# Supporting Information

# Structural Evolution in the Nanoscale Diffusion Process: A Case in Au-Sn Bimetallic System

**Kuai Yu [a], Tao Yao [b], Zhiyun Pan [b], Shiqiang Wei [b,#], Yi Xie [a, *]**

[a] Department of Nanomaterials and Nanochemistry, Hefei National Laboratory for Physical Sciences at Microscale, University of Science and Technology of China, Hefei 230026, P. R. China

[b] National Synchrotron Radiation Laboratory, University of Science and Technology of China, Hefei 230029, P. R. China

**Supporting Information S1**

Table S1. The preparation conditions for each Au/Sn sample. In the synthesis procedure, the concentration of Au nanoparticles and $Sn^{2+}$ is 1 mM and 10 mM, respectively.

| Sample number | Au nanoparticles (mL) | SnCl$_2$ (mL) | The mole % of Au/Sn |
|---|---|---|---|
| 1 | 50 | 2.7 | 65/35 |
| 2 | 50 | 5.0 | 50/50 |
| 3 | 50 | 10.0 | 33/67 |
| 4 | 50 | 20.0 | 20/80 |

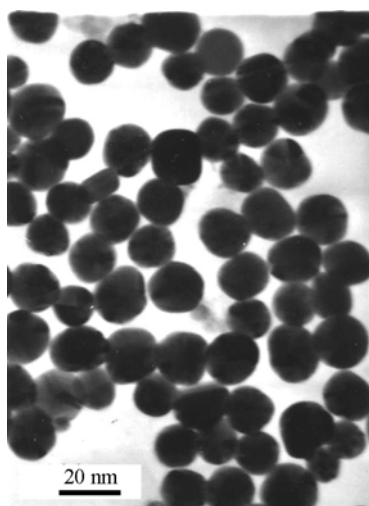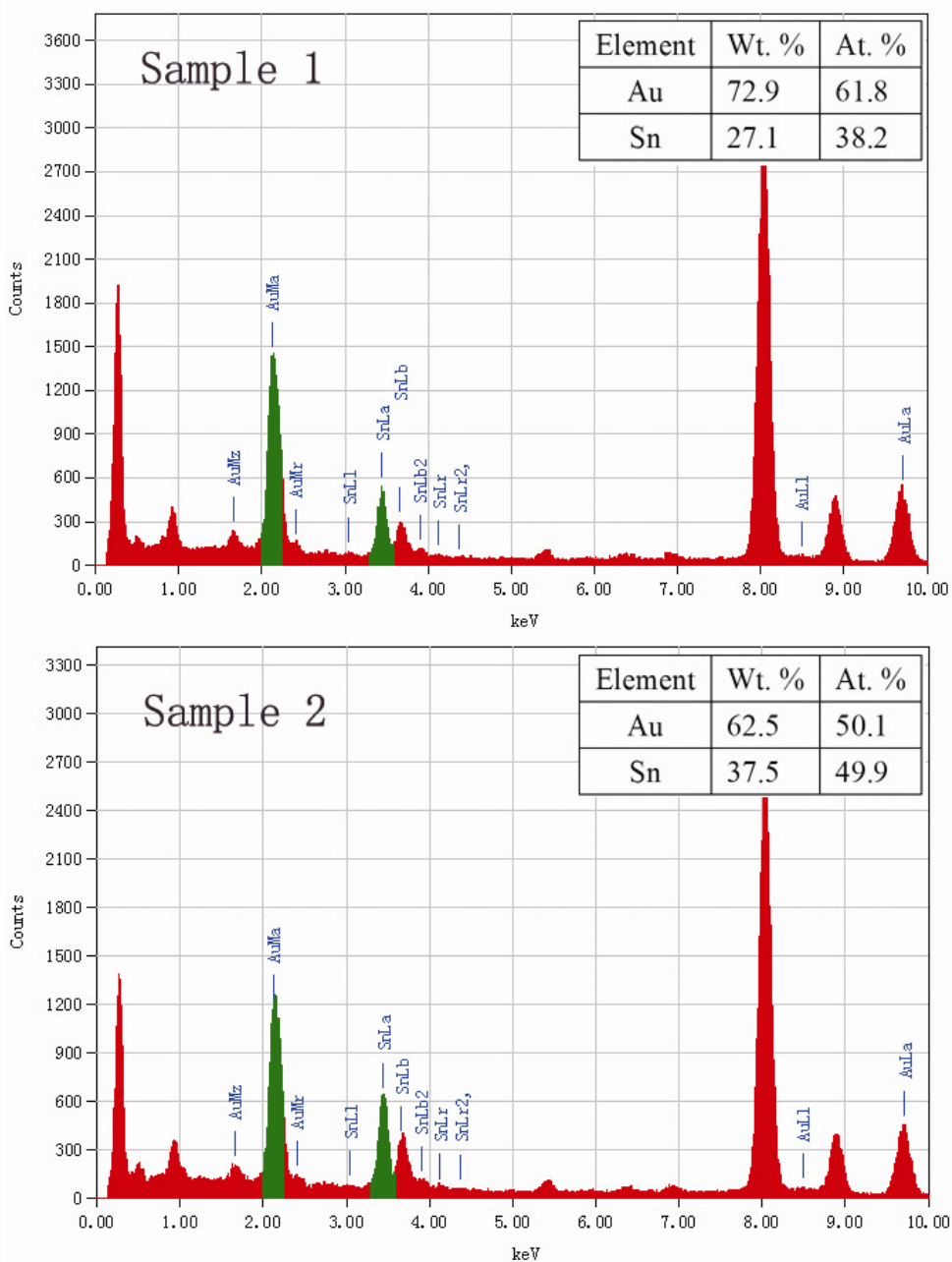Figure S1. The synthesized Au nanoparticles.



Figure S1. TEM micrograph of the as-prepared Au seeds.

**Supporting Information S2**

Figure S2 gives the results of EDX analysis of the Sample 1, 2, 3, and 4 showing that the final percentage of Sn to Au is closed to the calculated mole ratios.
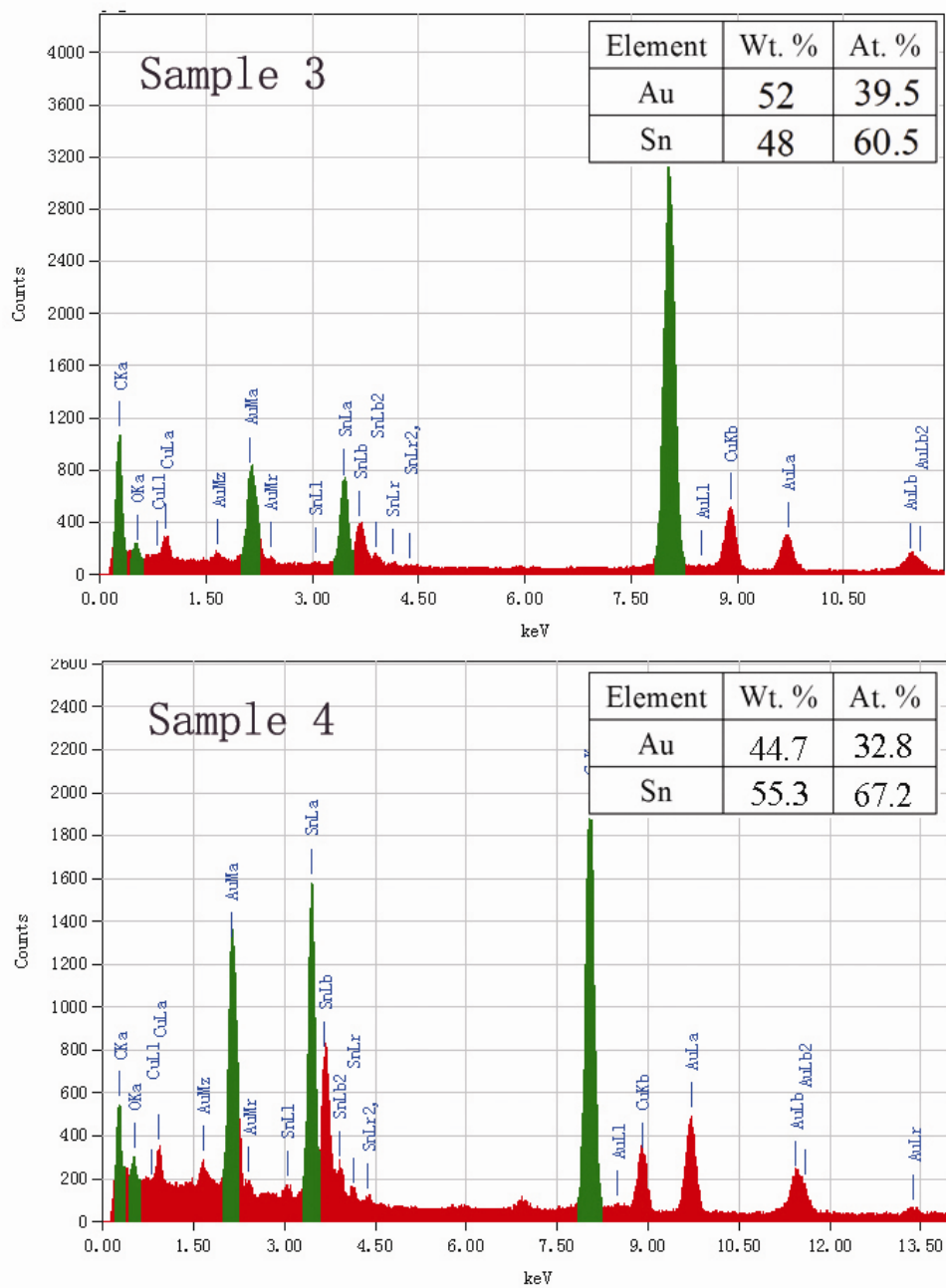


| Element | Wt. % | At. % |
|---------|-------|-------|
| Au | 72.9 | 61.8 |
| Sn | 27.1 | 38.2 |



| Element | Wt. % | At. % |
|---------|-------|-------|
| Au | 62.5 | 50.1 |
| Sn | 37.5 | 49.9 |

Figure S2. EDX analysis of Samples 1-4. The insets are the corresponding Au and Sn weight ratios and atomic ratios.

**Supporting Information S3**

Figure S3 shows some other HRTEM images of the Sample 1 and 3 which also give the characteristics of core/shell structure.
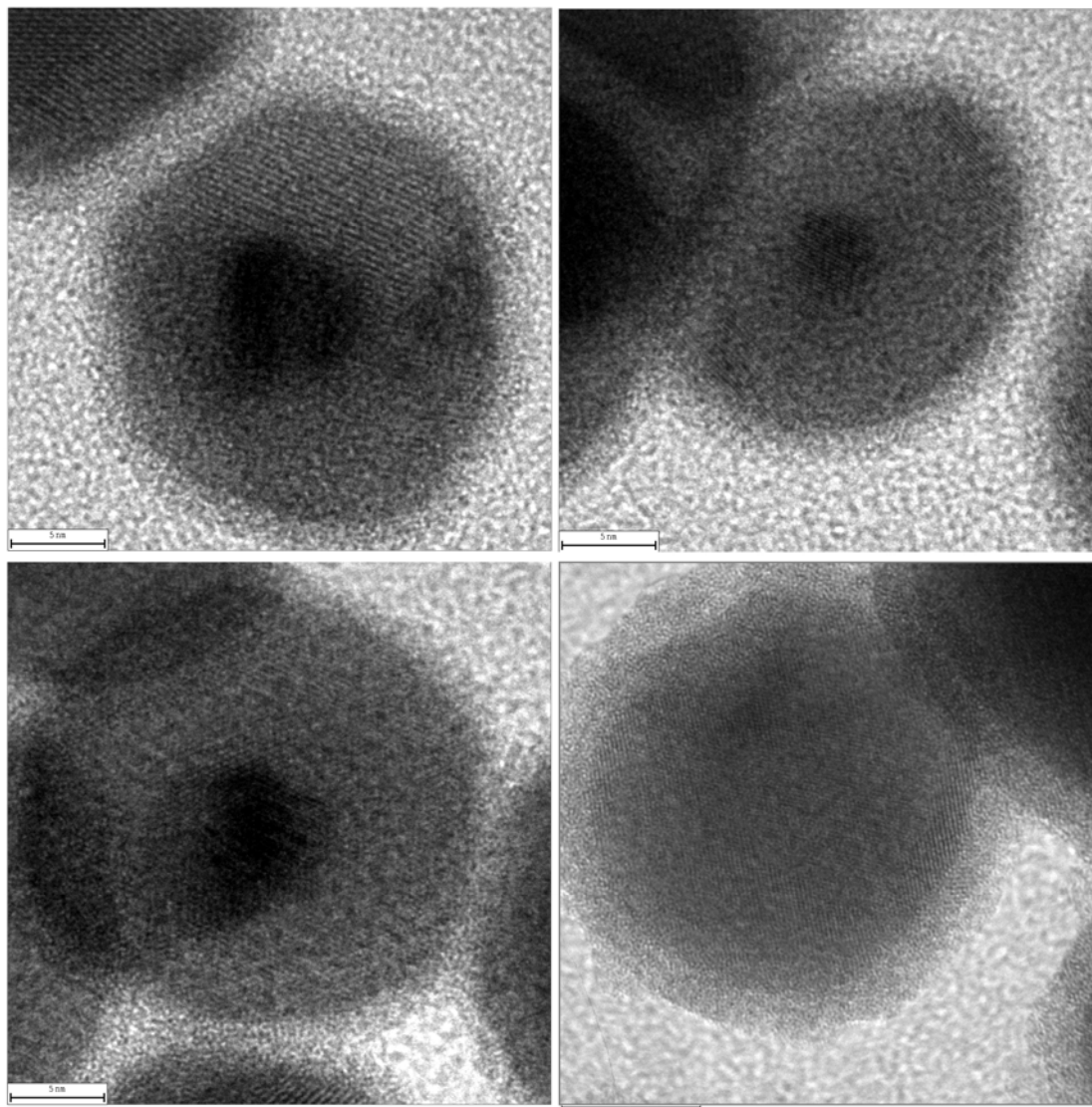


Figure S3. The HRTEM images of Sample 1 and 3 which represent the core/shell structures.

**Supporting Information S4**

Figure S4 shows the HRTEM images and their corresponding FFT images. Through filtering the HRTEM images, we can clearly distinguish the core/shell structures.
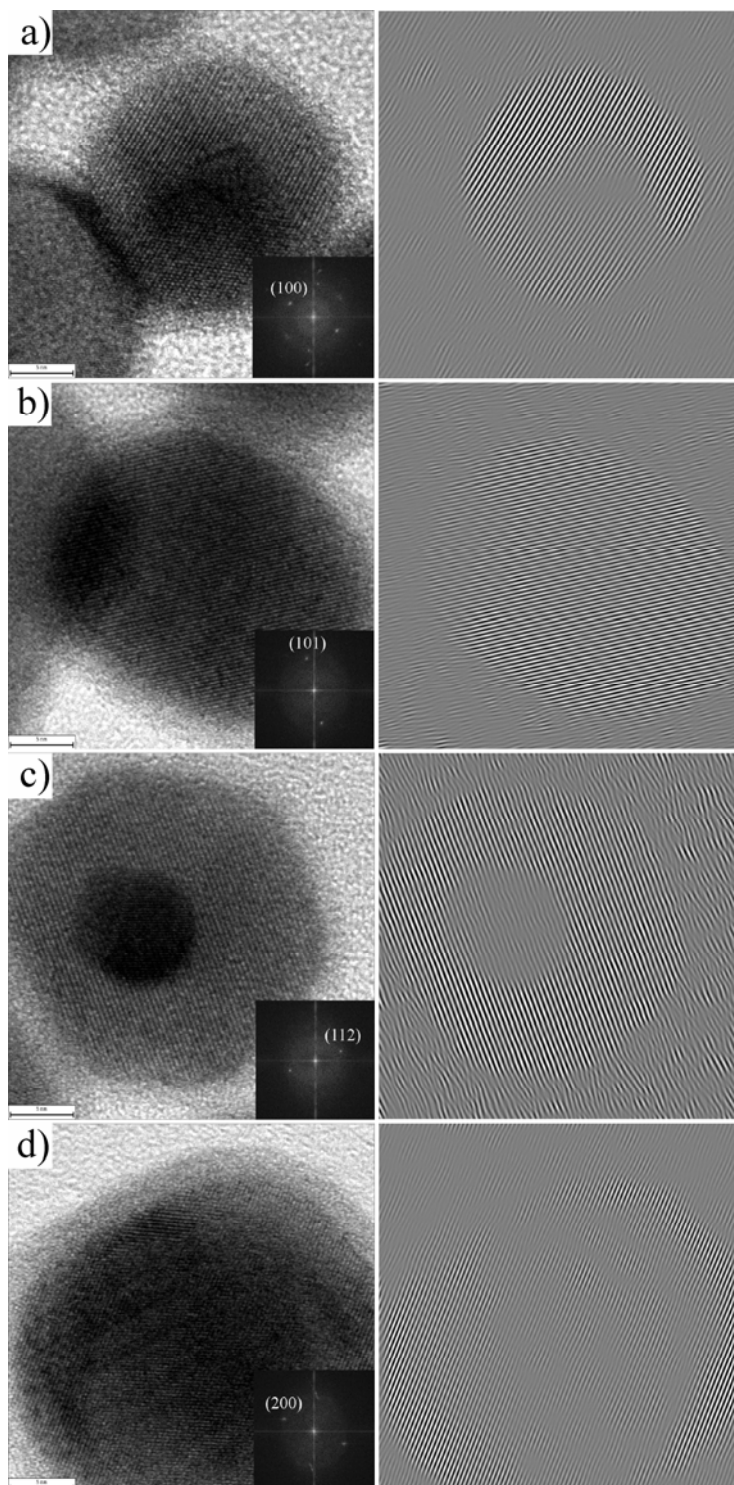


Figure S4. Phase constructions of Au/Sn particles showing the core/shell structures. The left line shows the HRTEM images (the insets show the FFT diagrams) and the right line shows the corresponding FFT filtered images constructed form the reflections showing in the FFT diagrams.