By Mark Stephen, editor

MISSION POSSIBLE

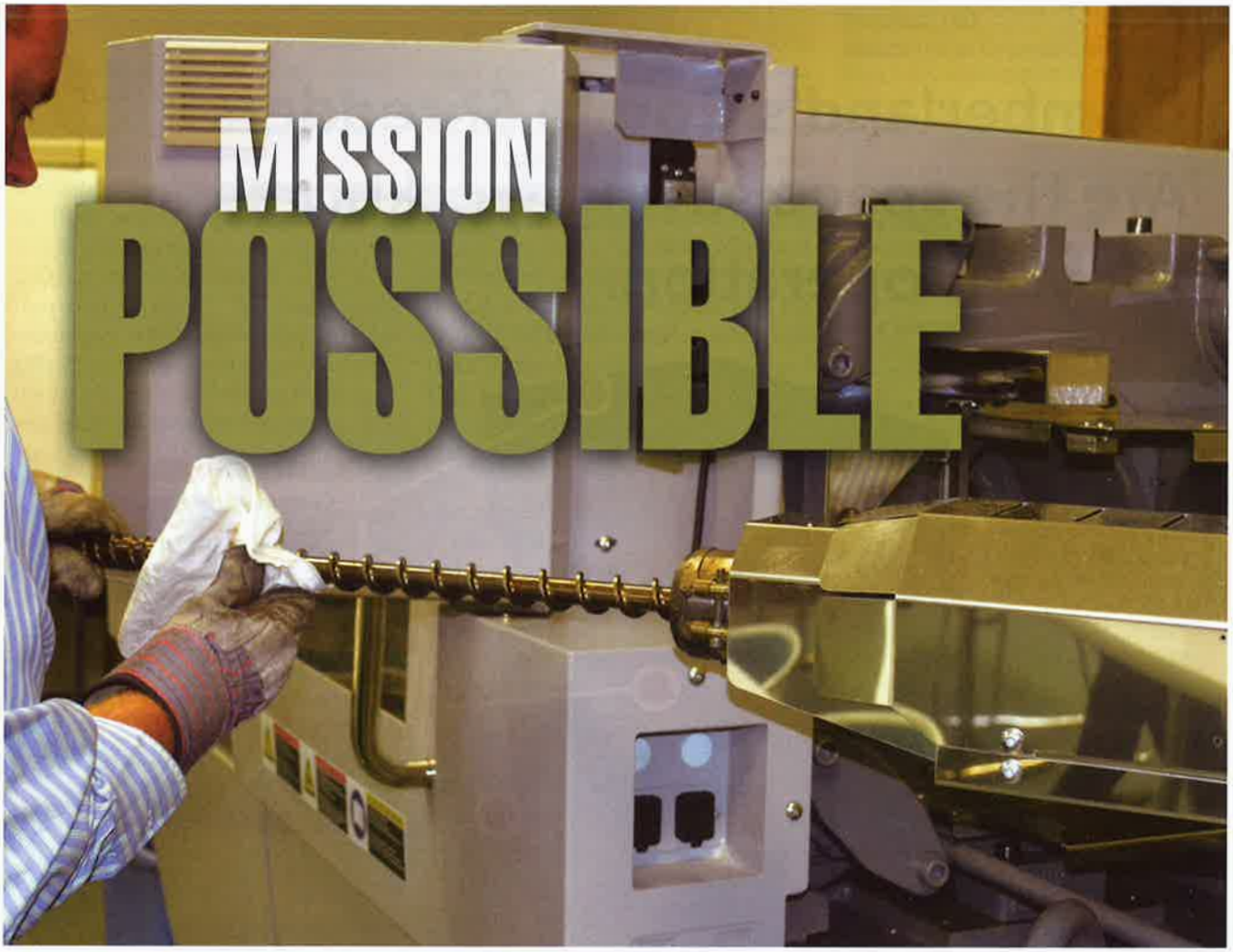

Photo Credit: Sun Plastech Inc

If you think the trick to purging high-performance engineering resins and other challenging materials is to run conventional CPCs at high heats and for soak times long enough to get halfway through *War and Peace,* you'd better think again. These tips, combined with the right compounds, can help you optimize the most difficult purging experiences.

A classic *Saturday Night Live* TV skit called "The Thing That Wouldn't Leave" told the story of a host who couldn't get a stubborn guest out of his house after the party ended. There's an equivalent in the plastics manufacturing world, but it's not as funny: trying to remove challenging materials like additives, liquid colourants, and highly engineered resins such as PPA, PPS, PEEK, PPO, PEI, PSU, and PVDF from processing machines.

High-performance engineering resins, originally designed for aerospace, can now be found in electrical/electronic, telecommunications, chemical, and medical industries. Each market shares a growing need to utilize thermoplastics that offer higher temperature resistance, strength, dimensional stability, and chemical resistance. More recently, the automotive industry has also started to use high-performance engineering resins due to pressing needs for more durability and lightweighting.

If there's a downside, it's this: High-performance, high-heat thermoplastics generally process at melt temperatures in the range of 520° to 800°F or 271° to 426°C, making them more prone to thermal degradation, in turn creating carbon build up leading to black specks. Which makes purging high-performance engineering resins, along with additives and liquid colorants, one of the fastest growing markets for commercial purging compounds (CPCs) — and also one of the most difficult, since both mechanical and chemical purging compounds are limited when it comes to residence times, flow restrictions, and heat stability above recommended

temperature ranges.

Which is why we talked with some of the experts about how to optimize your purging of high-temperature and other difficult materials.

THE DO'S AND DON'TS

"First, when purging high-temperature engineering resins, use a CPC designed for the job," said Eric Procunier, product development manager with Sun Plastech Inc., which carries the Asaclean line. "Most standard purge compounds have low-temperature carrier resins; these materials won't hold up at the temperatures required to remove high-heat engineering resins. The carrier resins utilized in CPCs designed for high-heat engineering resins are generally high-molecular-weight polymers with good thermal stability."

Second, be prepared to vary the purging procedure. "High temperature engineering resins such as PEEK, PPS, and PSU require special steps in the procedure to ensure operator safety," said Nancy Mitchell, technical product manager with Dyna-Purge. "The screw should be run in the forward position to promote positive conveyance, with the barrel kept full to minimize degradation; and be sure the melt temperature doesn't exceed the maximum temperature recommended by the CPC supplier." For heat- and/or moisture-sensitive resins such as PVC, nylon, and PCs — which degrade quickly and can therefore lead to carbon build-up and black specking — add the purge compound directly on top of the resin to begin purging, the experts say, so as to minimize exposure to oxygen during the purging process and prevent degradation. "Also, when shutting down the machine, it's imperative to remove any unstable resins, since they will tend to degrade," Mitchell said. "They should be replaced with a stable purging compound."

Molders that use hot runners might have to add yet another variation to the purging procedure. "They may have to close off certain valve gates and reroute the purge to more difficult areas to achieve the best results," said Christie Giles, co-owner of World Class Technologies LLC, which carries the MagnaPurge line. "Also, processing machines have their own specific factors that can affect the procedure, such as dead spots where it's harder to remove material."

Third, purge at the lower end of the recommended resin melt temperature range by lowering barrel temperature and, in some cases, lowering screw rpm. "CPCs are most effective when processed within each supplier's recommended temperature range, and this is especially true when purging both low- and high-heat materials," said Kathleen Jarvis, national sales director at Neutrex Inc., which manufactures the Purgex line. "If a resin is a high-heat ABS or PPA processing at 600°F or 315°C, the molder should purge within the temperature range of the resin being processed. You don't want to push the purge beyond its maximum heat because you'll risk burning the material inside the screw and barrel." This might just be the most common mistake processors make when purging engineering resins. "I see this error being committed all the time: customers leaving the CPC in the barrel at high temperatures for an extended time," said Juan Grino, factory sales representative with Slide Products Inc. "Time and temperature recommendations vary from product to product, but in most cases a maximum of 10 minutes is the longest the purge material should be left to sit in a high-temperature situation. The goal is to get the material in and out as quickly as possible to prevent burning."

Fourth, keep the feed throat cool to prevent "bridging" of the CPC in the throat. "The temperature of the feed throat coolant should be maintained at 80° to 120°F or 27° to 49°C," said Nancy Mitchell. "It's best to keep the feed throat temperature as

close to 100°F or 38°C as possible. In humid weather, the temperature should be slightly warmer than the dew point to avoid condensation."

UNCOLOUR YOUR WORLD

As with high-performance engineering resins, additives and colourants are also increasing in use by today's plastics processors. And they can be just as difficult to purge. "In almost 80 per cent of applications using additives, purging with a heavy-duty CPC should be sufficient," Juan Grino said. "In the remaining cases, CPC suppliers will usually have to create a specialized blend."

Additives such as flame retardants break down endothermically when subjected to high temperatures, leaving residue behind. "If your purge product is not effective in removing these additives, you may end up with carbon build-up, which becomes more difficult to remove as time goes on," said Nancy Mitchell. "Periodic purging to get rid of build-up will ultimately help eliminate contamination and may extend the life of the screw."

Liquid colourants and organic pigments are also difficult to remove. "Some of these additives have an affinity to metal and require a more aggressive purge for cleaning," Mitchell continued. "Processors that use colour concentrates should also be aware that some of the carrier resins, such as EVA, will thermally degrade if left in the barrel too long."

In the end, the most valuable tip for removing high-performance engineering resins and other problematic materials from molding machines and extruders is this: talk to your CPC supplier. "Every CPC brand is different, with its own unique characteristics," said Kathleen Jarvis. "Talking to the supplier, especially when purging difficult materials, ensures the molder uses the compound correctly, which might include adding another processing step. When molders improvise purging procedures on their own, bad things can happen."

Even worse than a houseguest who won't leave. **CPL**

Photo Credit: Sun Plastech Inc.

THE RIGHT STUFF

Here's a quick look at some CPCs designed specifically to handle difficult materials.

Asaclean

The company's SX grade, which has an olefinic base, is said to be suitable for purging super-engineering resins above 570°F or 300°C, and is used exclusively for super-engineering resins such as PPS, PEEK, LCP, and Ultem.

Dyna-Purge

The firm's Dyna-Purge E2 is a mechanical, non-abrasive CPC designed to offer "the most advanced technology breakthrough in heat stability and enhanced cleaning," Dyna-Purge said. "Its unique integrated polymer system was developed for purging high-temperature resins safely and efficiently in all areas of the machine, including tight channels."

MagnaPurge

For engineering resins, MagnaPurge PP 105 is a 95 per cent modified PP with a 5 per cent chemical compound, and is effective at temperatures up to 610°F or 320°C. For colourants and glass-filled materials, MagnaPurge PP 105 GLASS utilizes glass fibres for an additional mechanical action required for more difficult cleaning of products containing fillers and heavy colourant use.

Purgex

Created for more challenging colour and/or material changes in engineering resins, plus efficient cleaning of hot runner systems, Purgex 3057 Plus is described as a ready-to-use mechanical CPC consisting of active ingredients with a PET carrier.

Slide Products

The firm's Klenz CPC operates at temperatures up to 610°F or 320°C, and is formulated with a polyolefin carrier. All ingredients are GRAS-rated, making it safe to use for food packaging applications. For use with injection molding, extrusion, and blow molding.

RESOURCE LIST

Dyna-Purge Div. Shuman Plastics Inc. (Buffalo, N.Y.); www.dynapurge.com; 866-607-8743

Neutrex Inc. (Houston, Tex.); www.purgexonline.com; 281-807-9449

Slide Products Inc. (Wheeling, Ill.); www.slideproducts.com; 800-323-6433

AceTronic Industrial Controls Inc. (Mississauga, Ont.); www.acetronic.com; 905-564-7227

Sun Plastech Inc. (Parsippany, N.J.); www.asaclean.com; 800-787-4348

World Class Technologies LLC (Midway, Ky.); www.magnapurge.com; 859-226-0036