Synthesis of Ag triangular nanoplates protected by glutathione and their interaction of hemoglobin

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Ag trianglular nanoplates have attracted much attention because of their unique structure. On the other hand blood proteins such hemoglobin (Hb) are the major biomolecule in lives and the major target of many kinds of medicines, viruses, metal ions, *etc*. Consequently, the fundamental understanding of the conformational behavior of these proteins interacted with nanoplates is of critical importance in a protein-metallic conjugates system. In this study, we synthesized Ag triangular nanoplates protected by glutathione (Ag:SG nanoplate) [1], and analyzed the conformational change of Hb interacted with nanoplates

Ag:PVP nanoplates were synthesized by photoreduction of $AgNO_3$ with PVP . The obtained nanoplates were mixed and stirred with glutathione. After 20 hours stirring, the formed precipitation was rinsed by ethanol, and was re-dispersed into water. The products were characterized by UV-vis absorption spectroscopy, scanning transmission electron microscopy (STEM), circle dichroism (CD) spectroscopy and X–ray photoelectron spectroscopy (XPS). Afterwards, this solution was mixed with 1 mL of hemoglobin solution. The obtained products were characterized by the same analysis methods.

Ag:SG nanoplates showed characteristic Cotton effects in the CD spectrum which were induced by SPR of nanoplates. This indicates that new chiroptical properties were induced by the adsorption of chiral molecules in the achiral nanoplates. In other words, chiral electromagnetic currents are generated inside the metal nanoplates by the presence of GSH molecules as chiral chromophores. The UV-vis absorption spectra for Ag:SG nanoplates agreed well with those for typical triangular nanoplates. Therefore, the shape of nanoplates is not affected by the present substitution process. This is also confirmed by STEM image. Chemical shifts of the binding energy observed upon XPS analysis revealed that GSH molecules attached to Ag nanoplates in the S-Ag bond and that PVP of Ag nanoplates is largely removed thought substitution reactions with GSH.

As shown in Figure 1, three peaks pointed by arrows are observed at 400, 700 and 1100 nm for the nanoplates with Hb. These peaks can be ascribed as hemoglobin, truncated nanoplates, and triangular nanoplates, respectively. When absorbances of these peaks are compared with nanoplates without Hb as shown in Figure 1, the decrease of the 1100 nm peak is larger than that of the 700 nm peak. This indicates that reactivity of triangular nanoplates is higher than that of truncated ones. In fact, truncated nanoplates were dominantly observed for Ag:SG nanoplates with Hb in STEM images.

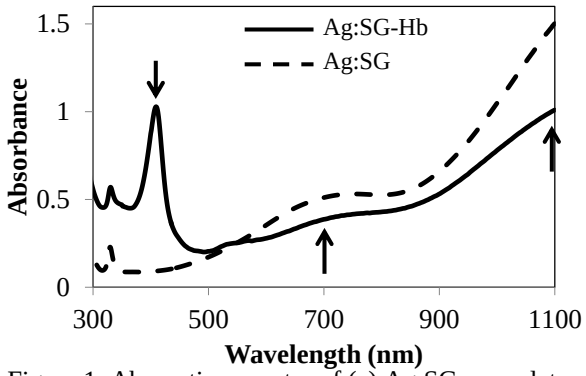

Figure 1. Absorption spectra of (a) Ag:SG nanoplates with Hb and (b) Ag:SG nanoplates without Hb

[1] N. Nishida, Y. Kojima, and H. Tanaka, (2012) *Chem. Lett.* **41,** 926-928