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Nano-Confined Liquids Studied by Synchrotron Radiation X-ray Diffraction

Liquids confined in nanometer-level spaces (nano-confined liquids) are known to exhibit properties different from those of the bulk liquid, due to the interaction with confining surfaces as well as the restriction of the mobility under confinement. For example, nano-confined liquids exhibit solid-like properties, i.e., the effective viscosity increases more than several order of magnitudes. The properties of nano-confined liquids are recognized to play a crucial role in developing technologies such as tribology. We have reported the interesting behavior of nano-confined liquids using a resonance shear measurement which we developed[1]. However, the molecular level understanding of the properties of nano-confined liquids is still limited.
We thought it is imperative to examine the structure of nano-confined liquids to understand the properties of nano-confined liquids. Thus, we have started X-ray diffraction study on nano-confined liquids employing synchrotron X-ray beam of SPring-8. Previously, there were X-ray diffraction studies on confined liquids, however, the gap they could measure was 500 nm or larger[2], which is not enough to study confinement. We have established X-ray diffraction measurement of nano-confined liquids, and obtained new insights on them including (i) structures of nano-confined 8CB and its relaxation process[3], (ii) structural differences of two nano-confined ionic liquids ([C4mim][NTf2], [C4mim][BF4]) which explain their different lubrication behaviors[4], (iii) effect of shear and surface properties on nano-confined 8CB[5], and (iv) structuring behavior of liquids (OMCTS and hexadecane) as a function of a separation distance between confining surfaces from the bulk to nanometer thicknesses, which revealed the gradual increase in the molecular order from the distances much greater than the distance range showing confined effect on viscosity[6].

Reference
1. K. Kurihara, Pure Appl. Chem., 2019, 91, 707-716.
2. S. H. J. ldziak, et al., Science, 1994, 264, 1915–1918.
3. S. Nakano, et al., Jpn. J. Appl. Phys., 2013, 52, 035002.
4. K. Tomita, et al., Phys. Chem. Chem. Phys., 2018, 20, 13714-13721.
5. M. Mizukami, et al., Phys. Chem. Chem. Phys., 2021, 23, 131-138.
6. M. Mizukami, et al., Langmuir, 2022, 38, 5248-5256.

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Dynamics of surfaces, interfaces, and nanostructures

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