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Mitsui Chemicals, Inc.

**Mitsui Chemicals Succeeds in Reducing Component Weight  
by Around 89% in Ultralight Robot Project**  
Robots fitted with gear made from LUBMER™ in pursuit of a carbon-neutral society

Mitsui Chemicals, Inc. (Tokyo: 4183; President & CEO: HASHIMOTO Osamu) is currently engaged in a joint development project that aims to use the company's Ultra High Molecular Weight Polyethylene LUBMER™ to develop plastic gears for use in robotics. Partners on the project are hide kasuga 1896 CO., LTD. (Minato-ku, Tokyo; CEO: KASUGA Hideyuki), as well as a Waseda University research team led by OTANI Takuya - Junior Researcher (Assistant Professor) at the university's Waseda Research Institute for Science and Engineering – and Professor TAKANISHI Atsuo of the university's Faculty of Science and Engineering.

The research partners recently published an article reporting their finding that replacing the metal gear in a humanoid robot finger joint with a gear made from LUBMER™ helped to conserve energy and reduce the robot's weight.

Escalating global problems with energy supply are a pressing issue for those researching and developing robotics, which have found increasing commercialization across a variety of fields in recent years. The large majority of electric energy consumed by robots is supplied by motors, with energy consumption increasing in proportion to the robots' size and weight. Consequently, making robots lighter is crucial in order to reduce their energy consumption. Mitsui Chemicals has previously contributed to robot lightweighting by supplying resin parts to replace metal ones, with a track record here including frames and arms made from high-strength plastic. However, to create fundamentally lighter robots, it is imperative to lighten not only external structures such as frames and arms but also the gears that drive them.



(Image) An industrial robot and a humanoid robot.  
Robots contain numerous gear components.

With this in mind, Mitsui Chemicals has been looking into the use of robot components made from its Ultra High Molecular Weight Polyethylene LUBMER™ as an alternative to metal. Hypothesizing that doing so would result in robots that were more energy efficient, lighter, quieter and maintenance-free, Mitsui Chemicals embarked on this joint development project with Waseda University and hide kasuga 1896. Now, project members have published an article\* detailing their finding that simply replacing the metal gear in a humanoid robot finger joint with a gear made from LUBMER™ reduced the weight of the component by around 89% and conserved energy, suggesting that LUBMER™ could also be applied for use in gears in the robotics field.

Going forward, the development partners intend to expand the scope of implementation to humanoid robot components required to bear a higher load and operate faster, including the elbows, shoulders and torso. They will examine the potential for creating ultralight robots by also verifying performance in accompanying metrics, including durability, practicality for use in oil-less drive systems and low noise effect.

\*Details of published article:

Name of journal: IEEE Access

Title of article: Energy Efficiency Improvement of a Robotic Finger with Ultra High Molecular Weight Polyethylene Gear

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References:

■ Waseda University press release:

<https://www.waseda.jp/top/news/84546>

■ LUBMER™ product website:

<https://jp.mitsuichemicals.com/en/special/uhmw-pe/features/lubmer/>

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