


(※本報告書は英語で記述してください。ただし、産業利用課題として採択されている方は日本語で記述していただいても結構です。)

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|  MLF Experimental Report | 提出日 Date of Report |
| 課題番号 Project No. 2013A0079 実験課題名 Title of experiment An Investigation on the Adsorption of Aqueous Polymer and Additives on Metal Surface 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 Dr. Norifumi Yamada 装置名 Name of Instrument/(BL No.) SOFIA (BL No.16) 実施日 Date of Experiment 28/4/2013-1/5/2013 (3days) |

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.

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| 1. 試料 Name of sample(s) and chemical formula, or compositions including physical form. |
| <p>Three kinds of metal-coated surfaces, iron, titanium and copper coatings, were deposited onto ultraflat silicon blocks for the analysis. Non-ionic surfactant with a hydrophilic middle block (PEO) and two hydrophobic end blocks (PPO) were prepared as additives for low-friction metal forming. The neutron reflectometer we used was SOFIA, a horizontal TOF neutron reflectometer, in J-PARC/MLF. We obtained neutron reflectivity profiles for each metal-coated surface in D₂O and in D₂O with the additives.</p> |

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| 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>Experimental method:</p> <p>A) The property of metal-coated surfaces was characterized in D₂O and air.</p> <p>B) 2, 4 and 6% vol Pluronic-R 17R2 in D₂O were used to detect the effects of concentration on adsorbed film structure.</p> <p>C) To repeat step B for Pluronic-R 17R4, which has different molecular architecture compared with 17R2. This step was used to investigate the effect of molecular architecture on adsorbed film structure.</p> <p>D) 0.5% and 1.0% vol Phosphate ester in D₂O was used to characterized the adsorbed Phosphate ester film.</p> <p>F) 0.5% and 1.0% vol Phosphate ester was added in 17R2 in aqueous solution to assess the influence of Phosphate ester additive on adsorbed film structure</p> |

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

Experimental results:

- On Ti surface

(a). Ti deposition film was oxidized and two kinds of Ti oxide layer were formed. The total thickness of Ti deposition film is about 42.3 nm.

(b). In 2%, 4% and 6% 17R2 + D₂O solution, the thickness of adsorbed 17R2 film is about 2.8 nm, 3.5 nm and 4.2 nm, respectively. The higher is concentration, the thicker is adsorbed layer.

(c) In 2%, 4% and 6% 17R4 + D₂O solution, the thickness of adsorbed 17R4 film is about 2.6 nm, 3.0 nm and 3.4 nm, respectively. The higher is concentration, the thicker is adsorbed layer.

The comparison of results (b) and (c) indicated that the molecular architecture of Pluronic-R affects the film adsorption in Ti surface. The higher is PPO ratio in copolymer, the thicker is adsorbed layer.

(d) In 0.5%, 1.0% Phosphate ester + D₂O solution, the thickness of adsorbed Phosphate ester film is about 3.7 nm and 3.74 nm, respectively. The increase of the Phosphate ester from 0.5% to 1.0% does not have a significant influence on adsorbed layer thickness.

(e). In 0.5% Phosphate ester + 2% 17R2 + D₂O solution, the thickness of adsorbed Phosphate ester film is about 2.3 nm, while the thickness of 17R2 film is 3.4 nm.

(f) In 0.5% Phosphate ester + 6% 17R2 + D₂O solution, the thickness of adsorbed Phosphate ester film is about 2.3 nm, while the thickness of 17R2 film is 3.9nm.

- On Cu surface

(a). Cu deposition film was oxidized. The thickness of Cu deposition film is about 40 nm.

(b). In 2%, 4% and 6% 17R2 + D₂O solution, the thickness of adsorbed 17R2 film is about 1.2 nm, 2.9 nm and 3.1 nm, respectively. The higher is concentration, the thicker is adsorbed layer.

(c) In 2% 17R4 + D₂O solution, the thickness of adsorbed 17R4 film is about 2.3 nm. When the concentration increase to 6%, the thickness keep constant.

The comparison of results (b) and (c) indicated that the molecular architecture of Pluronic-R affects the film adsorption on Cu surface.

(d) In 0.5%, 1.0% Phosphate ester + D₂O solution, the thickness of adsorbed Phosphate ester film is about 4.3 nm and 5.3 nm, respectively.

- On Fe surface

(a) Because there is nearly no difference between the measured data of pure D₂O and 2% 17R2 + D₂O solution, it indicates that 17R2 is not absorbed on Fe surface if the concentration is 2%.

(b) Although there is some small difference between the measured data of pure D₂O and 4% 17R2 + D₂O solution, the fitting results also shows that the thickness of 17R2 film on Fe surface is zero if the concentration is 4%.

(c) Although there is some small difference between the measured data of D₂O and 6% 17R2 + D₂O solution, the, the fitting results shows 17R2 is not absorbed on Fe surface even the concentration is increased up to 6 %.