Tribology

Low-wear, low-friction material; urushi lacquer containing a solid lubricant

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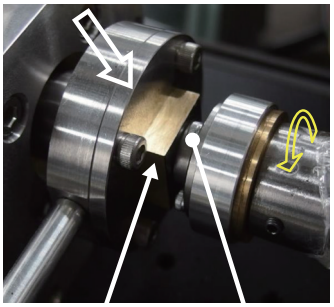
Purpose of Research

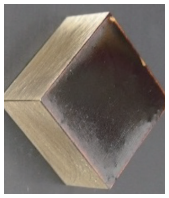
Urushi lacquer is a natural resin material, which has long been used in Japan as a hard coating material for tableware, armor and other items. As a resin material with excellent chemical and wear resistance, this research focuses on urushi lacquer, and aims to study the friction and wear properties of sliding materials made from urushi lacquer with PTFE added as a solid lubricant.

Summary of Research

In this research, we prepared a sliding material by hardening urushi lacquer with PTFE added as a solid lubricant, and conducted friction tests using a ring-on-plate friction tester under dry conditions. The results indicated that adding PTFE to urushi lacquer resulted in a low friction coefficient equivalent to that of 100 wt% PTFE, and a high degree of wear resistance equivalent to that of hardened urushi lacquer.

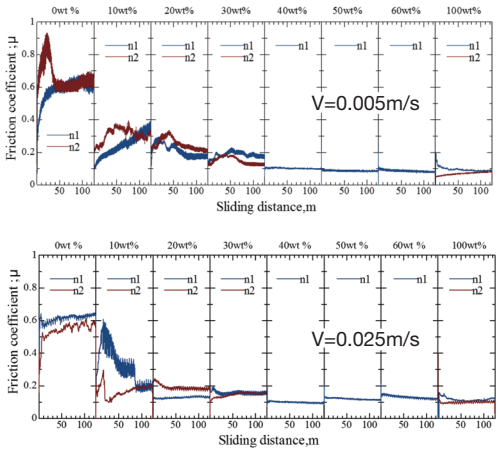
Ring-on-plate friction tester



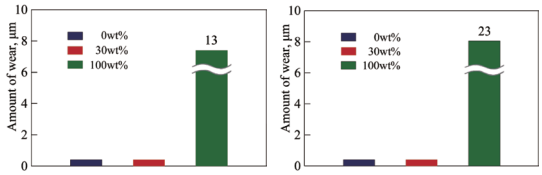


Test piece

Mating material



Friction coefficient measurement results



Wear measurement results

Comparison with Conventional or Competitive Technologies

Materials with a low effect on human health are required for the resin sliding parts of food processing machines, since, in manufacturing processes, small amounts of harmful substances may elute from the synthetic resins used in machine parts. In addition, there is a need for resin materials that are resistant to the chemicals in cleaners. This research aims to solve these issues.

Expected Applications

- Bearings for the reciprocating sliding parts and rotating parts of food processing and water treatment machines, etc.
- Materials applied to and hardened on metal and other base materials (wear-resistant coatings)
- Impregnants for lamination and hardening of woven and unwoven fabrics, such as cotton cloth (fiber reinforcing resins)

Challenges in Implementation

- Optimization of hardening conditions of urushi lacquer and PTFE
- Performance measurements under a wide variety of test conditions (load, temperature and various environmental conditions)
- Testing of materials containing solid lubricants other than PTFE, and testing for comparison with competing materials

What We Expect from Companies

- With the aim of utilizing this material for the bearings in the reciprocating sliding parts and rotating parts of food processing and water treatment machines, etc., we would like to conduct joint research with companies involved in this area.

Points

- **The effects of wear debris on human health are low, due to the use of urushi lacquer, a natural material with a long and successful history as a coating material for tableware**
- **Low-friction, low-wear sliding materials are produced by adding PTFE solid lubricant to urushi lacquer**

Future Developments

- Investigation to optimize the hardening conditions for urushi lacquer mixed with PTFE or other solid lubricants
- Conduction of performance evaluations under environmental conditions that have not been examined before, such as high-temperature and water circulation environments

■ Intellectual Property: Japanese Patent Application No. 2016-093303
"Sliding composites, sliding part materials and their manufacturing methods"
■ Prototype: Available
■ Sample: Available

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