

R&D about Tribology of The High Strength Gels



Name Masato WADA **E-mail** wada@tsuruoka-nct.ac.jp

Status Assistant Professor

Affiliations The Japan Society of Mechanical Engineers,
Japanese Society of Tribologists

Keywords Friction, Abrasion, Tribology, Gel, Soft Matter

Technical Support Skills

- Measurement / Evaluation in Tribology (friction, abrasion, lubrication)
- Technology about the three-dimensional molding
- Surface processing technique

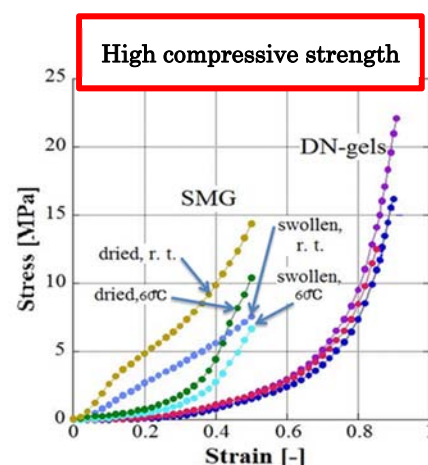
Research Contents

Each function of the polymer gel has flexibility, high ductility, high water absorption, shape memory, biocompatibility, electric field responsiveness, free formability by a 3D gel printer, and the like. These are specific functions not found in other materials. Among them, high strength double network gel (DN gel) boasts compression strength of several tens of MPa. Also, the gel exhibits a coefficient of friction of 10^{-4} and is expected to be applied as a high strength and low friction material. In addition, shape memory gel (SMG) exhibits behavior like rigid plastic at room temperature and flexibility as polymer gel under high temperature environment (about 50 to 60 °C). These functions are expected to be applied to various applications, and research is being actively carried out now. Furthermore, the friction behavior of gels is complicated and can not be explained solely by theory on solid friction. The following characteristics are known.

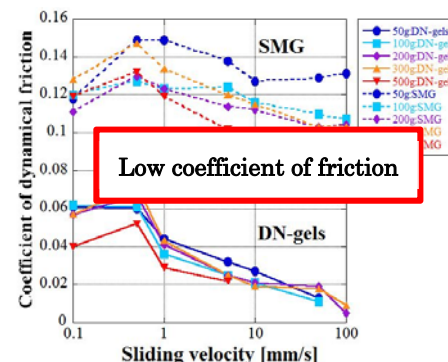
- ① The friction of the gel is smaller than the solid, and does not depend simply on the load.
- ② The friction of the gel depends on the apparent contact area.
- ③ The friction of the gel depends on the sliding speed.
- ④ The friction of the gel changes greatly depending on the properties of the counter substrate.

By elucidating the above friction mechanism, practical application of high strength and high performance gel is realized. Moreover, by using soft material as a mechanical material, it can be applied as a flexible and low friction sliding part which can not be achieved with hard material.

We aim at practical application in the tribology field of soft materials related to these research contents.



High compressive strength
 Compression test results of
 DN gel and SMG



Low coefficient of friction
 Friction measurement results of
 DN gel and SMG

Available Facilities and Equipment

Friction measuring device	
3D-CAD (SolidWorks)	
CO2 laser processing machine (HAJIME)	