TEKNOR APEX PRESENTS:

Get a Grip on Overmolding

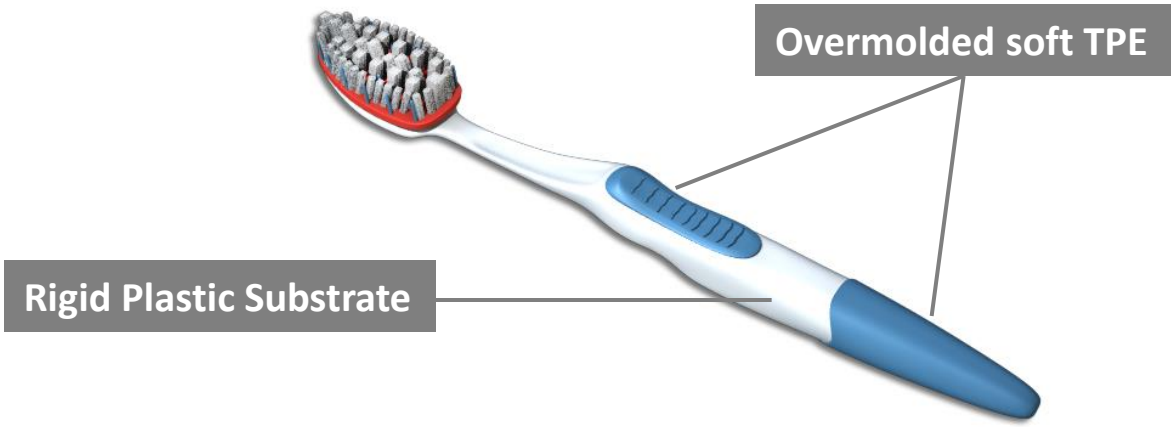
Contents

What is Overmolding?

OVERMOLDING is the process of creating a single part by injection molding a soft material, usually a TPE, onto a substrate, usually a rigid plastic.

Overmolding adds value by enhancing product features:

1. **ERGONOMICS** – Improved grip, provide cushion and comfort
2. **AESTHETICS** – Introduce color, texture, and haptics
3. **FUNCTIONALITY** – Provide a tight seal or damping characteristics



Choosing the Right Process: Insert vs. 2K Molding

There are 2 overmolding processes:

Insert and Multi-Shot (or 2K) Molding.

Insert Molding

Pre-molded insert is placed into a mold & TPE is shot over it.

Advantages:

- Can use conventional single shot injection molding machine
- Lower tool costs vs. multi-shot molding

Multi-Shot or 2-Shot (2K) Molding

Requires an injection molding machine with 2 or more barrels, allowing more than 1 material to be shot during the same molding cycle.

Advantages:

- Shorter cycle times
- Superior part quality
- Lower labor costs

RULE OF THUMB: Use Insert Molding when annual production volumes are low (<**500,000** units).*

*some exceptions may apply

Insert vs. Multi-Shot Molding: **Adhesion**

In some cases, better adhesion can be achieved with multi-shot molding versus insert molding.

- Adhesion between the TPE and the hard plastic is highly dependent on the chemistry and compatibility of the two materials.

- For certain combinations of hard and soft materials, a softened (or melted) hard component promotes the diffusion and entanglement of molecules at the interface, improving the bond. (This is known as a cohesive bond.) Inserts can be pre-heated to improve bond strength.

Choosing the Right TPE: Adhesion to Substrate

The substrate material plays a key role in the selection of the TPE chemistry.

- Styrenic TPEs (TPS) and thermoplastic vulcanizates (TPV) will generally adhere to polyolefins like PP and PE (fusion bond).
- TPS and TPV Materials exhibit poor adhesion to polar thermoplastics like PC, ABS, PC/ABS blends, polyamides (Nylon 6, 66, 12), polystyrenes (GPPS, HIPS, or blends), polyacrylates (PMMA), copolyesters (Tritan), polyacetals (POM), ASA, and PBT.
- Thus, standard TPEs need to be chemically modified to improve adhesion, and this modification is solely dependent on the chemistry of the substrate. TPEs are modified to adhere to a specific substrate (i.e. a TPE modified to bond to Nylon won't necessarily bond to PC).
- Teknor Apex has an entire portfolio of products, the Monprene® OM Series, that are adhesion-modified for excellent bonding to engineering thermoplastics (ETPs).

Choosing the Right TPE: 3 Factors to Consider

Many times in overmolding applications, product designers are concerned with the "look and feel" of the TPE in order to provide that certain "soft touch".

How does that translate into material properties or the optimal product design?

There are 3 Key Factors to Consider

- The amount of **"cushion"** you feel is more dependent on the thickness of the TPE overmolding versus the material's durometer.
- The **"feel"** of the TPE is characterized by its coefficient of friction (COF) and this can be customized.
- The **surface finish** of the TPE can be customized for gloss level.

3 Factors to Consider: “Cushion” & Thickness

The amount of “cushion” you feel is more dependent on the thickness of the TPE overmolding versus the material’s durometer.

- The thinner the TPE overmold, the harder it will feel.

- To increase cushion without increasing the thickness of the overmold, add multiple ribs placed closely together to create the perception of thickness.

3 Factors to Consider: “Feel” & Friction

The “feel” of the TPE is characterized by its coefficient of friction (COF) and this can be customized.

- TPE materials are often described as rubbery or “grippy” to the touch….this is not always true!

- Teknor Apex has the capability to customize the feel of a TPE, with formulations that range from silky smooth and lubricious to a very tactile or “grippy” feel. Even soft TPEs (40 Shore A) can be formulated to have a very smooth feel.

Coefficient of friction (COF) measures the tacticity of TPEs

***COF** = the degree of force required to move one surface across another*

3 Factors to Consider: Surface Finish & Gloss

The surface finish of the TPE is characterized by its gloss level and this can be customized.

- TPE materials can often resemble rubber, with a matte look, however gloss level can also be customized.

- Teknor Apex has the capability to adjust the gloss level of a TPE, with formulations ranging from a very glossy, vinyl-like finish to a zero-gloss, matte look.

GLOSSY

MATTE

Overmolding Tips: Tooling & Part Design

Ideal Gate Position / Gate Design

- Teknor Apex can assist with Moldflow® analysis to determine ideal gate position.

Influence of cavity surface finish (substrate)

- A smooth mold will cause a smooth (potentially glossy) finish on the part.
- A textured mold will cause a matte finish on the part, and can help hide a lot of surface defects.
- A textured finish on the substrate serves 2 purposes:
    1. Provides additional surface area in comparison to a high polish.
    2. Indentations act as nooks and crannies for the TPE to flow into and provide a mechanical lock on a micro level.

Part Design

- The use of mechanical interlocks in the component design will reinforce overmolding.
- Ensure thickness of TPE overmolding is not too thin as this can cause delamination.

Overmolding Tips: **Processing**

Minimize delay time between first and second shot:

- Maintain high temperature of substrate

Ideal injection speed of TPE:

- As fast as possible without warping or moving the substrate

Ideal holding pressure and holding pressure time of TPE:

- Ideal holding time is however long it takes for the gate to freeze off.
- Use a “Gate Freeze Analysis” - Weigh parts with different hold times & determine when the part weight doesn’t change.
- Determine the correct tool temperature of hard and soft component to reduce cooling time.

Overmolding TPEs: Material Handling

Drying

- The presence of moisture in either the TPE or substrate material will cause adhesion issues.
- Hygroscopic materials must be dried before molding. Consult the material's technical data sheet for proper desiccant drying instructions.

Coloring

- Typically PE-based color concentrates are used with standard TPEs.
- PE may not be compatible with specialty TPEs that are formulated for overmolding, and may adversely affect adhesion.
- Consult Teknor Apex on the best carrier resin to use.

Regrind

- For insert molding, clean TPE scrap generated from sprues and runners can be used as regrind at around 20%.
- Generally regrind is not used in 2-shot molded components.

Overmolding Tips: Maximizing Adhesion

Insert Molding – Substrate Preparation

- Best case scenario: Mold the inserts, and immediately transfer them to second mold to inject TPE.
- If inserts are molded and stored prior to overmolding, keep them protected from dirt, dust, and other contaminants. Wear hand protection when handling inserts and avoid contaminating with skin oils. Do not use mold release; as lubricants can also affect the bond.
- Preheating inserts can be useful and in some cases necessary.

TPE Melt Temperature

- TPE melt temperature is a critical parameter for overmolding.
- Melt temperature set point is determined by the substrate used and the target bond level. Teknor Apex will recommend the necessary melt temperature for a given TPE.
- In general, increasing the TPE melt temperature provides a stronger bond.

QUESTIONS?

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