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 	承認日 Date of Approval 2017/5/3 承認者 Approver Jun-ichi Suzuki 提出日 Date of report 2017/3/21
課題番号 Project No. 2016A0212 実験課題名 Title of experiment: The effect of shear on a mixture of water / organic solvent / antagonistic salt 実験責任者名 Name of principal investigator Koichiro Sadakane 所属 Affiliation Doshisha University	装置責任者 Name of responsible person Shinichi Takata 装置名 Name of Instrument/(BL No.) BL 15 実施日 Date of Experiment Dec 8 to Dec 10 (2016)

試料、実験方法、利用の結果得られた主なデータ、考察、結論等を、記述して下さい。(適宜、図表添付のこと)  
 Please report your samples, experimental method and results, discussion and conclusions. Please add figures and tables for better explanation.

1. 試料 Name of sample(s) and chemical formula, or compositions including physical form.
The mixture of D <sub>2</sub> O / 3-methylpyridine (0.17 vol%) / NaBPh <sub>4</sub> (150 mM) (We measured only one sample.)

2. 実験方法及び結果 (実験がうまくいかなかった場合、その理由を記述してください。) Experimental method and results. If you failed to conduct experiment as planned, please describe reasons.
<p><b>2-1 Experiments</b></p> <p><b>2-1-1 Background measurements</b></p> <p>Background measurements (i.e., direct beam, empty cell, standard sample) were done totally 4 hours.</p> <p><b>2-1-2 Sample setup</b></p> <p>The sample was inserted into the shear-cell (MCR302, Anton Paar), whose temperature was kept at 333 K. Then the sample temperature was decreased down to 298 K. In this process, we confirmed that the sample showed the phase transition from the isotropic-phase to the lamellar-phase. Noted that air bubbles could be contained if we inserted the sample without heating.</p> <div data-bbox="384 1715 1209 1989" data-label="Figure"> <p>The figure shows four SANS images at different time points: 0 s, 120 s, 240 s, and 360 s. The 0 s image shows a diffuse isotropic ring. As time progresses, the ring becomes more structured, indicating a phase transition to a lamellar phase. Below the images, a horizontal arrow labeled 'quench' points from '333 K (isotropic)' on the left to '298K (lamellar)' on the right.</p> </div> <p>Fig.1 The temperature dependence of the SANS image for a mixture of D<sub>2</sub>O / 3-methylpyridine / NaBPh<sub>4</sub>.</p>

## 2. 実験方法及び結果(つづき) Experimental method and results (continued)

### 2-2 Results

After the sample temperature was stabilized at 298 K, we performed the rheo-SANS measurements with the shear-rate of 0.1, 1.0, 5.0, 10, 25, 50, 100, 150, and 1000  $\text{s}^{-1}$ . The results are summarized in Fig.2. When the shear-rate is increased up to 0.1  $\text{s}^{-1}$ , the lamellar-structure is aligned in the flow direction (horizontal direction in the figure). It is noted that no notable change of the orientation could be confirmed up to 10  $\text{s}^{-1}$  although the viscosity slightly changes with time. On the other hand, isotropic scattering indicating the existence of onion structure is observed when the shear-rate is above 25  $\text{s}^{-1}$ . Under this condition, shear thickening is also observed.

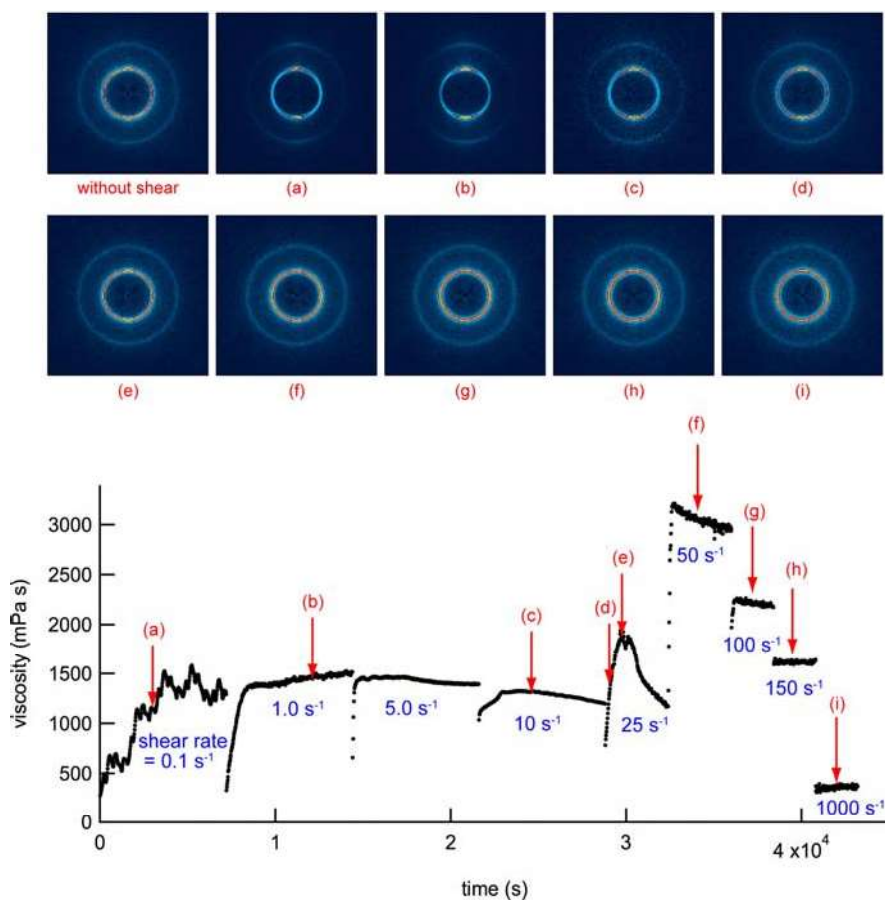


Figure 2 The rheo-SANS results for a mixture of  $\text{D}_2\text{O}$  / 3-methylpyridine /  $\text{NaBPh}_4$ : The 2D SANS Image measured at the radial geometry (upper) and the time dependence of the viscosity (lower).

In this manner, we concluded that the lamellar-structure generated in a mixture of  $\text{D}_2\text{O}$  / 3-methylpyridine /  $\text{NaBPh}_4$  is aligned at low-shear rate region (i.e., below 10  $\text{s}^{-1}$ ), whereas the formation of onion structure and shear-thickening are induced at a certain shear rate (i.e., 25  $\text{s}^{-1}$ ). These features are analogous to nonionic surfactant solutions.