IN-MOLD FLUORINATION PROVIDES COST-EFFECTIVE SOLUTION FOR HARD-TO-HOLD LIQUIDS

When you are looking for a high-density polyethylene container solution for hard-to-hold chemical or oil-based solvent products, working directly with Pretium, the company that patented the in-mold fluorination process decades ago, is the proven way to go.

“HDPE is a great polymer for so many packaging applications. However, it does not do a good job of preventing migration of these types of products through the side wall. On its own, it simply doesn’t have the barrier properties required to ‘hold’ oil-based products that contain xylene, toluene, or d-limonene/orange terpenes, to name a few. That’s where fluorination comes into play,” explains Alan Wood, barrier product manager, Pretium.

THE IN-MOLD FLUORINATION PROCESS

Here’s how in-mold fluorination works. A dilute mixture of fluorine in nitrogen is used as a substitute for compressed air for that is typically used in extrusion blow molding. In-mold fluorination can use a chemical modification of the polyolefin container’s inner surface, thereby enhancing the solvent barrier properties of polymers such as HDPE. As a result, this one-step process provides a significant reduction in the ability of most nonpolar solvents to permeate the container wall. Additionally, the treated surface is highly resistant to deterioration from chemical attack or mechanical abrasion.

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In-mold fluorination provides significant benefits to packagers. It enables them to use HDPE containers to contain solvents that otherwise would require a metal or glass container. Those material types can be problematic such as denting or rusting in the case of metal containers, and breakage, added transport weight and difficulty handling in the case of glass. In-mold fluorination enables lightweight HDPE to be used in applications such as insecticides, herbicides, cleaning solvents, agricultural chemicals and petroleum-based products, including gas additives, diesel fuel conditioners, and more.

POST-FLUORINATING “CONS”

There is another option for those looking to fluorinate containers and that is sending the HDPE container to a ‘post’ fluorinator. However, that process has multiple negatives associated with it. Containers need to be shipped to a secondary location, incurring cost, time and increasing chances of damage. Further, the second step negatively impacts speed-to-market because the brand owner now needs to factor in “to and from” transport time, additional processing time and percentage of the original production lost to damage.

Also, the in-line process differs chemically from the post treatment process when creating the hydrocarbon barrier. This is why post treatment requires more fluorine and a longer dwell time to achieve the same barrier property as in-line fluorination can achieve with less fluorine and less time.

“Using a post-fluorinator also has a tendency to change the color of the container over time because the fluorine is added to the exterior surface of the bottle. The bottle surface typically turns matte (vs. shiny) after the fluorination and can yellow over time.
This is not a positive attribute for those brand owners concerned with visual aesthetics,” explains Wood.

**THE PRETIUM SOLUTION**

To produce an in-mold fluorinated container that isn’t impacted by the visual negatives that can be caused by surface treatment, Pretium turned to a dual layer HDPE/HDPE coextrusion. That allows the interior, unpigmented virgin resin surface to be treated, while the external layer (which is other natural or contains color pigment) is unaffected.

Producing the containers in one-step also means that Pretium is able to do onsite barrier testing to ensure that the containers meet the Department of Transportation (DOT) guidelines for acceptable solvent permeability (weight loss).

“A container cannot lose more than 2% of its weight within six months of it being filled,” Wood said. “The one-step process gives us the opportunity to pull samples from each production run, fill the samples with toluene, and then place those samples in our test ovens to conduct permeability tests at 120 degrees F so that we are confident that the barrier property is good and the containers produced will meet DOT permeability requirements on a consistent basis.”

**CASE STUDY: HAND CLEANER SOLUTION**

A company producing a hand-cleaner wanted to market its product in a 16-ounce custom orange container with excellent barrier. Previously, they had been using a stock container that they would then have post fluorinated. The two-step process added significantly to the production time line and resulted in a container that did not have the desired aesthetic attributes. (Post fluorina-
tion can be problematic causing surfaces to change from shiny to matte and to yellow over time.)

Pretium was able to find a solution that addressed all of the hand cleaner company’s issues—a dual layer HDPE bottle that was in-mold fluorinated. The fluorine treatment was applied to the inner layer via the gas mixture during the blow-molding process. This meant that the fluorine did not touch the outer, pigmented layer. The end result was a bottle with the desired barrier attributes, yet not on the aesthetic problems that are created with post fluorination.

**PRETIUM IN-MOLD FLUORINATED RANGE**

Pretium has a wide range of stock in-mold fluorinated container options to offer companies interested in packaging challenging liquids. Additionally, Pretium frequently works with brand owners to develop custom containers for these applications—ranging from 15 ounces to 2.5 gallons.

The mainstays of the in-mold fluorinated stock line are the F-style and round gallons. The F-style family comes in .5-, 1- and 2.5 gallon sizes, as well as quart and pint options.

“Pretium specializes in being a solutions provider. We work with each brand owner individually to determine what container properties best support their product formulations. It is that individual approach that helps guarantee successful product commercialization,” Wood concludes.

To explore ways Pretium can help you with your packaging objectives, please contact us at: CUSTOMERSERVICE@PRETIUMPKG.COM