Throughout the entire value chain, from farm and field to table, the grocery business operates on extremely tight margins. Those margins have gotten even tighter in recent years due to two pressures. Consumers want convenience foods that demand sophisticated packaging solutions in order to retain their freshness—yet they want to buy those foods at a moderate price point. And as the retail grocery business comes to be dominated by national chains, such as Wal-Mart, Target, Carrefour and Tesco, those chains themselves put pressures on manufacturers to hold the line on prices.

Because of these pressures, manufacturers have taken a good hard look at their costs. And given that packaging is the second highest cost factor in food marketing (after labor), according to the U.S. Department of Agriculture, manufacturers are often inclined to squeeze costs out of the packaging process.

The problem is, cutting corners on packaging can have a strongly negative effect on freshness and flavor. Particularly for certain categories of convenience foods such as marinated fresh meats, packaging is critical to the quality of the product. According to a recent DuPont-sponsored survey, consumers rank “freshness” as their top concern with regard to food packaging. The same survey also found that faulty packaging could impact whether a consumer will purchase the same product again. So we can conclude that cutting corners on packaging can and often will result in a loss of customer loyalty if freshness is compromised.

Foods are kept fresh by maintaining the ideal packaging environment inside the package such as keeping moisture, air and other infiltrators out of the package. And one very important key to controlling infiltration—and retaining brand loyalty by retaining freshness—is an ethylene copolymer sealant that is used to maintain package integrity. So for manufacturers looking to control costs while maintaining their food product, they must look at selecting the right sealant for the right foods.

**Selecting a Sealant**

To select a sealant with the optimum cost-benefit ratio, it is first important to understand that different foods have different requirements. Sealant properties for packaging containing the marinated fresh meats cited earlier are more critical than those for chocolate or cereal, for example. The former requires sealants that can stand up to oil, grease and the acidic properties of vinegar, which are of little concern in cereal packaging.
Beyond oil and grease resistance, another important criteria for sealant selection is stiffness, which is important to how the packaging “feels” in the hand. A stiffer package conveys a sense of quality to the consumer. Also critical in many applications is puncture resistance, which is important when bones, sharp chips or other sharp objects are being packaged. Adhesion to the primary packaging material, such as foil, or nylon is important for the overall integrity of the package as is abrasion resistance, so that scuffs in the packing, shipping and handling process don’t result in tearing.

Today, there are essentially seven choices of ethylene copolymer sealants available to food manufacturers.

- **LDPE (Low Density Polyethylene)**: Typical uses include bread bags, juice cartons, condiment containers, “gable top” milk cartons and toothpaste tubes.
- **LLDPE (Linear Low Density Polyethylene) and mLLDPE (metallocene Linear Low Density Polyethylene)**: Sealant for flexible milk pouches, stand up pouches, hot-fill applications and coffee packs.
- **VLDPE (Very Low Density Polyethylene) and mVLDPE (metallocene Very Low Density Polyethylene or Plastomer)**: Offering better tear and puncture resistance than LLDPE, VLDPE and mVLDPE are often used in bag-in-box packaging, such as non-peelable cake mix packaging, and shrink wrapping. With its high gas transmission rate, mVLDPE is used in breathable produce bags.
- **EVA (Ethylene Vinyl Acetate) (DuPont ELVAX® brand)**: Common food packaging uses include cheese, cereal box liners and as a cap liner in soda bottles.
- **BLENDS**: Because polyethylene sealants have different chemical properties, they are commonly blended together for certain applications. For example, VLDPE is often blended with LDPE/LLDPE for improved sealing and toughness, while LLDPE is blended with EVA for sealing harsh liquids such as bleach pouches.
- **ACID CO-POLYMER (DuPont NUCREL® brand)**: Used in edible oil packets (such as salad dressings), as a condiment foil adhesion/sealant and a cook-in meat sealant.
- **IONOMER (DuPont SURelyn® Brand)**: Created to meet the special packaging sealant needs of processed and sub-primal meats, snack foods and canister inner liners, as well as for use as a powdered medication sealant.

In the most demanding packaging scenarios, which require the optimal combination of oil/grease/abrasion/ puncture resistance, as well as superior stiffness and adhesion capability, an Ionomer sealant is the preferred choice. But not all Ionomers are created equal.

**A Closer Look at Surlyn®**

DuPont™ Surlyn® uniquely combines critical chemical characteristics that make it the preferred choice of food processors who are looking to realize cost savings.

DuPont has several grades of Surlyn® with high stiffness that allow downgauging of the total thickness without compromising the “feel” of Surlyn®. We’ll explore those benefits further in just a moment. By using a proprietary modeling program to calculate package stiffness, DuPont may be able to re-design your package structure layers to provide the benefits of Surlyn® without added cost.

This model shows that by using a stiff sealant such as Surlyn®, the weight of the packaging itself may be downgauged, allowing manufacturers to save on a significant material cost. And this downgauging can take place without sacrificing stiffness, puncture resistance or the hermetic quality of the seal. An example for a paper based sachet structure for dry food packaging is illustrated in Figure 1, where the key features are:
• Material cost savings: up to 17 percent
• Reduced weight: up to 28 percent
• Maintained stiffness

Figure 1: Cost Cutter model result for a paper-based sachet structure. While the above example does not guarantee that similar results will always be achieved, DuPont works with its direct customers to evaluate the proprietary modeling program in their process capability and material costs.

This modeling reveals that the use of Surlyn® can be a direct raw material cost cutter which is able to deliver savings while offering all its established performance in use benefits.

To get a further in-depth understanding of the total sealant cost-benefit, manufacturers have to look at the real cost of using a sealant in processing. What may seem the more expensive choice on paper can actually be less expensive on the production line. For example, high performance sealants can enable a production line to move more quickly by forming faster seals. Those same sealants can dramatically reduce the percentage of “leakers” on a line, which have to be discarded, further driving up cost per finished unit.

DuPont has developed a second proprietary software program that calculates the total cost of the packaging that factors in packaging plant performance. The program considers inputs such as line speed, leaker rates and plant efficiencies. With this tool, DuPont is able to predict the total savings potential with reasonable certainty. A sample calculation for the packaging of marinated meat is shown in Figure 2. Here the film structure containing a Surlyn® sealant has been designed so that the roll stock cost (blue bar) is the same as a traditional structure containing a LLDPE sealant, yet the total cost of running the Surlyn® film is lower because of reduced labor costs (higher line speed) and fewer rejects (leakers).
One of the most critical characteristics a sealant can have is hot tack—the strength of heat seal measured before the seal is cooled, which is especially important in high-speed packaging operations. Surlyn® is recognized throughout the packaging industry for possessing maximum hot tack and excellent heat seal strength—measured after the seal has cooled. And because Surlyn® can be sealed through/around contaminants, it is used as a premium heat seal layer in packaging films.

Additionally Surlyn® offers superior foil adhesion, formability, abrasion/puncture resistance, , chemical resistance and clarity. Often it is the combination of several characteristics that make Surlyn® the preferred choice for a variety of demanding uses. DuPont has developed a third computer model to help rate the relative performance of the various families of ethylene copolymer sealants for a given application. Here the user inputs the relative importance of each characteristic for the application and the model scores the resins on a scale of 0 to 10, with 10 being perfect. One can then look at the relative cost vs. the performance of the resin families to choose the best sealant for the application. An example for a processed meat package is shown in Figure 3. Here the Ionomer outscores each of the other resin families because of its unique combination of strengths.
Our experience shows that Surlyn® is the preferred sealant choice for a variety of applications.

**Cook in Bags for Ham:** Used as a heat seal layer, Surlyn® offers a unique combination of adhesion to meat, delamination resistance, optimal shrink properties and outstanding puncture resistance.

**High Performance Vacuum Packaging (vacuum skin packaging and shrink bags):** Surlyn® dramatically reduces leakers in this meat packaging category through superior abrasion resistance, high hot tack, low seal initiation and puncture resistance.

**Forming and Top Webs for Frankfurter and Other Processed Meat Packaging:** Compared to mVLDPE, Surlyn® reduces waste and improves safety and quality. Broader hot tack, increased stiffness and better shrink and meat adhesion keep meat juice from getting between the hotdogs and film, while also increasing longer shelf life and reducing discoloration.

**Peelable Seals:** Surlyn® is also easily formulated for use in easy open peelable seals (e.g. cereal inner liners) where its ability to resist delamination helps preserve freshness.

However, when compared simply on a dollar for dollar cost basis, other ethylene copolymers can seem more affordable than DuPont™ Surlyn®. Such a cost comparison can be highly misleading, because it does not take into account those qualities of Surlyn® which lead to higher filling plant performance and reduced consumer complaints of poor seals. When closely investigated, Surlyn® can lead to significant overall cost reduction.

**Dairy Foods:** Processed cheeses, for example, typically use LLDPE in packaging, which often leads to curling in the extrusion coating phase of packaging. Use of Surlyn® eliminates the curling issue and allows a 20 percent downgauging.
Snacks: In one example, we found for vacuumed packed pistachios the use of Surlyn® can deliver cost material savings of up to 8 percent, while allowing a 24 percent downgauging.

Dry Powder Foods: For bagged dry soup mixes, we calculate that a downgauging of up to 28 percent is possible with Surlyn®, while direct cost material savings can be as much as 6 percent.

These are just some examples in which Surlyn® can actually reduce packaging material costs, or be cost neutral, while at the same time offering an unrivaled ability to preserve the flavor, freshness and safety of food. Using a sealant like Surlyn® can reduce the total cost of packaging which includes not only packaging materials costs but also productivity in the packaging production line and reduction of waste or “leakers” on the line.

This means that, by choosing Surlyn® to meet the most demanding packaging needs, converters and manufacturers can be responsive to major food retailers who want to hold the line on prices at the store level. And this responsiveness can be achieved while still delivering the high quality food the consumer expects—thereby helping to assure brand loyalty.

DuPont has a number of case histories and additional guidance for picking the right sealant for a given application on its website:

Additionally, for more information about this topic, visit us at www.scienceoffresh.com.