Growth Behavior of Gold Nanorods Synthesized by the Seed-mediated Method: Tracking of Reaction Progress by Time-resolved X-ray Absorption Near-edge Structure, Small-angle X-ray Scattering, and Ultraviolet-visible Spectroscopy

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Sample Holder (Figure S1)

The sample holder used for XANES and UV-Vis measurements of XANES and UV-Vis absorption is shown in Figure S1.



Figure S1. Cross-section diagrams of the sample holder for simultaneous measurements: (a) vertical plane parallel to optical path, (b) horizontal sectional view at the height of X-ray path. The main body of the holder is made of polyetheretherketone. Kapton windows (30 μ m) are sealed epoxy bonding agent.

Differential XANES Spectra (Figure S2)

The differential XANEAS spectra of 3 types of GNRs are shown in Figure S2. It is apparent that the reaction progress of GNR6 is much slower than those of the other two types of GNRs.



Figure S2. The time-resolved differential XANES spectra at the Au L₃-edge.



XANES Spectra Used for XANES Analysis and Curve Fitting Analysis (Figure S3 and 4)

Figure S3. (a) XANES spectrum and (b) differential XANES spectrum of Au foil at the Au L_3 -edge. A black arrow in (b) indicates the peak around 11.926 keV.



Figure S4. (a) XANES spectrum of the growth solution and (b) estimation of the ratios of Au_{GS} and Au_{Rod} by curve-fitting analysis of Au L₃-edge XANES for GNR6s at 1,490 s. Pink and light blue lines are the XANES spectrum of the growth solution and that of Au foil, respectively.



Curve Fitting Analysis of UV-Vis Absorption Spectrum (Figure S5)

Figure S5. Separation of small plasmon peaks for GNR6s at 1,651 s.

XANES and Differential XANES Spectra of AuCl (Figure S6)



Figure S6. (a) XANES spectrum and (b) the differential XANES spectrum of AuCl at the Au L₃-edge. A black arrow in (a) indicates the characteristic peak.



The Growth Process estimated from only the size of GNR6s (Figure S7)

Figure S7. The formation process for GNR6s based on maximum length (estimated from DDF) and AR (determined from the plasmon band).

TEM Image (Figure S8)

TEM sample was prepared by dropping the sample onto a carbon-coated copper grid.



Figure S8. TEM image of GNR6s observed after the measurements. Small rods and spherical or cubic particles are observed.