（ ※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。 ）

CROSS TOKAI **Experimental Report** J-PARC	承認日 Date of Approval **2015/1/4** 承認者 Approver **Jun-ichi Suzuki** 提出日 Date of Report **2014/7/22**
課題番号 Project No. 2014A0053 実験課題名 Title of experiment Surface Property of DNA-functionalized Nanoparticle 実験責任者名 Name of principal investigator Masahiro Fujita 所属 Affiliation Bioengineering Laboratory, RIKEN	装置責任者 Name of Instrument scientist Jun-ichi Suzuki 装置名 Name of Instrument/（BL No.） BL15 実施日 Date of Experiment 2014/05/23-2014/05/26

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.

In this beam-time, solution small-angle neutron scattering (SANS) of gold nanoparticles covered with DNA strands were carried out. The samples measured here were as follows:

Gold nanoparticles (Au); suspension in water.

DNA/Gold nanoparticle conjugate (nDNAx-Au: n = 100 – 400 strands, x = 15 – 45 bases); suspension in phosphate buffer (pH 7.0 or pD 7.0).

Water (H_2O); liquid,

Heavy water (D_2O); liquid

Phosphate buffer (10mM KH_2PO_4/K_2HPO_4 in H_2O (pH 7.0) or D_2O (pD 7.0); liquid.

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.

Colloidal stability of DNA-functionalized gold nanoparticles changes drastically in response to terminal base paring of DNA (Fig. 1). To understand this curious phenomenon, it is important to get directly the structural information of DNA brush layer. In this SANS experiment, gold nanoparticles with a diameter of 15 nm, surrounded by single-stranded DNA (15 or 45 bases *i.e.*, 5 or 15 nm in length), Au15-ssDNA15 and -ssDNA45, were prepared. The nanoparticles were suspended in an ordinary water phosphate buffer (10mM, pH 7.0) or in a heavy water phosphate buffer (10mM, pD 7.0), and concentrated. Just before SANS measurements, the suspensions were mixed in such a way that the ratio of H_2O/D_2O = 100/0, 80/20, 60/40, and 0/100 for contrast variation method. For data correction, the corresponding buffer solutions with the same mixing ratios were measured. All measurements were carried out using the standard sample changer, and the samples were thermostated at 25 ˚C. Although the sample concentration was intended to be high enough to acquire a SANS image in a shorter period as far as possible, one measurement was made in 4 ~ 8 hours more than expected, depending on the mixing ratio of H_2O/D_2O. In addition, due to some interruptions of neutron beam, the data of Au15-ssDNA15 were only acquired.

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

In the vicinity of the match point of gold, unfortunately, no useful data were obtained. However, the difference between the data of Au nanoparticles with and without DNA strands in light water could be detected for the first time. Fig. 2 shows the SANS profiles from Au15 (blue symbols) and Au15-ssDNA15 (red symbols) in H_2O. The scattering intensity of Au 15 was well fitted with theoretical curve of a simple hard sphere with a size distribution. On the other hand, the data of Au15-ssDNA15 was obviously influenced by the structural information of DNA brush layer. In this figure, the data could be roughly fitted with a core shell model. For precise analysis of DNA brush layer, higher quality data should be obtained. For this purpose, more concentrated samples may be required.

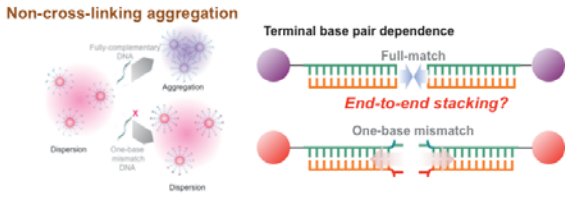

Figure 1 Non-cross-linking aggregation of DNA-functionalized AuNP in response to terminal base paring of dsDNA.

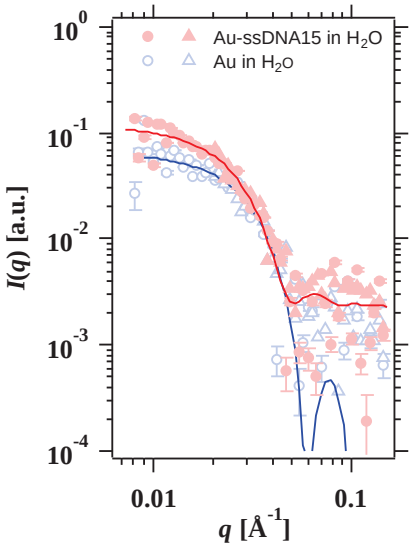

Figure 2 SANS profiles of Au15 and Au15-ssDNA15. D_2O/H_2O was 0/100.