

Supplementary information for:

Phase Selection Behavior of Nano-Sized GaIn Liquid Alloys Governed by Mixing Enthalpy

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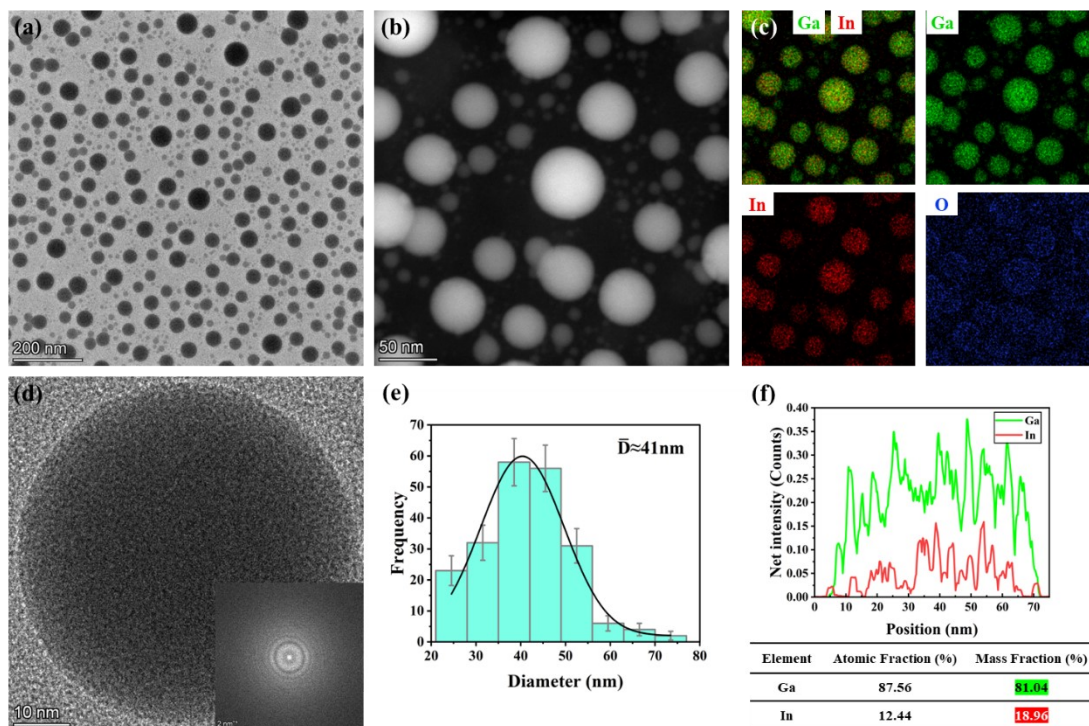


Figure S1 Preliminary characterization of near-eutectic GaIn nanoparticles

(a) Low-magnification TEM image (b) STEM image (c) EDS elemental mapping (d) HRTEM image (e) Particle size distribution statistics (f) EDS line scan analysis

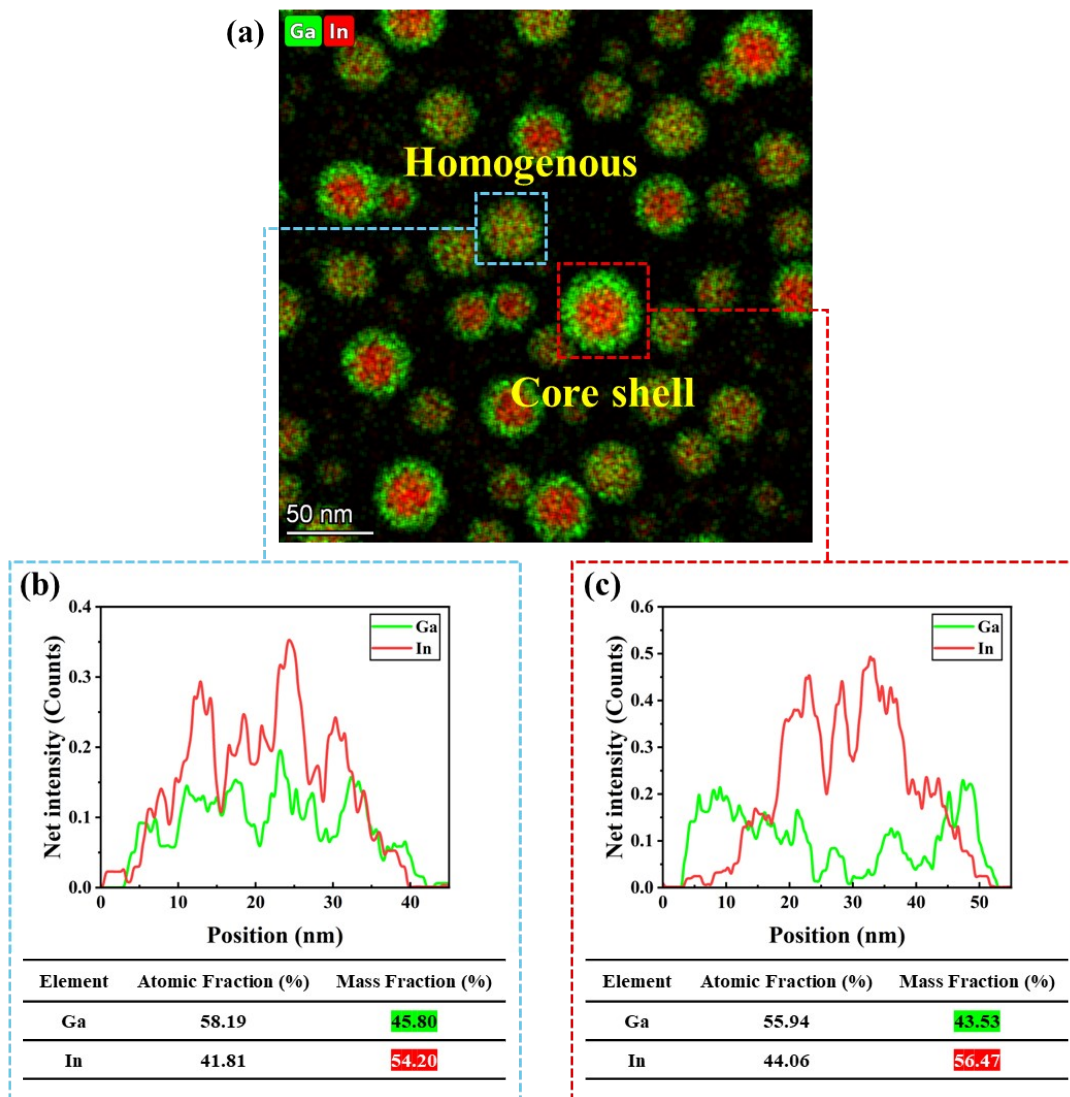


Figure S2 Composition and structural analysis of GaIn nanoparticles with an average composition of 55 wt% In: (a) EDS elemental mapping images corresponding to the sample in Figure 4c (Ga: green, In: red), showing the coexistence of core-shell and uniform structures. (b) Line scan result of a single homogeneous nanoparticle marked by the blue dashed box in panel (a), with an average composition of Ga:In = 45.80:54.20 wt%. (c) Line scan result of a single core-shell structured nanoparticle marked by the red dashed box in panel (a), with an average composition of Ga:In = 43.53:56.47 wt%

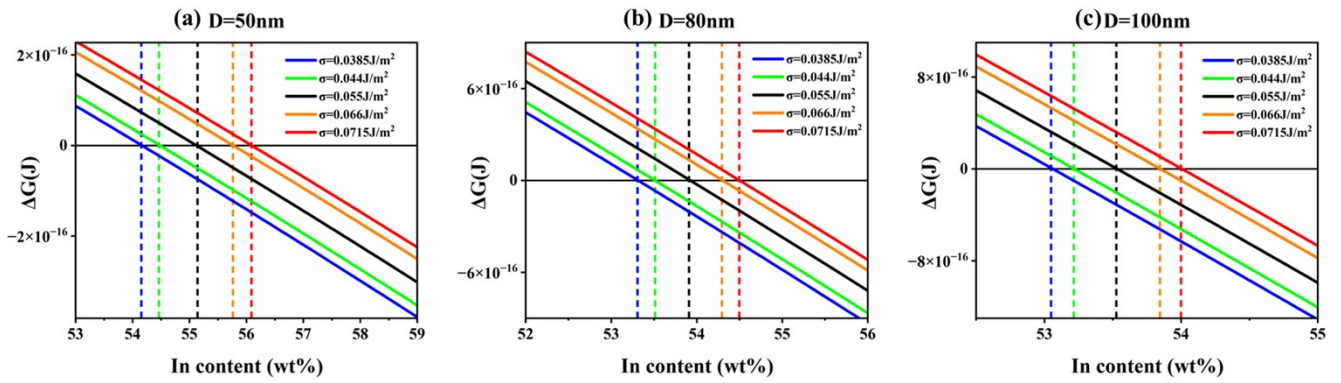


Figure S3 Sensitivity analysis of the Gibbs free-energy change (ΔG) as a function of In content under different interfacial energies for GaIn nanoparticles with diameters of (a) 50 nm, (b) 80 nm, and (c) 100 nm. The baseline value is $\sigma = 0.055 \text{ J} \cdot \text{m}^{-2}$; the $\pm 30\%$ range corresponds to $0.0385\text{--}0.0715 \text{ J} \cdot \text{m}^{-2}$. The horizontal line indicates $\Delta G = 0$, and the vertical dashed lines mark the corresponding critical In contents.

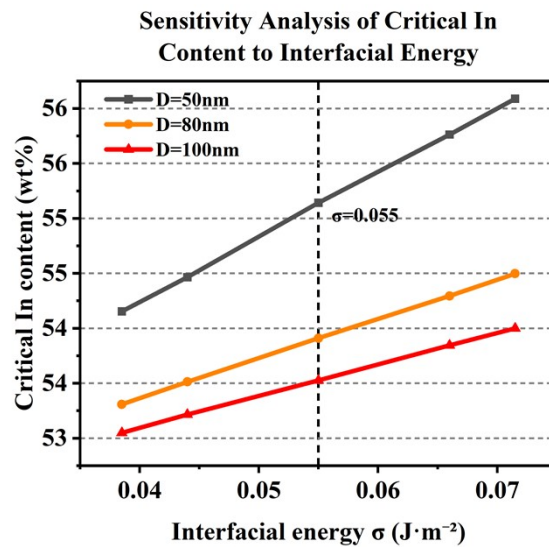


Figure S4 Sensitivity analysis of the critical In content as a function of interfacial energy for GaIn nanoparticles with diameters of 50, 80, and 100 nm. The dashed vertical line marks the baseline value $\sigma = 0.055 \text{ J} \cdot \text{m}^{-2}$. Within the $\pm 30\%$ range ($0.0385\text{--}0.0715 \text{ J} \cdot \text{m}^{-2}$), the critical composition shifts only slightly, supporting the robustness of the composition-driven phase-selection trend.