What is Thermoplastic Elastomer?

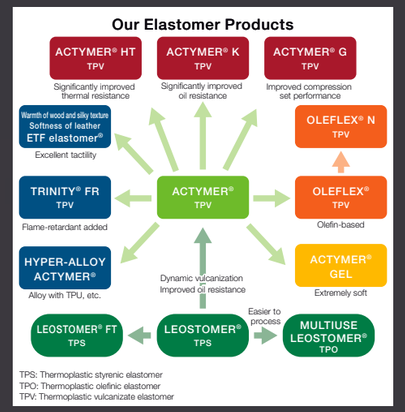
Thermoplastic elastomers are polymeric materials that soften and become fluid when heated and return to a rubbery state when cooled. Thermoplastic elastomers have excellent recyclability and moldability like plastics. They are therefore used in a variety of products from automobiles, electric wires, building materials, home appliances, and everyday items to toys, hygiene products, and medical products. The use of these materials in automotive parts, in particular, is increasing as they contribute to weight reduction compared to conventional vulcanized rubber.


Dust Boot (Automotive Molding Component)


Syringe Gasket


Pen Grip


Packing for Pitcher



Material of Interest as an Alternative to Rubber Expectation for Elastomer

Having found the potential of the excellent properties of elastomers, RIKEN TECHNOS started developing thermoplastic elastomers (hereinafter, elastomers) in the 1990s. Since then, starting with the automotive field, we have developed a number of products for various fields responding to our customers' requests. Recently, the use of elastomers for new development projects as materials that can contribute to the circular economy is also increasing along with the elevating concern over environmental issues.

We held a roundtable talk inviting four employees engaging in the R&D of elastomers. The participants explained the environment in which RIKEN TECHNOS's elastomers have been developed and exchanged their opinions about the future direction.

Participants **Shinzo Saito, General Manager of the Core Technology R&D Department**
Satoshi Takahashi, Group 1, Material R&D Department No. 1, R&D Center
Mamiko Yamada, Material Group, Core Technology R&D Department
Koji Sakai, Group 2, Material R&D Department No. 2, R&D Center

Held on July 17, 2024 at RIKEN TECHNOS's R&D Center.
* The affiliations and titles of the participants are current as of the talk.

Shinzo Saito
General Manager of the Core Technology R&D Department
Saito has engaged in the R&D of thermoplastic elastomer compound materials for various fields such as automotive, medical, food, daily goods, and industrial materials. Now, he engages in the DX of R&D in addition to core technology development.

Expansion of Use of Elastomers in Wider Products

Saito: Thermoplastic elastomer compounds are our flagship products like polyvinyl chloride (PVC) resin compounds. Due to their advantageous properties such as flexibility, durability, weather resistance, moldability, and processability, elastomers are widely used in automotive parts, medical equipment, everyday items, and industrial products, among others. Please share examples of elastomer development in the field you are engaging in.

Takahashi: I engage mainly in the R&D of elastomers for the automotive field. A variety of resins are used in automotive parts, and elastomers are used for many parts. Elastomers started to be appreciated in the late 1990s because of their excellent recyclability and low environmental load. In the late 2000s, interest in elastomers, with excellent compression set properties and humidity resistance, elevated, and their demand as alternatives for automotive vulcanized rubber, including that for glass run channels, increased. At present, the use of elastomers has increased to products such as boots, bellow-shaped molded products that require flexibility. The introduction of elastomers is advancing as those of today can fulfill the strict functional and molding requirements of some components, which was impossible in the past.

Yamada: I engage in the R&D of elastomers for our customers in the building material, daily goods, and food fields. One of the memorable projects is the development of an elastomer for household chopping boards. As these chopping boards come into contact with food, I prescribed and engineered an elastomer placing a focus on material hygiene. I repeated trial and error considering the texture of contact with the blade of a kitchen knife hitting a chopping board (flexibility) and grip comfortability when chopping, heat resistance against disinfection with boiled water, etc. As I often engaged in the R&D of elastomers for daily goods and building materials, I am happy to see that the products I developed are being used in daily life in various places.

Sakai: I engage in the R&D of elastomers related to daily goods and building materials, centered on medical and food. In terms of use, elastomers for medical equipment in particular need to secure hygiene to make them safe materials. Moreover, they need to fulfill various property requirements. In developing a rubber cap for a medical device (intravenous drip), I successfully found the optimal formula design while checking performance in use. As a result, the excellent hygiene of the product, which does not require vulcanization, was highly appreciated, and we achieved the switch from isoprene rubber to elastomer.

Satoshi Takahashi
Group 1, Material R&D Department No. 1, R&D Center
Utilizing the experience of engaging in the development of "ACTYMER® G," a grade of improved compression set performance, among others, Takahashi engages in the R&D of compound materials centered on automotive molding compounds.

Saito: I understand that elastomers are used in various products in many fields and all of you find the R&D of elastomers rewarding. Please tell me about what you place importance on in developing elastomers.

Takahashi: I try to keep close communication with customers. When developing a product, we can check the required specifications quantitatively in advance, but what our customers want always includes elements that are not noticeable from the figures. I therefore endeavor to engage

Mamiko Yamada
Material Group, Core Technology R&D Department
Yamada engaged in the R&D of thermoplastic elastomer compound materials for building materials, daily goods, and food products. She now is in charge of proposal-type new product development and core technology development making the most of her experiences to date.

in developing products while communicating with customers and checking the actual molding materials and molding conditions on-site to develop a product with which both we and the customers can be satisfied. This culture is RIKEN TECHNOS's R&D style, which I think will be handed down to the next generations.

Yamada: I also believe in the importance of communication. For example, let's suppose I received a requirement from a customer for an elastomer that withstands the temperature of 100°C. The required properties are completely different between a case where the elastomer to be developed will be used in an environment in which the temperature momentarily gets to 100°C and where it will be used for several years in an environment in which the temperature stays 100°C. I therefore strive to propose the optimal material by hearing the background of the environment in which the product to be developed will be used for what purpose.

Sakai: I believe that communication is also important internally in addition to it with our customers. While prioritizing meeting customers' requirements, I keep close communication with manufacturing sites to conduct formula design of elastomers that can be stably manufactured. I am also always aware of the necessity of developing formulations that our customers can continue to use without concerns over supply and product quality.

Saito: As Mr. Sakai said, even if we can make a good prototype, if we can't stably produce the same quality with an actual mass-production machine, it will cause trouble not only for the factory but also for the customers as well. Developers are required to consider various aspects and always develop products recognizing new customers value. Do you have any recent development trend of interest?

Recent Trend in Elastomer Development and Proposal of Customer Value

Takahashi: I frequently hear the word "environment" at the R&D sites for the automotive industry I am in charge as well as for other industries. For example, the number of R&D projects aiming to replace vulcanized rubber is increasing. Vulcanized rubber, however, excels in mechanical properties such as rubber elasticity and durability mainly due to its flexibility. To replace it, the development of elastomers with higher performance is necessary.

Sakai: Elastomers are said to be lighter by approximately 20% compared to vulcanized rubber. Switching vulcanized rubber to elastomers would contribute to improvements in transportation fuel efficiency. Furthermore, vulcanized rubber does not return to its original shape even when reheated once it has molded. On the other hand, molded elastomers can be re-molded by crushing, like chocolate. Elastomers are also environment-friendly materials due to their easy recyclability.

Yamada: Depending on the molding method, burrs (unnecessary portions produced by stuck-out material during molding) are generated during rubber molding in some cases. The process to remove these burrs is necessary with rubber, but with elastomer molding using the injection method, the deburring process can be reduced due to the elastomers' excellent moldability. Furthermore, burr portions can be reused, without wasting, in manufacturing molded products, which pushes the yield ratio to almost 100%.

Sakai: As post-processing for burrs is unnecessary, the risk of contamination by foreign matters can be prevented. For this reason, there is also demand in the medical field, where a high level of hygiene is required. Moreover, deburring is often performed manually, requiring many workers. As the labor force decreases due to a shortage of human resources, I think that the removal of this process is a great advantage. As such, elastomers have many advantages not only improving yields but also reducing various cost.

Takahashi: In terms of reducing labor hours, elastomers have the property of being able to be heat-sealed with hard substances such as polypropylene resin and ABS resin*. This also brings the major advantage of making it easy to create two-color molded products made of different materials. Using two-color molded products made of elastomers reduces the volume of assembly work for elastomer parts and makes parts attachment smoother. In addition, as no chemical agent such as an adhesive is needs to be used for parts attachment, elastomers are expected to contribute to both person-hour saving and environmental conservation.

Saito: I understand that the elastomers we develop are materials that can contribute to solutions to environmental and other various issues. Let's continue to work on the R&D of materials that "Stay ahead of customers' expectations" while sincerely facing diverse challenges with our customers.

Value Creation and Development Style Going Forward

Saito: More than 30 years have passed since we started developing elastomers. While our R&D theme has been constantly changing with the times, I think that the style of standing close to customers to solve issues together is the most prominent characteristic and strength of RIKEN TECHNOS's R&D. We should not change this style. Meanwhile, product development becomes increasingly difficult and shortening the development periods to spend on R&D is being required. Although shortening the development period and reducing person-hours required until product developments are finished will ultimately contribute to energy-saving, we need to consider how to enhance development efficiency while handling various projects one by one with due consideration.

Koji Sakai
Group 2, Material R&D Department No. 2, R&D Center
Sakai engages in the R&D of thermoplastic elastomer compound materials mainly for medical equipment, food products, daily goods, industrial materials, building materials, and civil engineering materials, customer support, and the development of new markets made by developed products.

Yamada: The R&D departments are also working on DX, developing elastomers utilizing materials informatics (MI) with artificial intelligence (AI) including machine learning. We have already seen the results on product development and this has made efficient experiments possible. We expect that the newly acquired capabilities of developing new materials in a shorter period and utilizing data has enabled us to respond to diverse requests from customers more rapidly and flexibly than ever before. Moreover, establishing an environment in which various data can be stored is useful for accelerating R&D and handing down technological expertise accumulated in the Company.

Takahashi: R&D using MI has been introduced to many companies and is attracting increasing attention. You might think that the use of MI enables our competitors to develop similar materials, but actual data to be input is the key. To elevate the accuracy of analyses, the material evaluation technology must be improved. As we have our unique expertise including the methods and lessons accumulated through product design and development in the past, our starting point is completely different from those of competitors. Sense is also needed in interpreting the output. By skillfully integrating MI with the evaluation technology we have cultivated over the years, we should be able to create new value. In the automotive field, which I am in charge of, progress with EVs is progressing. To match the shift from engines to electric motors, requests to switch materials from vulcanized rubber to elastomers are increasing. I would like to fulfill our customers' expectations as a material manufacturer by utilizing various R&D methods and promptly proposing elastomers that exceed their expectations.

Sakai: Under the Mission "Mission and Purpose" to be a challenger, RIKEN TECHNOS engages in three businesses comprising compounds, films, and food packaging. As a person engaging in R&D, I would like to continue to take on challenges. As the Company has grown from compounds to derivatives, namely films and wraps, I would like to continue to challenge myself to develop new product series that can underpin RIKEN TECHNOS in the next era.

Saito: By promoting DX of R&D from manufacturing to quality control as well, I think that we can establish a system to promptly launch high-quality products to market. Let's accelerate challenges in new fields by increasing contact points with startups and academia without being constrained to conventional approaches and common sense. Let's enjoy R&D together more than ever by taking on bold challenges to find customers' voices of excitement and smiles of joy.

* ABS resin: synthetic resin copolymerized combined with acrylonitrile, butadiene, and styrene