MECHANICAL RESPONSE INDUCED BY CHANGE IN SHEAR STRENGTH AT THE SLIDING CONTACT BETWEEN A FINGER AND A MOLECULAR LAYER-COATED SOLID SURFACE

R. Yanagisawa[a], L. Yimeng[a], S. Aoki[a*]
*saoki@chemeng.titech.ac.jp
[a]Department of Chemical Science and Engineering, School of Materials and Chemical Technology,
Tokyo Institute of Technology,
S1-31, 12-1 O-okayama 2-chome, Meguro-ku, Tokyo 152-8552, Japan

KEYWORDS
Finger friction; Molecular-film-coated solid surface; Tactile perception

ABSTRACT
The friction characteristics of a finger slid on a solid surface coated with an organic molecular film were investigated by changing in the interface between the finger and the solid surface. In addition, mechanical response induced by friction stimulationgiven to the finger was also evaluated by observing the change in shear strength of the interface when the finger was slid from the uncoated solid surface to the molecular layer-coated one.

Friction characteristics of an index finger pad slid on a surface of a test specimen was measured using a laboratory-made tribometer that can measure x and y component force and z component force perpendicular to plane surface simultaneously. Si wafer and a glass plate were used as a solid substrate and then coated with an organic molecular film composed ofoctadecyltrichrolosilane-based self assembled monolayer (OTS-SAM). In addition, contact area of the finger was measured with varying normal load by using a black stamp ink.Previous study by the authors has reported that the normal load dependency of friction coefficient was observed from the measurement of finger friction characteristics slid on a Si surface coated OTS-SAM having different film thicknesses [1]. It has been also found that there was the linear correlation between the contact area and the friction force, and then the linear slope was defined as a shear strength of the interface between the finger and the substrate. The shear strength decreased with increasing the thickness of OTS-SAM.

Pattern interval and width of the film was varied in order to investigate the effect of the change in the shear strength of the interface on the friction characteristics of the finger and on the response to the friction stimulation.The normal load changed as the friction force changed significantly when the finger crossed over the boundary between the areas with and without the OTS-SAM. The change in the normal load was probably due to the phenomena caused by the tactile perception. Based on the results,the relative normal load changewasplotted against the relative shear strength change, regarded as the response induced by the friction stimulation.Figure 1 shows that the negative correlation between the load change and the shear strength change was observed. This implies that the relation between the friction stimulation and the response could be estimated numerically.

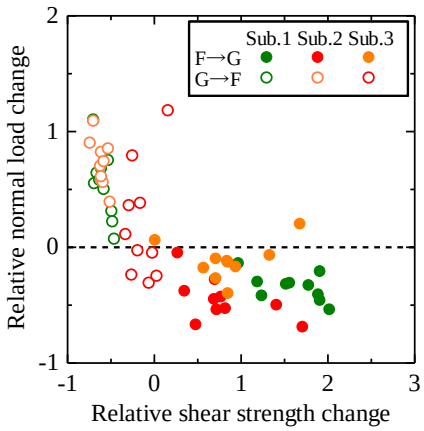

Fig.1 Correlation between the friction stimulation and the mechanical response

ACKNOWLEDGMENTS
This work was supported by JSPS KAKENHI Grant-in-Aid for Scientific Research (C) Number 16K06040.

REFERENCES
[1] Yanagisawa, R., Aoki, S., Masuko, M., “Friction characteristics of Fingertips Slid on the Molecular-Layer-Coated Solid Suefaces with Different Layer Formation State,” Tribology Online 11,1, 2016, 396-402.