

TPE opportunities in future smart auto interiors

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As in other industries, TPEs have penetrated auto interiors via drop-in replacement in existing applications (instrument panel skins, body/glazing seals, door trim, etc). Looking forward, non-TPE developments in the form of devices for sending and receiving electronic signals accompanied by a shift to electric vehicles (EVs) and (eventually) autonomous vehicles (AVs) will drive TPE usage and profitability in auto interiors well beyond drop-in replacement.

1 Auto interiors market evolution

Both the supply and demand side of the auto interior are being affected by recessionary conditions which are reconfiguring the supply chain. Auto interiors must accommodate growth in electronic sending and receiving capabilities and the associated growth in sensor technology. In addition to mass electrification, saturated automotive segments (e. g. SUVs) are clamoring for product differentiation which will open opportunities for interior TPEs.

2 New technologies driving TPE growth

In addition to the acceleration of mass electrification of vehicle models, the interior TPE market will be driven by the implementation of 5G communications and associated hardware technology to provide signal sending and receiving capabilities. The result will be the evolution of smart interiors which will require a new generation of smart materials, including smart TPEs and opportunities for TPEs with improved acoustic performance and adhesion performance.

3 TPE role in a shifting automotive interior supply chain

As the automobile moves toward new concepts, configurations and capabilities, the supply chain is shifting toward increased reliance on the silicon valleys of the world (USA, Europe, China, India).

It remains to be seen where the profits settle in the supply chain shift and what will be the role of TPEs in capturing value from the improved functionality of the components.

4 Evolution of auto interior components

Auto interior technology has evolved from simple monolithic structures to post-mold lamination of films or foams to fabric/film insert molding to the molding of smart components or assemblies capable of:

- sensing/receiving of electronic signals
- sending commands (capacitive switches for example)
- image projection
- participating in 5G systems.

5 Interior TPEs and smart systems

TPEs can enter automotive interiors via several paths. Prominent among these will be via on-board with sensors as part of smart systems for data generation and sending. In sensor systems, TPEs may be part of a sensor housing or as part of the sensing device that responds to several types of actuating forces (light, photoluminescence, capacitive response (as in current touch screens) or pressure generated piezoelectric signals.

Mega trends favor TPE growth in auto interiors as summarized in **table 1**.

6 Smart TPE configurations

The smart portion of the TPE may be either exterior to the TPE (via laminates or inserts) or interior to the TPE via smart fillers and additives as illustrated in **figure 1**.

Single layer, high-conductivity synthetic graphite sheet, currently used in consumer electronics can be used as a laminate. Advantages are ability to fit into tight spaces, good flex resistance and relatively simple manufacturing steps (**fig. 2**).

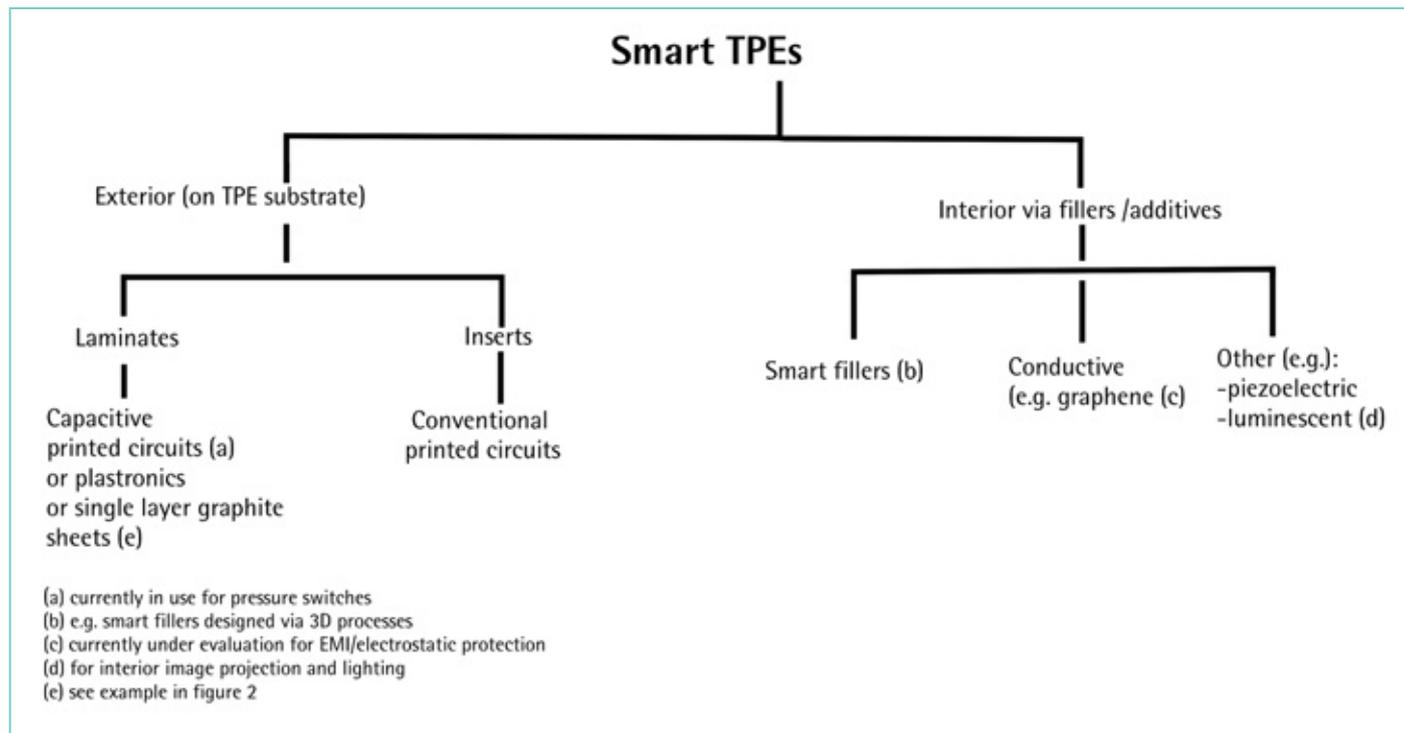
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Tab. 1: Megatrends and TPE growth paths in auto interiors (Source: Robert Eller Associates LLC)

Megatrends	TPE growth paths
<ul style="list-style-type: none"> • Rapid electrification • Implementation of 5G • Pressure for sustainability • COVID 	<ul style="list-style-type: none"> • Drop into existing systems (a) • Improve existing TPE properties (b) • Add new smart capabilities (c) • Improve adhesion to PP, ETPs
(a) instrument panel skins, door trim, body/glazing seals (b) improved resilience (for TPV body seals for example) (c) e.g. via smart TPEs for signal sending/receiving and image display capabilities	

Fig. 1: Smart auto interior TPE paths



7 Forces reshaping auto interiors

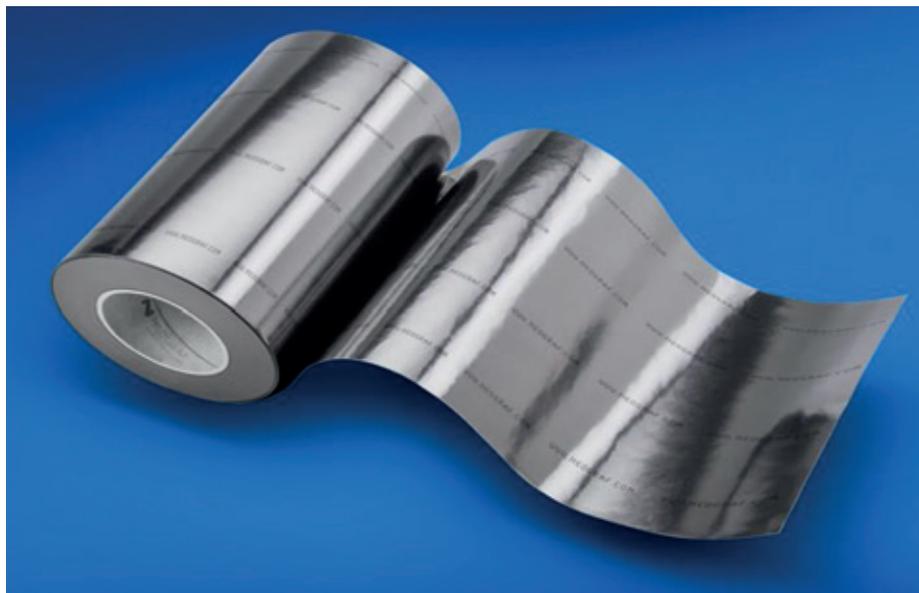
A number of forces are reshaping auto interiors and creating TPE opportunities. These forces include:

- COVID spread: causing vehicle sales decline and supply chain shifts (getting shorter), increased reshoring from Asia, reconfiguring via acquisitions as weak players leave.
- Vehicle sector saturation: results in the requirement for redesigned, differentiated interiors and a color palette shift as well as the incorporation of electronic capabilities for sending and receiving signals
- Data intensive smart capabilities including a shift from mechatronic devices to devices based on smart components. This shift, as well as an expected tsunami of profits will drive global Silicon Valley companies into the interior supply chain, if not into OEM positions

8 Technology push

In addition to a re-shaping of the auto interior supply chain, a number of factors are contributing to a technology push. These include:

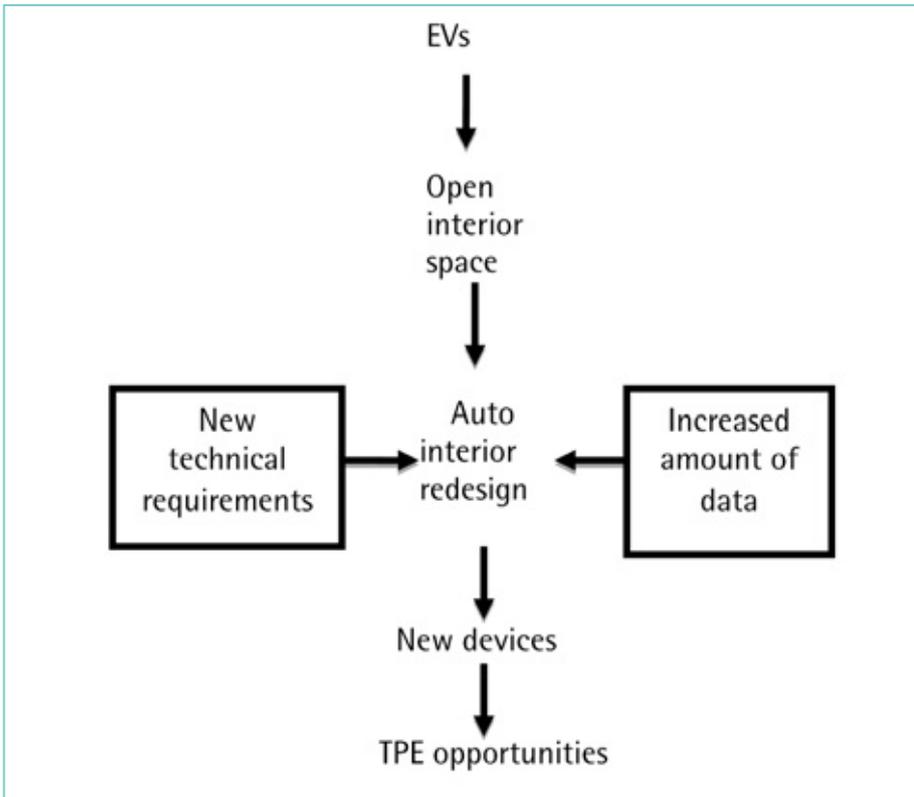
Fig. 2: Single layer graphite sheet laminate



Tab. 2: Inter TPE competitions in auto interiors (Source: Robert Eller Associates LLC)

Battle ground	Challenger	Incumbent	Note
Driver airbag	TPO	H-SBC	Battle during the 90's
Body/glazing seals	TPV	EPDM	Improved resilience TPV grades
Instrument panel skins	H-SBCs	TPO	Via improved flow H-SBC grades
Adhesion to ETPs	H-SBC		Recent improved adhesion grades
Floor covering	H-SBC	Carpet	Innovation from Weathertech

Fig. 3: TPE opportunities in auto interiors via vehicle electrification



- The shift from internal combustion engines (ICEs) to electric vehicles (EVs) which is rapidly gaining momentum
- The demand for connectivity to manage massive amounts of data
- Demand for sensors
- EMI shielding requirements
- Improved acoustic requirements
- The need for COVID-related cleanability which in turn results in demand for TPE mats (e. g. from Weathertech Inc.) and surfaces able to resist cleaning agents
- TPE grades with improved adhesion to ETP substrates
- Inter-TPE competition as shown in **table 2**.

Some of the pathways for increased TPE penetration in auto interiors resulting from vehicle electrification are illustrated in **figure 3**.

9 Summary

- Autos are evolving toward vehicles with smart interiors, creating new TPE opportunities.
- The COVID-driven recession will re-shape the auto interior supply chain. The associated financial crisis will drive out weak players, encourage consolidation and re-shoring.
- The vehicle is shifting from mechatronic-dominated systems to software defined systems.
- The era of simple 1:1 drop-in substitution is ending.
- 5G implementation will increase demand for sending/sensing, managing high data volume and further increase penetration of global electronics/software companies into the auto interior supply chain.
- Smart TPEs used in sensing/receiving systems add value and growth potential.
- The potential for TPEs in displays, image projection, lighting and signaling remain to be fully exploited.
- There will be a role for enhanced additives/fillers and improved adhesion grades.

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