TPE growth and market breadth at a turning point

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The TPE industry has enjoyed steady, fairly-high growth for 30+ years based on favorable general properties (elastic and thermoplastic), relatively low cost of the major polymers used (polyolefins, styrene block copolymers, elastomers) and fabrication process advances (coextrusion, overmolding, foaming, adhesion, scratch/mar improvement). As the industry has matured, new challenges are opening markets, creating value-added opportunities and an inflection point in growth of the TPE industry.

The inflection point

In addition to the well-established TPE advantages, some of the factors that will drive up TPE demand and value at and beyond the inflexion point are briefly listed in **table 1.**

Automotive TPE market

The automotive market is important for TPEs (especially TPO, SEBS, TPV, COPE) as described by this author [1 – 3] and others [6]. The automotive market is undergoing a revolution in production methods, performance requirements (heat resistance, scratch/mar resistance, VOC). The penetration by TPOs into exterior panels (lift gates and fenders for example) and new approaches to foamable TPV formulations based on polyolefin blends (olefin block copolymers and random copolymers, possibly with silane cross-linkers) are examples of new approaches driving increased automotive TPE growth opportunities.

The anticipated slowdown in global automotive sales from the current level of ~ 87 million vehicles [6] could dampen optimism for automotive TPEs but looking only to organic growth of vehicle demand (typically 3 %/y) will lead to an over-cautious approach. It is likely that TPE demand growth will come from lightweighting and new automotive functions such as smart applications (smart TPEs capable of sending/receiving signals, displays, acoustic controls, continued growth of new applications (exterior TPO panels for example) and the trend to larger vehicles which is driven, recently, by lower fuel costs.

Globalization of auto production is one of the factors that has driven US and European TPE compounders to produce in Asia and to stimulate recent investment in India. Reverse globalization (e.g. Chinese and European compounders investing in NAFTA) has also been described [3, 5]. Shifts in the automotive supply chain are drawing Chinese compounders, component producers and suppliers of advanced vehicle and component manufacturing technologies to NAFTA [4]. An excellent listing of several types of Chinese automotive investments [5] illustrates how the Chinese advanced automotive component manufacturing base and TPE compounders are beginning to evolve in NAFTA. Not surprisingly, many of the Chinese advanced component, R/D, connected vehicle, autonomous vehicle, sensor system companies are located in or near Silicon Valley.

Customer consolidation

TPE end-use customers are consolidating. Example consolidating industries include telecon, pharmaceuticals, defense, appliance manufacturing and hardware retail. In retail hardware for example, the top 2 players

Tab. 1: Factors driving up TPE value and demand at the inflection point

Driver	Notes
Manufacturing revolution	Seeking lower labor content. TPEs can reduce manufacturing steps. Kraton IMSS process [7] and overmolding are examples.
Autonomous/semi-autonomous/ electric vehicles	Driver for new automotive functions and designs
Bio-TPEs	Growth has started and will accelerate
Body/glazing seals	Growth will be stimulated by improved properties, better foaming control and new TPV formulations
Broadened range of super-TPVs	Via expanded range of cross-linked elastomer "islands" in plastic "seas"→ new applications
Challenge to silicones	Cost savings vs. over-engineered silicone applications
Exterior automotive panels	TPO lift gates, fenders
Fire retardance	FR additives and FR-TPE performance have steadily improved
Foaming	Lower density. Finer cell size and distribution in TPVs
Heat resistance	Opens auto under-hood applications (to at least 150 °C)
Improved bonding	To polar and non-polar substrates
Improved VOC and smell	Important in China auto interiors
Medical TPEs	TPEs are well-suited to many medical applications, alone or in combination (via coex or blend) with polyolefins
New performance requirements	Higher heat resistance. Transparency. Improved scratch/mar resistance
TPE role in smart materials	Smart applications will grow in sensing and signal sending (role for smart fillers, conductives, electroluminescents)
Vibration/acoustic damping	Quiet auto interiors, improved damping
Wire/cable market	Challenge to PVC. Higher heat requirements
Source: Robert Eller Associates LLC, 2019	

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advanced from a 42 % market share in the early 2000s to 80 % in 2018.

The reasons for corporate gigantism (often via international acquisition) are well known and will affect the TPE supplier sector. The traditional driving forces for consolidation are well known: increased purchasing power (note downward pressure on TPE pricing). In the appliance industry, for example, modernization of product (e.g. digitization, improved energy efficiency, incorporation of "smart" elements, IoT, connectivity, robotic manufacturing in the home ecosystem) have contributed to industry consolidation.

Broadening geographic and market footprints are major drivers for customer consolidation. Examples from the appliance sector are:

- Hisense, the Chinese electronics and appliance manufacturer, has acquired the Gorenje Group appliance manufacturer (Slovenia) which allows expansion in Western and Eastern European markets.
- Whirlpool, the world's largest appliance manufacturer, with multiple global acquisitions.

Product modernization drives consolidation in many industry sectors and is a vector for TPE technology development and associated added value gain. The incorporation of smart elements into automotive TPEs was described previously by this author [7] and will be applicable to appliances.

Maturity effects

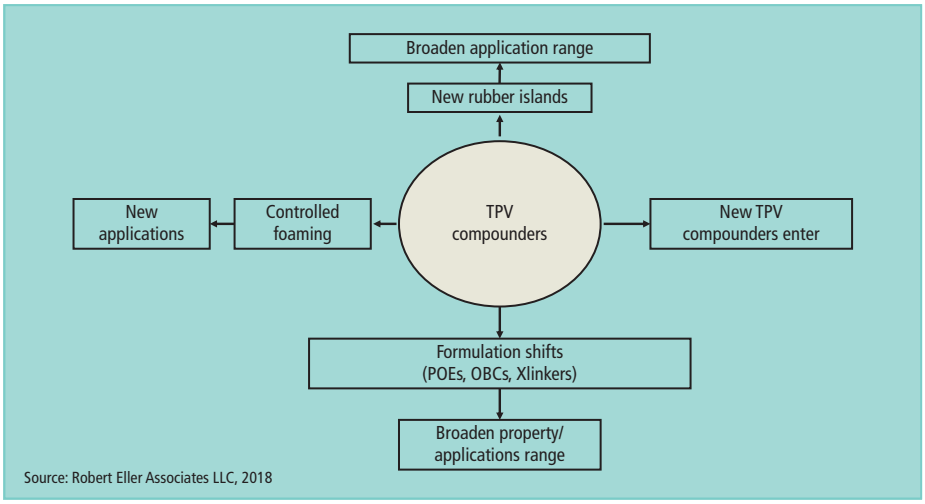
As portions of the TPE market have moved up the product maturity curve, the usual effects have begun to play a role as TPEs, within a class, become less differentiated between suppliers, the number of competitors increases and commoditization takes hold. However, as a class, TPEs remain more like a specialty than a commodity, especially when compared to commodity resins as illustrated in **table 2.**

Tab. 2: TPEs remain specialties when compared to commodity resins

Characteristic	Specialty (TPE)	Commodity resin	Note
Willingness to tailor	Yes – often for smaller annual volumes	Less willing to tailor for small order sizes	Shorter production campaigns for TPEs
Common name	Brand (e.g. Santoprene)	Polymer type (e.g. polypropylene copolymer)	Increased TPE branding (e.g. medical grades)
Price competition	Less intense but increasing	Very intense (some general published prices)	
Suppliers	Many (small-medium sized compounders)	Few (large resin companies). Most (not all) with captive compounding	Number of TPE compounders is increasing
Compounding extruder output	Lower/more versatile	Often quite high → reluctance to tailoring	

Source: Robert Eller Associates LLC,2018

Fig. 1: TPVs expanding on both supply and demand side



Silicone opportunities

Their inherent benefits have recently driven demand growth for silicones in some markets (medical appliances for example). Silicones are not usually direct TPE competitors but in some cases, they are over-engineered for the application (for example medical masks, clear and translucent peristaltic tubing) and recently present opportunities for TPE growth via targeting grades for silicone replacement with silicone-like properties (chemical resistance, food exposure approvals, reduced compression set, good haptics, good low and high temperature properties, sterilization resistance).

Role of PVC

PVC has had an important role in development of the TPE industry. A number of TPE compounders evolved from the PVC industry and provide TPE as PVC replacement (footwear, wire/cable, sealing profiles, auto interior skins for example). Due to the cost advantages of PVC formulations. PVC remains in applications where its lower cost is valued and where properties are adequate. PVC-coated fabrics for example remain unchanged.

TPV broadening

The TPV-type TPE sector has been primarily based on cross-linked EPDM rubber "islands" in a "sea" of PP resin since their introduction by Monsanto in the early 1980's. There are many other rubber "island"/plastic "sea" combinations (super-TPVs) which can lead to property improvements, increased heat resistance, re-sealability of needle punctures (for septa on medical vials for example). A challenge to EPDM is also coming from increased use of olefin block copolymers and ethylene/alpha olefin blends, cross-linked via silane rather than more traditional cross-linkers. **Figure 1** illustrates how the TPV universe is broadening on both the supply and demand sides.

Transparency-TPEs (for example SEBS) have penetrated the films sector (medical fluid bags, bandages, possibly smart applications), packaging as multilayer coextru-

sions or blends with polyolefins where they are valued for transparency, cold temperature flexibility and adhesive properties. In some of these applications they compete with plastomers.

Summary

Property improvement, organic end-use market growth, the use of TPEs in higher functional value applications (e.g. transparency, low VOC, improved foaming, silicone replacement, new approaches to TPVs) and fabrication cost savings are driving TPE demand at the inflection point. Customer consolidation will drive demand while increasing downward price pressure on TPEs and favoring further compounder globalization and acquisitions.

References

[1] Twenty Years of TPO and TPE Evolution in Auto Interiors and a Vision of the Future; SPE TPO Conference, October 2018; Detroit, MI, USA.

[2] B. Eller. "Global TPE Markets", TPE Magazine; 1/2017; p.22.

[3] B. Eller. "Global TPE Strategies", TPE Magazine; 1/2016; p.18.

[4] "Supply Chain Dynamics and Future Technologies in Auto Interior TPOs and TPEs", B. Eller, Robert Eller Associates LLC; SPE Auto Polyolefins Conference, October 2016; Detroit, MI, USA.

[5] M. Dunne. "Chinese Automotive Investments in the U.S."; Automotive News November 5, 2018; p.16.

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K 2019: New technology as a motor for innovation

Special show and Science Campus address pioneering key issues of the polymer industry

Innovative materials and technology have been a hallmark of all presentations staged at the K trade show in Düsseldorf, Germany, the international flagship fair for the plastics and rubber industry. K 2019, which will take place from 16 – 23 October 2019, will also revolve around the key issues of circular economy, resource conservation and digitisation, all of which will be addressed at exhibition stands and by the accompanying programme. A total of 3,000 international exhibitors are expected to attend K 2019 and showcase their latest developments from the areas of machinery and equipment for the plastics and rubber industry, raw materials and auxiliaries as well as semi-finished products, technical parts and reinforced plastics products. More than 200,000 visitors from all over the world are expected in Düsseldorf to attend K 2019.

The special show, traditionally hosted alongside K 2019 under the known title of "Plastics shape the Future", will illustrate how plastics can have a sustainable impact on our future, which developments have emerged today and which visions have the potential of becoming reality tomorrow. Centred on several topics, the seven-day event will offer expert discussions, kick-off speeches, entertaining presentations and exciting experiments. Explorations of economic and ecological aspects will also tackle problematic issues and provide solutions for discussion. The special show is a project that was initiated by the German plastics industry under the aegis of **PlasticsEurope Deutschland e. V.** and **Messe Düsseldorf.**

The Science Campus K 2019 open platform encourages an active discourse between research and the industry. It also provides exhibitors and visitors with an opportunity to gain a comprehensive overview of recent scientific activities and results that affect the plastics and rubber industry and offers room for the exchange of information between universities and companies.

The Science Campus and special show programmes are carefully aligned. Both platforms address topics that will dominate the global development of the polymer market in the coming years. These key issues were defined by scientists and experts from the innovation circle of K 2019 as follows:

Digitalisation/Plastics Industry 4.0
- Platform economy
- Value-added networks

Plastics for Sustainable Development
- Water management
- Renewable energies
- Circular economy (alternative raw materials etc.)

System integration: functionality through material, process and design
- New materials and additives
- Additive manufacturing
- Lightweight engineering
- Mobility (e-mobility)
- Bioplastics

Special attention will be paid to the question of how to recruit new, young professionals for the industry, science and training. The key issues will be prepared by the participating universities, institutes, associations and funding agencies and induced and explored in presentations with the help of select exhibits.

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Elastomer special
Hall 6 will again host a special area dedicated to rubber and thermoplastic elastomers.