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Toray Industries, Inc.

· Precision High Polymer Technology Project (FY2001-FY2007)

Plastics that Soften when subject to High Speed and Strong Impact



High polymer materials starting with plastics are superior in strength, impact resistance, workability, and being light-weight, and are used in the exterior, casing, mechanism element, and components of various products. Needs for high polymer materials are becoming more diverse and advanced, and development of new materials using “polymer alloys (alloying)” that combine different types of high polymer materials is becoming active. However, with conventionally known polymer alloys, it was difficult to sufficiently bring out the characteristics held by each of the polymer bodies prior to alloying. In view of this, NEDO started the “Precision High Polymer Technology” project in 2001. Toray Industries, Inc. participating in the concentrated studies (concentrated studies = a research and development method where researchers of each of the participating manufacturers come together in one research institute such as a university) at Yamagata University as a fabrication group, succeeded in developing a “a special plastic wherein, a hard plastic, when impact is applied thereto, becomes soft like rubber” by utilizing the structural control technology of nanometer orders. The new high polymer material having a characteristic that has never been created in the past is gathering attention in various fields such as safety components of vehicle and sporting equipment, and is continuing to evolve towards productization.



As a result of a destruction test, a conventional product cracked while the impact absorbing nylon was only dented like an empty can. Recovery from this state is also possible.

Q. Why did this project start?

Nano technology is considered a key technology capable of bringing drastic changes to the field of industrial technology, as functionality and characteristics can be improved immensely by controlling materials on a nanometer level. Yet despite such innovative capabilities, structured technology foundations remained unproven, so the Ministry of Economy, Trade and Industry launched the "Nanotechnology Program" in 2000 with the aim of building a foundation for nanotechnology and developing industrial technology. This project formed part of this initiative.

Q. What was the aim of the project?

Polymers are used in a wide range of applications, including as an industrial material such as plastic, rubber and paint, as well as more familiar products such as synthetic fibers, tires and construction materials, and even as components in electronic devices. Yet to develop polymeric materials with new functions and applications that were not available previously, polymers required structural control on a nanometer level. This project aimed to establish the relevant framework and pave the way for training of personnel and commercialization of these materials. One of the results of this project is "NANOALLOY®" (shock absorbing nylon), a polyamide material that becomes softer as sudden shocks are applied.

Q. What is the role of NEDO?

While nanotechnology is an essential form of technology for industrial development, establishing foundation technologies and research and development prove extremely difficult, which results in greater risk due to longer development times and larger investment required, and as such the intensive research and development project run by NEDO was required. NEDO provided support in launching the project, from development of foundation technology through to research and development. An intensive research approach was adopted by collaborating universities and research institutions with advanced research and equipment, with companies. NEDO also had the role of running evaluations on research results and achievement levels, and selected potential topics that would lead to commercialization and business.