

Making a Future Where Robots and People Live Together Safely

Team Leader, Polyurethane Materials Design Department
Synthetic Chemicals Laboratory, R&D Center, Mitsui Chemicals, Inc.

Hiroshi Kanayama



Exterior materials to mitigate shocks

Photo: Tokyo Robot Lab. ORIX Rentec Corporation

Robotics will have an impact on our lives and places of production. As a next-generation business, Mitsui Chemicals has set their sights on this field. The company is paving the way into new territories with its diverse technologies for designing and molding resins. Standing at the forefront is Hiroshi Kanayama, who leads the development of urethane products. He is stepping into the rapidly growing market of “collaborative robots”.

A pile of a substance that looks like giant blocks of “koya dofu” (freeze dried tofu) can be found in a cabinet, but touching it reveals various qualities of elasticity and smoothness. These are actually samples of urethane foam prototypes developed in the past.

“Urethane foam is used all around us, as cushioning material in car ceilings and seats, insulation material in refrigerators, and more. Attributes, such as strength and elasticity, which are required to achieve a specific degree of functionality or performance, will vary according to application.

Therefore, we always design and commercialize the optimal materials”, explains Hiroshi Kanayama, who has devoted himself to the design of urethane materials for 18 years.

In 2015, the team under his lead began a project to greatly expand the possibilities of urethane. The target was exterior parts and materials for robots that work alongside people, “collaborative robots”.

Japan’s Industrial Safety and Health Regulations were partially revised in December 2013, allowing industrial robots of 80W or higher rated output to work together

with people without the previously required safety barriers. In response, the competition among robot manufacturers to develop collaborative robots has intensified. One of the keys to solving the greatest issue of all, safety, is the cushioning material. Mitsui Chemicals has extensive experience and achievements in the processing of urethane foam, which offers high shock absorption. Leveraging this strength, the company started developing materials for exterior parts suited to robots.

Breaking through difficulties by using the company's strengths as a raw material manufacturer

“Our first difficulty was the material design. We had to achieve the targeted performance with several constraints, such as flame retardance. We went back to the raw materials in our investigations, and designed the optimal molecular structure. That let us break through the difficulty,” says Kanayama.

But that was not the only difficulty. Even as the launch date for the collaborative robot drew near, the shape of its

parts remained undecided.

“We have to produce ideally-shaped parts stably, within the determined time. As the robot will work alongside people, visual design sense is also required. We had an especially hard time creating the surface smoothness,” Kanayama recalls. For numerous parts of complex shape, Mitsui Chemicals managed to come up with over 100 improvements in just two months. “We made use of our experience in creating hundreds of molded products for car interiors,” says Kanayama concerning the days of sweating over the work.

At the end of the struggles, the collaborative robot was launched on schedule,

and drew attention as a robot that could safely perform heavy work. From that experience, Mitsui Chemicals has moved forward with development of optimal processed materials for robots, widening its view from industrial robots to also encompass service robots used in nursing care and customer interaction.

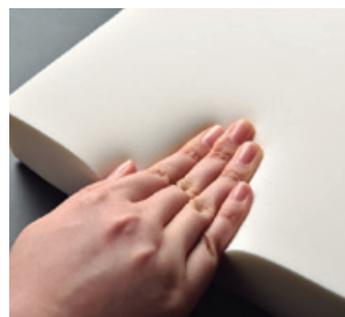
“Polyurethane gels are drawing attention as a material to replace the silicone that is used for the exterior of humanoid robots. By controlling the mixture ratio of isocyanate and polyol, our company has developed a human skin-like gel that combines transparency, strength, and flexibility,” says Kanayama.

The wonderful sense of achievement at the summit

“He doesn’t quit. Even when others say something is good enough, he carries through. I think that’s his good point.” That’s how the members of the project team evaluate Kanayama as a researcher.

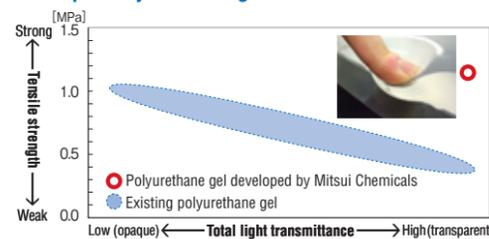
Kanayama was a member of the mountain climbing club in high school. Hailing from Fukushima Prefecture in the Tohoku region, he carried heavy loads in excess of 20 kilograms numerous times up Mount Adatarata and Mount Bandai.

“Every time I climbed, I wondered why I was doing something so hard, but at the summit there would be a wonderful view. Through my experience mountain climbing, I may have picked up the idea that something good will happen if I stick it out and continue,” Kanayama laughs cheerfully. He is sure to make use of that natural persistence as he continues pioneering new worlds in urethane.



Developing diverse urethane foams matched to applications

Human skin-like polyurethane gel that achieves transparency and strength



The soft polyurethane gel developed by Mitsui Chemicals has a high total light transmittance of about 90%, and achieves over twice the strength of existing polyurethane gel of the same transmittance.

Helping the robot industry develop through performance and lighter weight

Mitsui Chemicals established the Robot Materials Business Development Division in April 2016, with the aim of offering total solutions that span materials to component processing. In addition to urethane exterior materials, the division will support the commercialization of robots from a variety of angles, including polyolefin lens materials for vision, POLYMETAC™ integrally molded metal and resin for bones, and touch sensors for robotic hands.