



Flambeau® INC.

TECH report

Shaping the products of tomorrow... in plastic®

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Hyperier® Versus Fluorinated Fuel Tanks

There are several accepted methods to meeting permeation requirements. Two common alternatives Flambeau currently offers and holds CARB EO's and EPA Certifications for are Hyperier and Fluorination.

▼ What is Fluorination and Hyperier

Fluorination is a chemical treatment performed by Inhance™ and Hyperier is an additive type solution for polyolefins (HDPE, LDPE or PP). Hyperier is the LG Chemical® trade name for its nanocomposite alloy made of nanometer scale inorganic layered silicates (clay) and various polymers (typically a nylon carrier). Hyperier is produced in Korea and is distributed by Entec® Polymers in the United States.

▼ Hyperier as a Cost Effective Alternative to Fluorination, but Not a Drop-in Solution

Hyperier is a cost effective alternative to Fluorination, but needs to be looked at on an individual basis as far as application and size. Due to the process used for Hyperier it is not suitable for all applications. Fluorination can be used as a drop-in solution for legacy products, but Hyperier is not. We have found that Hyperier is not an effective solution on fuel tanks under 2.5 gallons (9.46 liter).

In Flambeau's experience it has shown, in order to maximize the seam integrity on tanks run with Hyperier there needs to be a dam in the mold to force material build-up

into the parting line and many times this dam needs to be more aggressive than a straight HDPE fuel tank dam. Fluorination of tanks does not require the more aggressive dam.

▼ Hyperier is Sensitive to Handling and Processing Conditions

Hyperier is very sensitive to handling and processing conditions. Over the past two years Flambeau has researched and created ideal processing conditions which create the most consistent low permeation barrier fuel tanks. Through this effort we worked closely with CARB and EPA to become the only blow molding company to receive certifications which include how we process the material and conduct quality control. Our mission, which was successful, was to create a very specific, controllable, and measurable processing window with the Hyperier material.

When properly processed Hyperier offers good barrier properties, but has a tight processing window. Ultrasonic equipment is required in order to verify barrier properties and the barrier can be adjusted with process. Flambeau currently has Ultrasonic equipment in Madison, Georgia and Baraboo, Wisconsin. When compared to a tank run with straight HDPE, Hyperier tanks have somewhat decreased Cold Impact properties. This is probably attributed to the additive itself because it is considered a contaminant.

▼ Aesthetics of Hyperier Versus Fluorinated Fuel Tanks

With regard to aesthetics, natural Hyperier tanks are somewhat brownish/yellow in appearance and black tanks can have streaks, specks, delamination on the parting line pinch and some hazing or a whitish appearance (cont'd pg 2).



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For more information on Hyperier or Fluorination at Flambeau:

Call: 1-866-836-0198 or
E-mail: fluids@flambeau.com

A medium to heavy texture would be preferred on black visible tanks. Fluorinated fuel tanks will have a hazy dull appearance and can also have a rainbow type reflection when they are wet.

In most cases, however, Hyperier is still a cost advantageous alternative over fluorination because tanks molded with Hyperier can be molded, machined, assembled and tested at the press. Tanks needing to be fluorinated have to be shipped outside for the fluorination process which typically takes 10 to 14 days and then need to be returned to be finish machined, assembled, tested and packed.

When we run Hyperier we create excess regrind that has limited use for other applications. When running fuel tanks we are restricted on the amount of regrind we are allowed to use and on average the lay-flat is approximately 3 times the part weight, but this also varies depending on the tank configuration. The reason this is pertinent is because there is no barrier property credit carried forward with the regrind and therefore any percentage of Hyperier being used has to be added to the entire shot not simply the virgin portion of the blend. For example if we have a part that weighs 5 lbs. the lay-flat will weigh about 15 lbs. and the total shot weight will be 20 lbs. If we are running a 20% Hyperier blend @ \$3.50 lb. with 3% UV additive at \$3.00 lb. and 77% HDPE @ \$1.00 lb. the blended material is worth \$1.56 lb. In this example we will create 7.7 lbs. of excess regrind with every tank we produce.

The tank assembly on the right is molded with Hyperier additive. If we were to mold this same tank with HDPE and fluorinate it the cost would be approximately 25% more. The major cost drivers would include transportation to and from Inhance and fluorination treatment totaling between \$14.50 and \$15.00 per tank.



Hyperier Facts - Positives and Negatives:

Positives:

- + Cost effective barrier solution
- + Eliminates cost of Fluorination
- + Eliminates shipping costs to and from Fluorination
- + Tanks can be molded, machined and assembled at the press
- + Reduced lead-time because the tanks do not need to be treated
- + Good barrier properties when processed correctly
- + Barrier level can be adjusted during processing

Negatives:

- Not a drop in replacement for existing fuel tanks. Many times requires the addition of an aggressive dam in the mold to maximize the strength of the parting line.
- Tight processing window
- Cannot be injection molded
- Barrier detection requires ultrasonic equipment
- Cold impact is generally reduced when compared to HDPE/Fluorinated Fuel Tanks
- Excess regrind is generated
- Fuel tank qualification testing in the application is mandatory because tank design influences performance
- Pricing of tanks run with Hyperier need to incorporate the material scrap produced because the Hyperier additive is introduced at 20 to 24% based on the size of the tank to the entire shot. Typically the lay-flat weighs anywhere from 3 to 4 times the part weight.

As the market leader we are continuously working on new materials and processes which will exceed the ever tightening requirements set by CARB and EPA. Our efforts are founded on rigorous engineering, testing, and collaboration with strategic partners and customers.