DESIGNING CONSUMER PRODUCTS WITH TPES

SENSORY ENHANCEMENT PROVIDES COMPETITIVE EDGE

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One of the top consumer product design trends for 2013 is sensory enhancement. According to JWT Intelligence, a “sensory explosion,” meaning an increased demand for sensory stimulation, is apparent in consumers globally within diverse market sectors. There are a number of explanations for consumers’ desire for an enhanced sensory experience when selecting products ranging from smartphones to home medical devices and from kitchen implements to power tools. First, a pleasing tactile feel, such as smoothness, silkiness or warmth, is typically perceived as higher quality. For example, automotive designers may choose materials for vehicle interior surfaces to create the perception of quality and luxury. Also, factors such as greater affluence, online access to a huge array of goods from around the globe, and the strong influence of social media on taste and opinion have contributed to a generation of consumers who are searching for products with extra sensory value.

Importantly, these consumers are often eager to choose and willing to pay a premium for items that offer improved sensory qualities. Designing products with sensory attributes such as texture and surface feel can provide valuable differentiation for a competitive advantage and allow manufacturers to command higher prices. However, a key challenge is finding a way to add sensory differentiation without jeopardizing design, adding manufacturing complexity, or significantly increasing production costs.

Thermoplastic elastomers (TPEs) offer designers a unique solution to these challenges. These versatile materials combine the functional performance and properties of thermoset rubbers with the processability of thermoplastics. TPEs can be customized in a number of ways to suit the needs of the application. Modifications include hardness, color, physical properties, service temperature, clarity, and bondability.

In addition to their use in standalone applications, TPEs can be overmolded onto a rigid plastic substrate using co-injection or insert injection molding technology. The result is an outer layer of TPE material over a rigid substrate, contributing a distinct, soft-touch feel to the stiffness and strength of the supporting structure. Specialized chemistries enable TPEs to adhere to many different plastic substrates, including polypropylene (PP), polycarbonate (PC), acrylonitrile-butadiene-styrene (ABS), PC/ABS, copolyester, polyamide and polystyrene, for a seamless and permanent bond.

The addition of TPEs is an affordable way to make an ordinary product stand out and to justify a better value to buyers. A few grams of a TPE material can often make a major difference in the perceived value and quality of an item. Further, incorporation of a TPE via overmolding can streamline manufacturing through part consolidation and elimination of secondary operations, such as application of an adhesive, for further cost savings.

ERGONOMICS AND BEYOND

Garden hose overmolded with TPE.

TPEs have been used extensively to provide ergonomic benefits to consumer products, particularly for usability and safety. For example, overmolding a resilient TPE grip onto a power tool handle can supply vibration damping to avoid discomfort or even injury. For the manufacturer of a garden sprayer, a TPE increased usability of the ABS handle by contributing anti-slip performance, even when the part is wet. Customers can keep a firm grasp of the sprayer to prevent dropping or twisting. Many companies employ TPEs to help meet the requirements of the US Occupational Health and Safety Administration (OSHA) for ergonomically designed tools.

Healthcare is a major area for ergonomic design, particularly in view of the U.S. Food and Drug Administration's draft guidance, *Applying Human Factors and Usability Engineering to Optimize Medical Device Design.* Incorporating TPE materials into grips, handles, buttons, plungers, caps and closures can help reduce forceful exertion, repetitive motion, contact stress and vibration. For example, surgical tools are often enhanced with a soft, textured TPE to provide comfort and firm grip during long procedures, thus reducing the surgeon's fatigue. In another example, Biowave Corporation, the manufacturer of pain therapy devices, used a TPE to create a non-slip grip for its portable BiowavePRO® non-invasive neuromodulation system designed for individual use by athletes to reduce pain and enhance rehabilitation.

Beyond their practical benefits for ergonomics, TPEs' versatility and unique properties can be leveraged by designers to deliver superior sensory performance for its own sake. TPEs can supply the following sensory qualities:

1. SURFACE FEEL

TPEs can be customized to provide surface feel ranging from grippy or tacky to smooth and silky. For example, a home medical device for elderly people who have fragile skin can benefit from parts featuring a super-smooth TPE that minimizes irritation and encourages use. In one application, a TPE was used in an award-winning prefilled syringe designed by OXO, a New York-based consumer products brand, for UCB, a global biopharmaceutical leader. The syringe and its secondary components were designed for use with UCB's CIMZIA® (certolizumab pegol), a prescription medication for adults with moderately to severely active rheumatoid arthritis. A TPE material was overmolded onto the large thumb pad to provide a soft, cushioned sensory experience for people with this debilitating condition characterized by painful joints.

The Cimzia® syringe has been awarded an "Ease-Of-Use" commendation by the Arthritis Foundation.

Today it is estimated that 40 million people suffer with arthritis in US,

but this number is projected to grow to 60 million by 2020. Improving user comfort and ease of use with soft, grippy TPEs has already begun and will become more important as the incidence of this condition grows.

TPEs played a significant role in a new packaging line for pain medication introduced by Bayer Consumer Care, a division of Bayer Healthcare in Morristown, N.J., in 2009. Their main objective was to create an easy-open bottle for arthritis sufferers. The new bottles are now larger, sleeker and oval shaped. Most importantly, they are overmolded with TPE to make the cap easier to remove.

2. TEXTURE

A wide range of textures can add sensory interest to a product. Consumer electronics, subject to fierce competitive pressures, often rely on stylish surfaces for differentiation. TPEs can provide unusual texturing, such as a bubble or ridged surface or a leather-like feel for phone and tablet cases, as well as combinations of different textures that accentuate electronic functionality. Textured TPEs can replace expensive secondary painting or adhesion operations.

TPEs are available in a wide array of colors and effects, which can amplify their sensory qualities and contribute to brand identity and shelf appeal. TPEs can be customized with bright colors and effects such as metallics, sparkles and pearlescents, and various shine levels, including eye-catching high gloss, which can provide a high-tech or high-fashion aesthetic. They are produced in opaque, semi-transparent and transparent formulations for additional aesthetic interest. TPEs can even be infused with a scent, such as the material used to create mosquito repellant wristbands, pet tags and hanging grids, which incorporates a proprietary formula of all-natural essential oils and fragrance to repel mosquitoes.

FROM FEEL TO FUNCTION

Not only do TPEs help improve touch and appearance, but these features can also be combined with functional performance. For example, the vibration damping performance of TPEs can be optimized through careful formulation to optimize energy absorption at a product's continuous use temperature. This can improve user comfort by helping to reduce stress carried through the device (in applications like power tools or bike handles), or it can help protect the device from impacts received during use or misuse of consumer electronic devices, for example.

Novel smart polymers include shape memory TPEs, which not only provide a soft grip but can be molded to the shape of the user's hand for a comfortable, ergonomic grip. Functional components can also be combined with overmolded grips, such as hinges.

COMPETITIVE AND ECONOMIC ADVANTAGES

TPEs offer a powerful solution to designers aiming to set their new products apart from the ordinary and win greater market share by addressing consumer desires for a high-quality, sensory experience.

1. COMPUTER MOUSE

A global business equipment manufacturer decided to develop a premium line of computer mouse products offering improved soft-touch qualities as well as ergonomics. The business goal was to boost penetration in this market category by creating a new higher-performing mouse that offered added comfort and features aimed at an enhanced user experience.

Key to the product development effort was a soft-touch mouse grip that would give users a smooth feel, easy handling, and greater physical comfort. The manufacturer sought a high-performance material to significantly improve the computer user's experience. Its design team determined the need for a soft-touch material with strong chemical resistance and color stability for the mouse grip. The company selected a clear overmold TPE for the mouse grip to provide comfort and usability.

The new premium mouse hit store shelves amid positive reviews, generating brisk sales. In addition, the profit margin on this product was about 30 percent higher than that of other models. The TPE helped the OEM to increase market share and generate more than $400,000 in sales during the first year of production.

2. RUNNING SHOE

Running shoe maker Brooks Sports began a project to develop a truly adaptable cushioning system for its 2010 line of footwear. The design team wanted to create a technology that would better respond to individual runners and their weights, gaits, running surfaces, pressures and speeds with varying levels of cushioning to improve comfort. At the same time, this system would feature an energy return midsole to add spring to the runner's step.

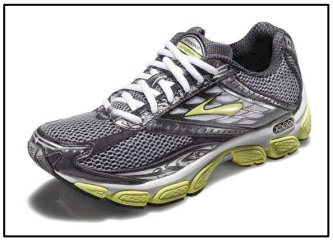

Figure 1. Brooks Running shoe uses TPE as part of their DNA technology.

The company chose high-performance, customized TPEs for the cushioning technology. The Glycerin® 8, introduced in January 2010, was the first shoe to feature Brooks® DNA, the new adaptive cushioning technology. Within a month of its release, the shoe was featured as the "Editor's Choice" in the *Runner's World* Spring 2010 Shoe Guide. Retail bookings for the Glycerin 8 shoe in its first spring were 40% higher than for the previous version of the shoe. In addition, the use of TPEs enabled Brooks to reduce manufacturing steps from two processes to a single injection molding process.

As indicated in these use cases, the addition of TPEs can enable manufacturers to reap greater financial rewards from their products. This phenomenon can be seen in the results of a recent, informal survey of products at a big-box retailer. A comparison of products such as a corkscrew, razor, ice cream scoop and hand saw demonstrated consistently higher prices – up to 1300x higher – for the versions that had been enhanced with TPEs. The use of colors and effects in TPE components, such as buttons, grips, triggers and handles, makes it easy to visually indicate to consumers the added value that these materials provide to a product.

Price Comparison of Consumer Goods With & Without TPEs			
Product	**With TPE**	**Without TPE**	**% Change**
Hammer	$4.47	$3.88	15
Tape Measure	$10.88	$6.97	56
Hand Saw	$10.88	$8.88	23
Ice Cream Scoop	$5.97	$3.97	50
Toothbrush	$1.99	$0.99	101
Spot Light	$29.88	$19.88	50
Utility Brush	$2.49	$1.49	67
Vise Grips	$12.47	$10.96	14
Razor	$6.99	$0.49	1327
Mechanical Pencil	$1.33	$0.33	303
Stud-finder	$29.97	$15.86	89
Cork Screw	$19.99	$8.76	128
Measuring Cups	$19.99	$12.97	54

Table 1.Big box store observed prices.

TPES ELEVATE THE TOOTHBRUSH

Today, even the most basic and traditional consumer products have evolved into sophisticated and highly differentiated and personalized brands. TPEs are playing an important role in this evolution by allowing designers to add ergonomic features, unique sensory benefits and appealing aesthetics.
Consider the common toothbrush, for which 3,000 patents have been granted. Consumers today can choose from hundreds of styles, many featuring soft-grip handles, special textures, integrated toothpicks or stimulators, and various levels of softness, to meet their individual preferences for oral hygiene. Again, these enhanced products typically are priced higher than standard designs. In the example above, a toothbrush with TPE components was twice the value of one without.

According to a Catalyst case study on redesigning the toothbrush, Oral-B® redesigned the traditional stick toothbrush in 1996 evolving into the CrossAction™ toothbrush. The redesign incorporated elastomer on the handle for a more effective grip. Three years after the CrossAction toothbrush hit the market, Oral-B gained an additional five percent share of the $5 billion toothbrush market.

CONCLUSION

Every day, consumers see and choose from among competing products found side-by-side on store shelves. Research has shown that differentiation of a product via sensory enhancement and aesthetics can attract buyers and also justify a higher price point. Today's TPEs, which offer a vast number of choices in surface feel, texture, compatibility with substrates, and colors and effects, are a practical and cost-effective way for designers to add the sensory experience and perception of higher quality that are in ever-greater demand by consumers.

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