FILM PROCESSING UPDATE – THE LITTLE CHANGES ADD UP

The average thickness of film decreased by 20 to 40% during the 1980's, depending on the end use market. Why? Consider what has changed in resins as an example. The big switch during the 1970's was from LDPE to LLDPE. In the 1980's, HMWHDPE film made significant inroads into many markets. Each material enabled significant down-gauging compared to LDPE.

One of the miracles of life is that living organisms can reproduce exact duplicates of complex molecules. Science can't duplicate this cost effectively in plastics. We measure the size variation by the molecular weight distribution (MWD). Resin suppliers adjust the MWD to meet end use requirements by changing reaction conditions. For example, adding more heavy molecules improves strength properties. It makes the resin more difficult to process, and the finished product is more opaque (hazy film). Adding more light molecules improves processing. We often describe it as an internal lubricating aid.

The newest family of polyolefins is "single-site" metallocene catalyst resins. Metallocene catalyst technology produces molecules that are more alike than by traditional methods. Metallocene resins have a narrower MWD. The typical shape of the molecule is different as well. This is why these resins offer improved toughness without sacrificing film clarity. They also exhibit slightly lower melt tension than LLDPE. For these reasons, there is potential for down-gauging compared to conventional LLDPE's.

Equipment manufacturers will adapt to these changes in the resin portfolio. Barrier screws and grooved feed throat extruders were the response to pumping capacity limitations with LLDPE and HMWHDPE. Metallocene resins tend to be more viscous when molten than LLDPE. They may draw more motor amps, melt more quickly, exhibit higher melt pressure and be more prone to melt fracture. Keeping the melt temperature under control may be a little more challenging than with the more familiar LLDPE's. The resin manufacturers may blend in a processing aid to counteract these problems. Film processors can blend in 5 to 10% LDPE or a processing aid masterbatch as well.

Dual lip rings and internal bubble cooling (IBC) systems increase cooling capacities significantly. A 1970 vintage single lip air ring can cool between 6 and 8 pounds per inch of die circumference (ppid) of LDPE. The newer dual lip air rings have taller forming cones. This "deep dish" style can cool between 20 and 24 ppid of LLDPE.

The suppliers of metallocene resins claim that these resins will run LLDPE equipment without any major modifications. It really depends upon the condition of the equipment. Don't expect these resins to perform miracles on older, poorly maintained lines. Extruder screw clearances must be tight. Any air ring with a lip set more than five years old is a candidate for replacement. The frost line is often higher with these resins. Bubble stabilizing cages will help maximize productivity. Replacing an old air ring lip set and adding a bubble stabilizing cage often increases the cooling capacity of a line by more than 30%. Keep in mind that thinner films are more difficult to wind and slit. Precise tension control and sharp slitter blades are required. Winders with tapered tension control are useful for films less than 1 mil thick.

Metallocene resins are an example of one of those little changes in the blown film industry that can add up to big profits, if you know how to use them properly.

Please direct any questions you may have to Paul Waller Canadian Plastics Institute, (416) 441-3222, or attend the monthly meeting in February where Paul will be the guest speaker