KYODO YUSHI TECHNICAL BULLETIN
No. 13 February 22, 2019

OBSERVATION OF THICKENER STRUTURE IN GREASE

Lubricating grease is defined as “a solid-to-semi fluid product of dispersion of a thickening agent in a liquid lubricant”. Although it is important to know the thickener state of being in grease, thickener structure in grease still remains to be explained. The observation has traditionally been made using an electron microscope, TEM or SEM. However, it requires grease sample processing such as dilution, dispersion and oil extraction. This study aims to make direct observations of thickener structure in grease using a confocal laser fluorescence microscope, CLFM.

A CLFM is capable of noninvasively observing a specimen to generate a distinct in-focus image at high resolution by taking advantage of both confocal optical system which can selectively detect fluorescent light coming from the focused point of a specimen and fluorescent microscopy which measures fluorescent light when the specimen illuminated with excitation light moves from excited state to normal state. In this study, a laser beam emitting a wavelength of 488nm was employed as excitation light. Sampling in a X-Y direction and shifting in a Z direction were performed at intervals of 0.4μm and 0.5μm, respectively.

Grease sample was prepared with diurea as the thickener and mineral oil as the base oil and had a thickener content of 4mass%. The grease sample of 10-20mg was placed on a glass slide and gently pressed with a cover glass to achieve a thickness of 20-30μm.

Fig. 1 shows a 3-D image of sample grease, where worm-like fibers are present to form a network structure.

To further examine the fibers shown in Fig. 1, the grease sample was diluted 20 times with its base oil. The 3-D image obtained for diluted grease shows that there are fibers of a few μm in diameter and 10-50μm in length coupled with finer fibers (Fig. 2).

The SEM image of grease, Fig. 3, indicated that fine thickener fibers of <1μm in diameter and a few μm in length are present, being bundled together to form thick fibers of 2-3μm in diameter and 40μm in length. These thick fibers of the same size as those in the CLFM images provide sufficient evidence to consider that the 3-D images show the thickener network structure in grease.

M.Yoshihara & T. Moriuchi: NLGI Spokesman, **81**, 1 (2017), 28.

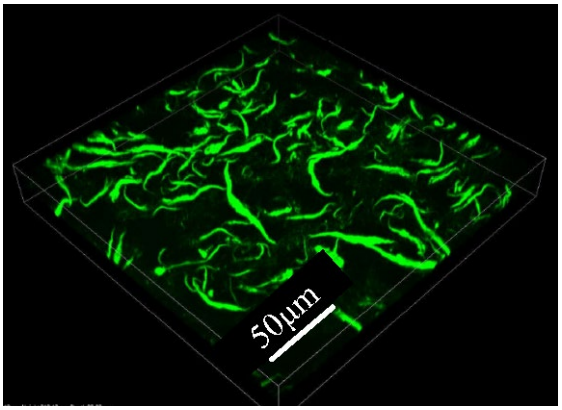

Fig.2 3-D structure of diluted grease

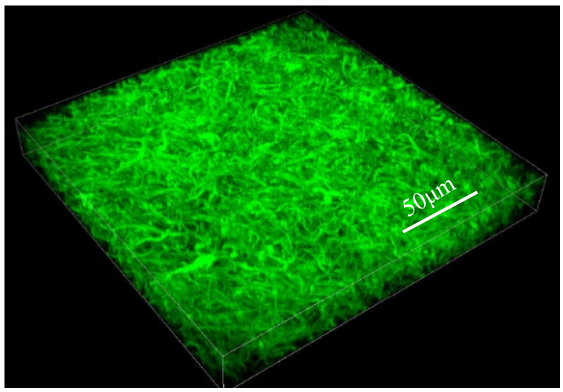

Fig.1 3-D structure of sample grease

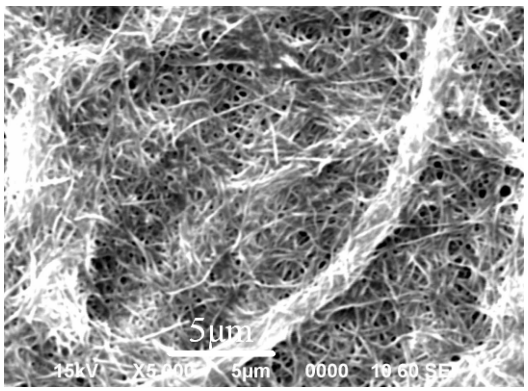

Fig.3 SEM image of sample grease