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The average processor has a small fortune tied up in engineering materials and even more in processing equipment and plant facilities. And, the value of keeping the long-term trust of your most demanding customers? Priceless.

If you consider the fact that improper drying can have a negative impact on all of the above, you begin to get the idea that using the right equipment and following the resin suppliers' recommendations are absolutely critical to staying successful in today's challenging marketplace.

There has been a lot of hype lately about new dryer technology and it may be tempting to think that there is a better way to dry material; an approach that is supposedly faster; or one that claims it requires less heat input. The plain, unvarnished truth is that, until someone invents a workable microwave dryer, or a freeze dryer, or some other as-yet unheard-of approach, there are certain unalterable facts about drying polymers. And these facts dictate that every dryer – no exceptions – needs to accomplish the same things if you want these moisture-loving polymers to dry:

• Heat is required to loosen the molecular bonds between polymer and moisture;
• The freed moisture has to be forced (by vapor-pressure differential) to migrate out of the polymer;
• The moisture has to be removed from the space around the plastic pellets (usually by air flowing through a hopper).

Producers of hygroscopic materials – companies such as Bayer, Dupont, Eastman, GE, Dow, BASF and others – have spent millions of dollars over the years analyzing the conditions that result in optimum drying of their materials. They have a huge vested interest in getting this right because, unless their expensive engineering materials are dried correctly, they won't produce good product. And if a molder or extruder can't make good product, they're going to be on the phone to the resin company asking why their material is failing to perform up to spec. In fact, these materials companies will tell you that the vast majority of customer complaints about resin performance are rooted in improper (and, therefore, incomplete) drying.

When you run a polymer that is incompletely dried, you will likely see problems in one or more of the following areas:

• Processing problems. High levels of moisture in or on the surface of the pellets will be super heated and turned to steam during melt processing. In extrusion, this may cause surging, spitting, sputtering and a foamy melt at the die.
• Cosmetic Problems. In injection molding excessive moisture can cause splay and form surface streaks and, in some cases, bubbles in the molded parts. In extrusion, moisture escaping as steam through the die may cause a rough and scaly surface on the extrudate.
• Structural and Physical Problems. Even if your finished product is free of cosmetic defects, a small amount of moisture can cause hydrolytic degradation, which in turn can change the polymer's melt viscosity, molecular weight and mechanical strength. This may be the most dangerous problem of all because it often escapes detection with the naked eye.

Clearly, processing problems that result in obviously unacceptable products can suck your profits dry. Not only do you have the cost of the products that must be scrapped (material, machine time and labor), but you also have the downtime that is inevitably required to troubleshoot the problem, fix it (if possible) and restart. Considering that it can take several hours to dry a new batch of material, the cost of downtime can easily reach thousands of dollars in just a single incident.

Structural and physical problems can be even more costly, not only in terms of lost production and rejected products, but also in terms of customer goodwill. There can even be legal ramifications.

Engineering resins, which are most likely to be susceptible to moisture-related problems, are developed to deliver a

very specific set of performance properties. And usually a designer has specified them to ensure that certain characteristics – weatherability, paintability, low-temperature impact strength and similar critical properties – are present in the finished product. Chemical changes that result from improperly dried material can compromise those properties. If the problem is identified soon enough, losses may be limited to a few hours production. But if the problem goes undetected until a shipment is delivered to a customer – or, worse yet, until after your customer has assembled his product using your defective products and shipped those products to his customers – thousands or even millions of products may be involved and the impact can be catastrophic. Just imagine if the application involved personal protection (a football helmet, for instance) or even human health and welfare (in the case of a medical components).

How could such a thing happen? Wouldn't performance properties and processing parameters be carefully checked before a critical part goes into full production and is shipped to the consumer? Of course, but remember that drying effectiveness can be seasonal. A marginal dryer may perform adequately in the winter when ambient humidity is low, but in the summer, when temperatures and humidity soar, the very same dryer may fall woefully short in preparing the resin properly for processing.

That's why it is so important to look carefully at the track record of resin dryers. Talk to materials suppliers and ask if they have done tests using the dryer you intend to use. Ask what drying equipment other users of their materials have chosen and which of those users have had problems related to poor dryer performance. Any dryer can malfunction from time-to- time. Operators can mess up settings and mishandle material. But those problems, while inconvenient and even expensive, are minor compared the consequences of using a dryer that is inadequate to the task of preparing you expensive materials for processing.

– Pete Stoughton, Conair

Return to Consultants Corner