is a measurable competitive advantage in the marketplace.

Other approaches to addressing this problem with pressure sensitive hot melt adhesives have been the development of "sausage packs." These are film wrapped quantities of tacky adhesive that provide easy handling. They are typically one or more pounds in mass and are very usable in larger capacity melt tank systems.

In some instances, the formulative nature of the hot melt adhesive dictates the possible forms for supply. For highly filled hot melts used for applications such at edge banding, etc., the filler content allows an extruded and chopped pellet to be most easily produced. Such a form finds ready use in the hot melt applicators typically with these applications. The presence of fillers in the formulated adhesive limits the type of applicators and packaging machinery to those without gear pumps.

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In case and carton sealing applications, the most common forms of adhesive are slats, pastilles, and pellets. These forms are very easy to handle and offer melt rates that are ideal for most commercial melt tank systems. They are also economical to produce and package into reasonable sized boxes or bags by the adhesive suppliers. In most packaging applications, having a small box or bag that can easily be moved to the particular packaging line is desirable. In some large automated packaging operations, bulk handling systems can allow the adhesive supplier to provide these small forms of adhesives in bulk totes or bags distributed to multiple packaging lines by vacuum systems. These usually require a totally tack free form of adhesive. The best form is a small, easily-flowing, dry form.

Conclusion

The form of an adhesive is often equally as important as the adhesive properties for a formulated hot melt adhesive. The form must match the application requirements when considering product distribution, addition to the melting device, and impact on the melt rate of the adhesive itself and that already in the melt system at the time of addition. Adhesives must also exhibit all the basic requirements for a given application-melt properties, adhesive properties, resistance to char, etc. Adhesive formulators can often enjoy success at an end user with the best form of adhesive even if some other property is deficient vs. a competitive offering available only in a less convenient form. Having the proper form of adhesive can take significant costs from the value chain for the end user. A savvy adhesive supplier can capture a share of this value.

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Bob joined ChemQuest in 1999 with 27 years experience in the Adhesives, Sealants and Coatings Industry. Prior to joining ChemQuest, he served as Business Manager and New Business Development Manager of Ashland Specialty Chemical Polymers & Adhesives Division. He brings with him extensive knowledge and experience in developing high-productivity sales and marketing teams, developing business processes, market assessment, competitive analysis and business modeling. His primary strategic focus has been in catalyzing growth through internal initiatives as well as business and technology acquisition, licensing and partnerships. He holds a B.S. in Chemical Natural & Synthetic Polymer Chemistry from SUNY College of Environmental Science & Forestry. Call Bob at (614) 792-3673 or rwsmith@chemquest.com.

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