

SUPPLEMENTARY INFORMATION

Supplementary movie #1: Full data set of nanocrystal growth depicted in Figure 2. $M = 100,000\times$ and $i_e = 40 \text{ pA}$, which corresponded to an electron dose rate of $3.37 \text{ electron}/\text{\AA}^2\text{s}$. The pixel size is 3.13 nm/pix . The movie was recorded with a bright field detector and a dwell time of $5 \mu\text{s}$, and is displayed in real time with a frame rate of 2 fps.

Supplementary movie #2: Full data set of nanocrystal nucleation at $M = 100,000\times$ and $i_e = 20 \text{ pA}$ (blue square Figure 3a). The pixel size is 3.13 nm/pix . The movie was recorded with an annular dark field detector with a dwell time of $5 \mu\text{s}$, and is displayed in real time with a frame rate of 1 fps.

Table S1. Cut-off times for induction time measurements in Figures 3, 4, and 5. The cut-off time is determined by visually inspecting the data sets, and is defined as the time period where nucleation was occurring with no significant loss of nanocrystals with time due to coalescence, charging, or aggregation.

Supplementary movie #3: A BF STEM movie of nanoplate growth at $M = 100,000\times$, $i_e = 7 \text{ pA}$ and a pixel dwell time of $5 \mu\text{s}$, yielding an electron dose rate of $0.59 \text{ electron}/\text{\AA}^2\text{s}$. The pixel size is 3.13 nm/pix . The movie is displayed in real time with a frame rate of 1 fps.

Figure S1. BF STEM image taken at $M = 150,000\times$ of silver nanoplates grown for 120 seconds at the same imaging conditions, precursor concentration, and fluid path length as in Figures 4d-f. The scale bar is 200 nm.

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