BL-8B/2014G116

In Situ Measurement of Growth Process caused by Fusion Growth of Gold Nanoparticles in water

Yoshimi Ito, and Takeshi Morita*
[1]Chiba Univ., Yayoi, Inage-ku, Chiba 263-8522, Japan

1 Introduction

Au nanoparticles have unique properties various size from small nanoclusters to large nanoparticles. It was recently reported that the growth kinetics of Au nanoparticles from Au nanoclusters induced by the phase transition of thermoresponsive polymer. [1] Crystallite size is one of the most important information for making clear mechanism of growth process of Au nanoparticles. Crystallite size is determined with diffraction line. It can be measured by Wide-angle x-ray scattering and calculated Scherrer equation, $D=K\lambda/\beta\sin\theta$, where D is crystallite size, K is a constant of Scherrer, λ is wavelength, β is full width at half maximum, FWHM, and θ is scattering angle.

2 Experiment

Au nanoparticles were synthesized by thermal-induced nanoprocessing method using thermoresponsive polymer. [1,2] To observe growth process of Au nanoparticle, we changed the condition of heating time.(30, 60, 90, 120, 150 min.) After synthesis, all Au nanoparticles solutions were concentrated with vacuum apparatus and staller for 2 days. At BL-8B, WAXS measurements for crystallite size of Au nanoparticles using 1.0 mm capillary at room temperature. X-ray beam energy was determined 11.7 keV and measurement time was 300 sec.

3 Results and Discussion

At first, we measured intensity of transmitted x-ray after setting capillary every time, it allow that the highest intensity of x-ray was focused on center point of capillary. Figure 1 shows the raw data which the sample condition of heating time were from 30 min. to 150 min and water as background observed WAXS measurement. All spectra have peaks around 2 theta = 19, 28 deg. These peaks due to water and capillary scattering. As solutions are heated, crystallite size and particle diameter of Au nanoparticles are growing up caused by fusion growth of Au nanoparticles. The data of time-resolved observation should show the change of crystallite size but Au nanoparticles data and water one are almost same, we cannot get sufficient data for analysis of crystallite size. One of the reason for this problem is low concentration of Au nanoparticles in water. Using more thick capillary or improving experiment to concentrate solution may become the key grasp of available data.

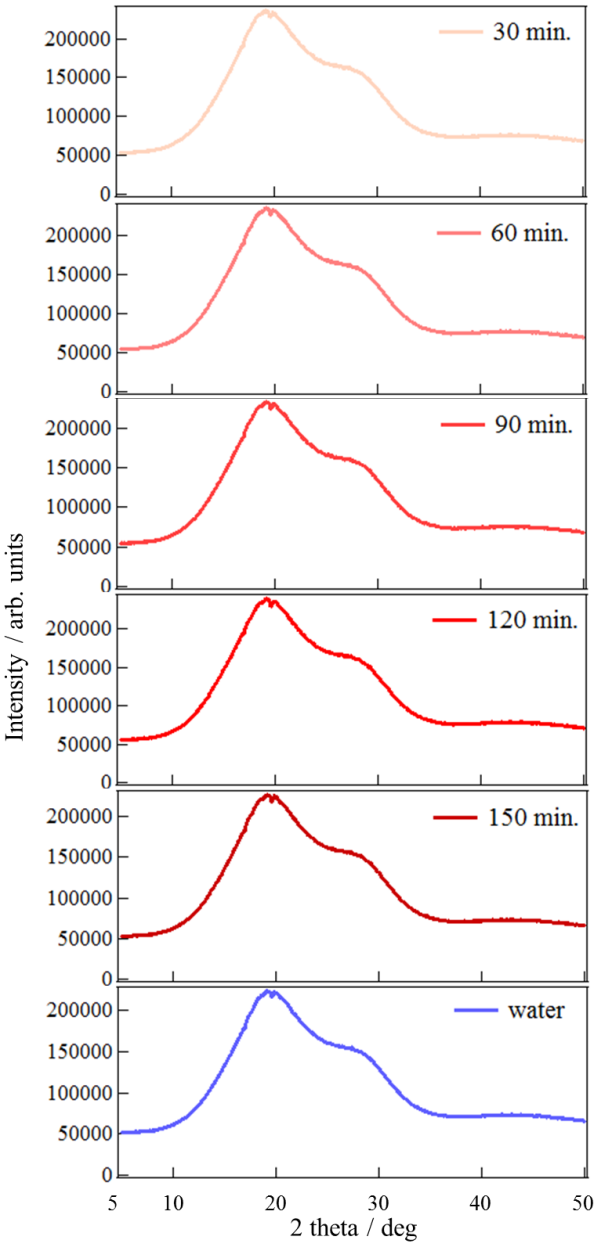

Figure 1: Spectra of various heating time sample and water.

References

[1] N. Uehara *et al.*, *J. Colloid Interface Sci.*, **359**, 142 (2011).

[2] T. Morita *et al.*, *J. Phys. Chem. C*, **117**, 26, 13602 (2013).

* moritat@faculty.chiba-u.jp