



Cost Will Make You Rethink Polypropylene



END OF THE PP ERA NOW IN SIGHT?

There are indications that polypropylene's (PP) multi-decade reign as the polymer with the lowest material cost per cubic inch is ending. Seismic changes in energy markets and their derivative products over the past decade are now combining to structurally alter the market dynamics of PP. As a result, many products and packages made from PP may need to reconsider whether it remains the best material for the application.

HOW THE OLD DYNAMIC WORKED

PP demand has historically been supplied as a by-product, primarily from gasoline and ethylene production. With the gasoline connection, PP has been produced mainly from crude oil, although it can also be made with natural gas. Crude oil produces more propylene than ethylene, while natural gas produces more ethylene than propylene. Rising ethylene and gasoline production provided sufficient propylene to meet growing market demand until recently, when higher cost "on-purpose" propylene refineries have become necessary. A small but reliable price gap between oil and natural gas limited arbitrage potential between the energy sources.

ANATOMY OF A STRUCTURAL SHIFT

Today, new dynamics are causing a structural shift in PP markets by reducing the amount of by-product propylene in the face of rising demand. This is the result of three powerful trends:

1. Reduced gasoline consumption in developed countries from higher fuel efficiency, aging populations that drive less, and displacement by alternate fuels such as ethanol and electricity.

2. Greater use of newly cost-advantaged natural gas-based ethane as the route to ethylene, the result of a more than tripling of the price spread between crude oil and natural gas. The price spread comes from structurally constrained world oil supply growth and the rapidly growing supply of natural gas.

This has helped the ethylene industry to keep its costs low, but it also contributes to structural price increases for propylene by limiting propylene supply.

3. Rapidly increasing use of more expensive "on-purpose" propylene, because of the growing shortage of by-product propylene, has raised the industry's marginal cost of supply

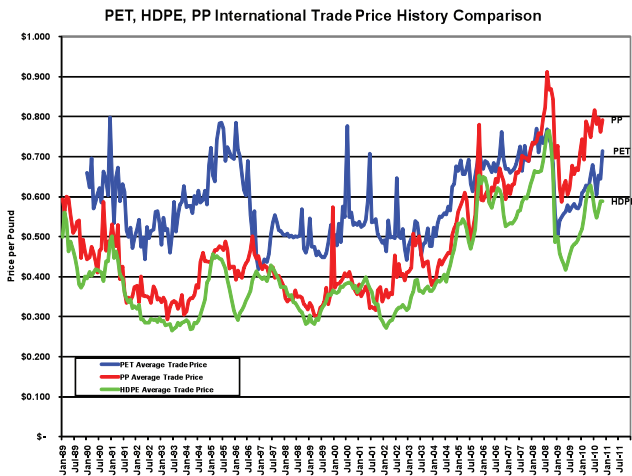
	Processing	Dimensions	Weight	Charpy Impact	Gate Drop Impact	Flange Impact	Thread Jump	Torque Rotation	Yield Strength	Elastic Modulus	ESC Resistance
Material 1	Green	Green	Green	Green	Green	Blue	Blue	Green	Green	Green	Green
Material 2	Green	Green	Green	Green	Green	Blue	Green	Green	Green	Green	Green
Material 3	Green	Green	Red	Green	Green	Green	Green	Green	Green	Green	Green
Material 4	Red	Green	Green	Green	Green	Blue	Red	Blue	Green	Blue	Green
Material 5	Red	Green	Green	Blue	Green	Blue	Red	Blue	Blue	Blue	Green
Material 6	Blue	Green	Blue	Red	Red	Blue	Red	Blue	Green	Green	Green
Material 7	Red	Green	Green	Blue	Green	Green	Green	Green	Green	Blue	Green

TABLE 1: SES performance-based comparison of alternate resins relative to baseline.

NO GOING BACK

These effects indicate a permanent, structural increase in the cost and price of PP. While there are some immediate short-term issues with unexpected refinery outages and new propylene supply ramping up slowly that will eventually ease, the fact is that the underlying economics of PP have changed. *Plastics News* reported a statement from Esteban Sagel of CMAI in its January 24, 2011 issue to the effect that PP has changed from "the lowest cost per cubic inch for much its his-

tory to being 2nd highest among major plastics trailing only ABS". The same article noted examples of switching out of PP, including going back to paper. While it is possible to argue the precise parameters of Mr. Sagel's statement, it is inescapable that PP is becoming structurally more expensive relative to other resins.



The chart of HDPE, PET, and PP prices since 1989 shows the rise of PP relative to the other two materials over the course of the 2000-2010 decade to be the highest cost per pound of these three primary resins since early in 2008.

IN SEARCH OF NEW LOW COST OPTIONS

There is no question this change will result in products that historically made sense in PP, to change to other materials. On which of your current or proposed PP products are you willing to tolerate permanent costs per cubic inch approaching ABS? Which products will they be and why? PP has material properties that will require its use in some product-specific environments despite its price. However, there are many applications where PP's use was based on its low cost position.

THE DEVIL IS IN THE DETAILS

Some closures can be converted to PE, but others—living hinges come quickly to mind—cannot. Many PP containers, whether injection or blow molded, may be convertible to HDPE with only minor technical challenges. For a number of years PP made inroads against PET in stretch blow molding. How many of these applications should reconsider PET? Recent advances in using PET for retort may be even more

important with the rising cost of PP, previously the only retort-capable material.



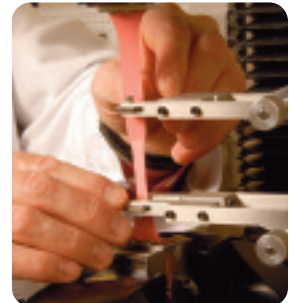
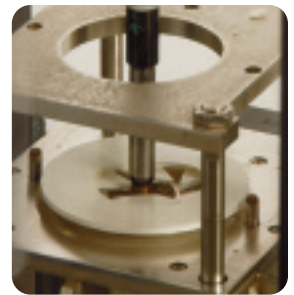
Any retreat from PP will mitigate its price increases, while adding to price pressures on new destination materials. This may complicate the picture, but feeling the effect will take time. **Early movers will maximize the benefit.**

Stress Engineering Services (SES) has the expertise and experience to assist in evaluating your full range products of and packages, to determine where alternatives to PP should be considered and pursued.

SES excels in performing holistic, integrated, technical and economic analyses to identify and evaluate choices necessary to make the best possible business decisions.

TESTING & MATERIALS CHARACTERIZATION

This expertise is supported by a full service in-house materials testing laboratory that is equipped with the most advanced instrumentation, monitoring and data-acquisition systems available. SES can design the right tests, gather the most critical data, develop custom fixtures and perform all the testing and characterization needed to help you identify the right replacement materials.



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