

 <b>MLF Experimental Report</b>	提出日 Date of Report 30 March 2015
課題番号 Project No. 2014A0311 実験課題名 Title of experiment Adsorption of Aqueous Polymer and Additives on Metal Surfaces for Low-Friction Metal Forming 実験責任者名 Name of principal investigator Tomoko Hirayama 所属 Affiliation Doshisha University	装置責任者 Name of responsible person Norifumi Yamada 装置名 Name of Instrument/(BL No.) SOFIA (BL16) 実施日 Date of Experiment 24-29 May 2015

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.

<p>1. 試料 Name of sample(s) and chemical formula, or compositions including physical form.</p> <p>We investigated the use of polymer aqueous lubricant as metal forming eco-friendly lubricants. The structures on three different metal surfaces including Ti, Fe and Al were studied. Two types of triblock copolymers (nonionic surfactants) namely: normal type <math>PEO_6</math>-<math>PPO_{32}</math>-<math>PEO_6</math> (L62), <math>PEO_{13}</math>-<math>PPO_{30}</math>-<math>PEO_{13}</math> (L64), and reverse type <math>PPO_{15}PEO_{10}PPO_{15}</math> (17R2), <math>PPO_{14}PEO_{24}PPO_{14}</math> (17R4) and <math>PPO_{21}PEO_{14}PPO_{21}</math> (25R2). At the test temperature, all mixtures were in liquid form.</p>
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<p>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> <p>The experimental method:                  1) prepare the solution                  Solutions were prepared from 2%, 4% and 6% copolymers – L62, L64, 17R2, 17R4 and 25R2 concentration and D<sub>2</sub>O. The complete experiments done are given below.</p>
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## 2. 実験方法及び結果(つづき) Experimental method and results (continued)

2) inject the solution into the liquid cell

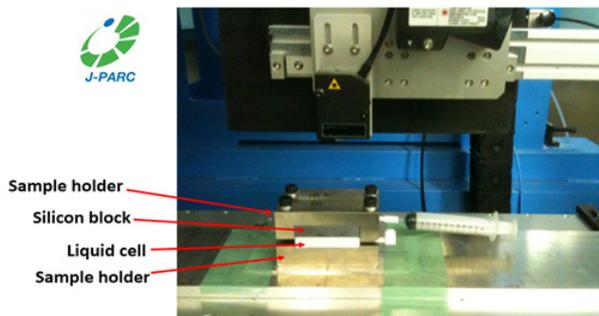


Fig. Sample holder and experimental situation

3) obtain neutron reflectometry profiles from three incidence angles using the following steps:

Step 1: in air (To fix the thickness of coating)

Step 2: in  $D_2O$  (To fix the SLD value of coating in  $D_2O$  because coating layer has several porous, so the SLD value of coating layer in  $D_2O$  will be a bit larger than that in air.)

Step 3: in  $D_2O$ +polymer (the neutron test will start immediately after the polymer was injected to the liquid cell. We just continuously scan one angle to determine the kinematic of the polymer adsorption within 30min)

Step 4: in  $D_2O$ +polymer (After step 3, we consider the polymer thickness will be constant; hence we will scan 3 different angles to fix the thickness and density of adsorbed polymer layer).

The neutron reflectometer we used was SOFIA, a horizontal TOF neutron reflectometer, in J-PARC/MLF. So far we are only able to obtain reflectivity profiles data from the Titanium surfaces. We are trying to resolve the data processing and data analysis problem. Once the other data are obtained, the adsorption film structures will be correlated with our other measurements using QCM-micro balance of the mass deposition.