catalysts

MDPI

Supporting Information

A facile direct seed-mediated growth of AuPt bimetallic shell on the surface of Pd nanocubes and studies on their DSHP properties

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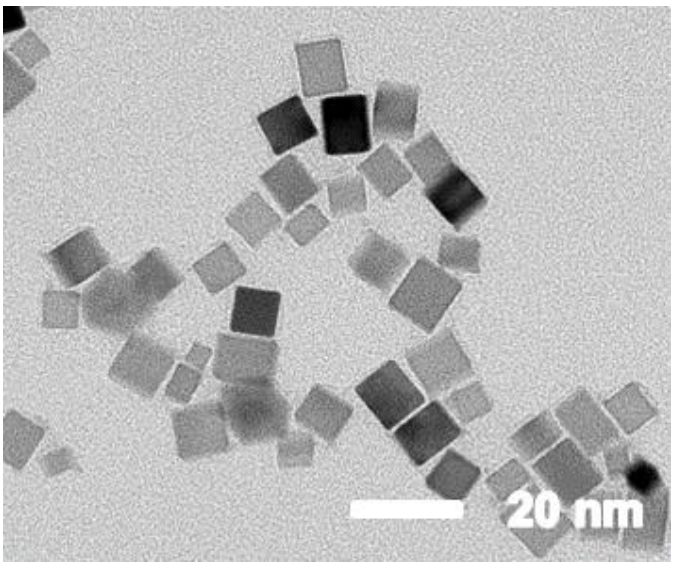

Figure S1. TEM image of Pd nanocubes as core materials.

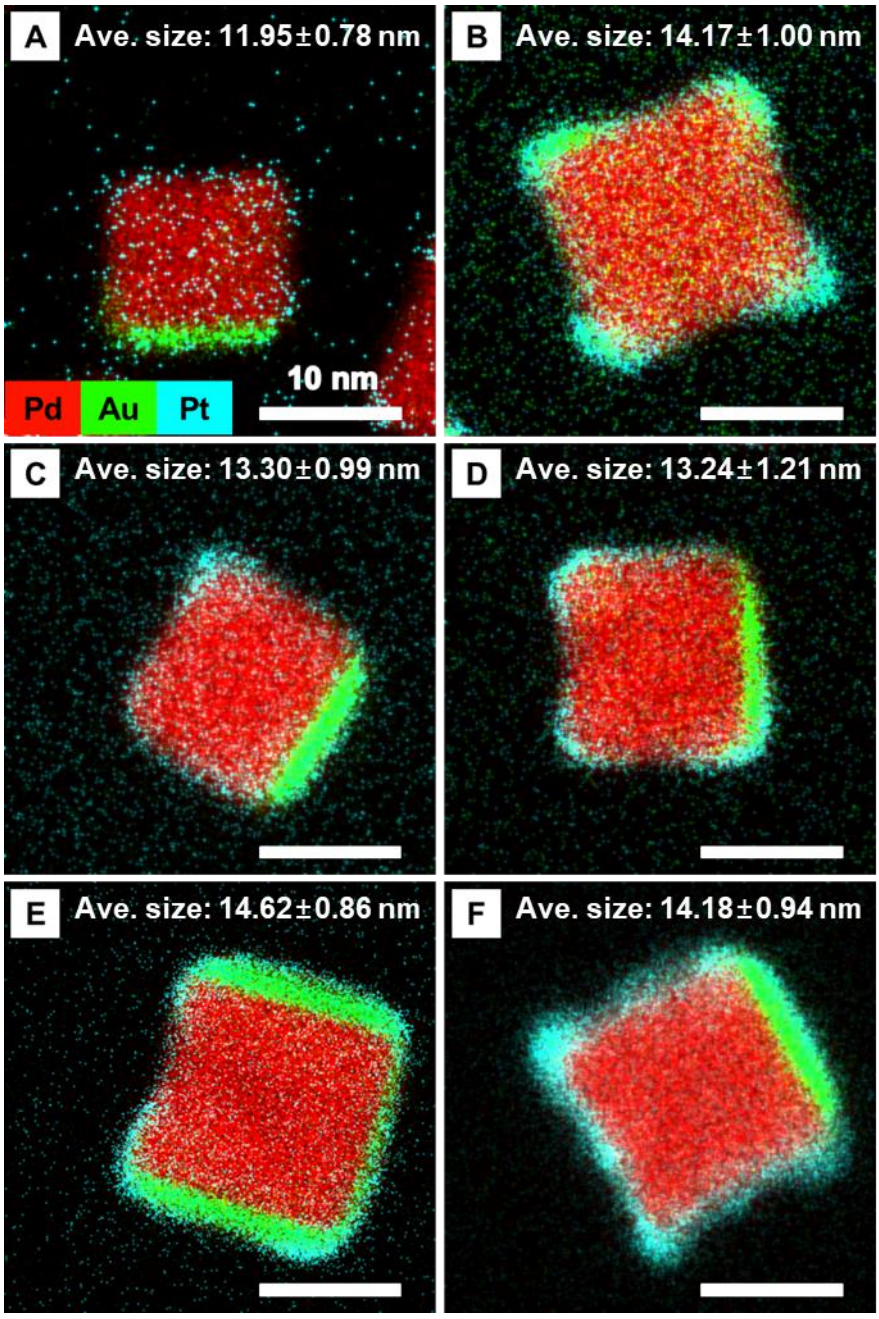

Figure S2. The EDS mapping images and average particle sizes of AuPt@Pd nanoparticles synthesized with varying mol % ratio of Au and Pt. The mol % of Au:Pt were (A) 2:1, (B) 1:2, (C) 5:2.5, (D) 2.5:5, (E) 25:5, and (F) 5:25. Scale bar indicates 10 nm.

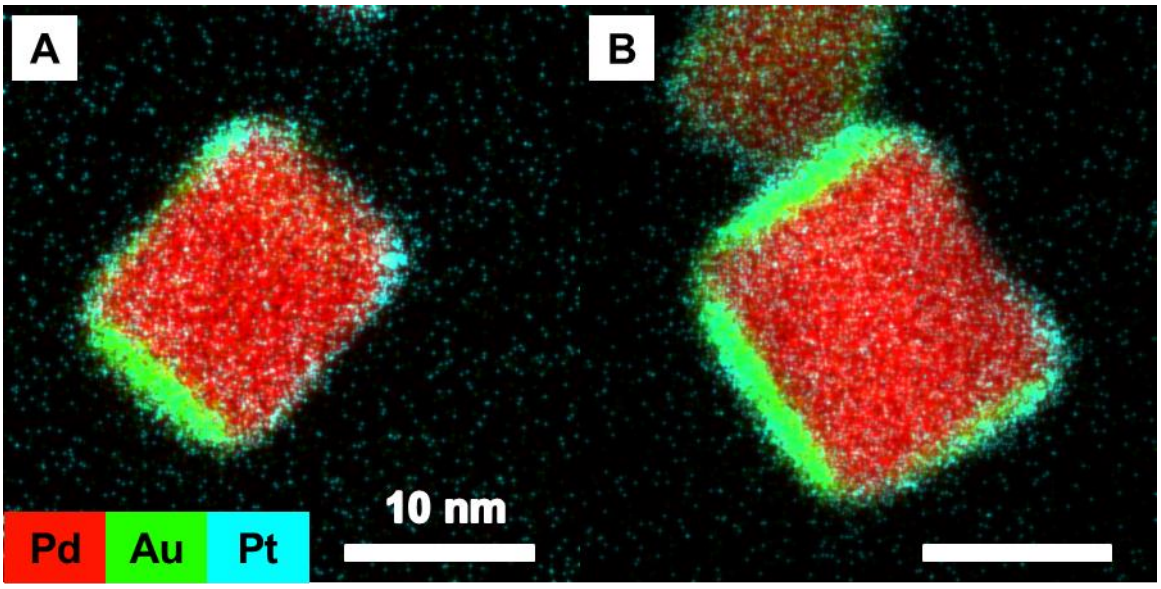

Figure S3. EDS images of Pd@AuPt nanoparticles synthesized with different sequences injection of the Au and Pt precursors: (A) Pt injected, followed by Au 1 min later and (B) Au injected following Pt 1 min later.

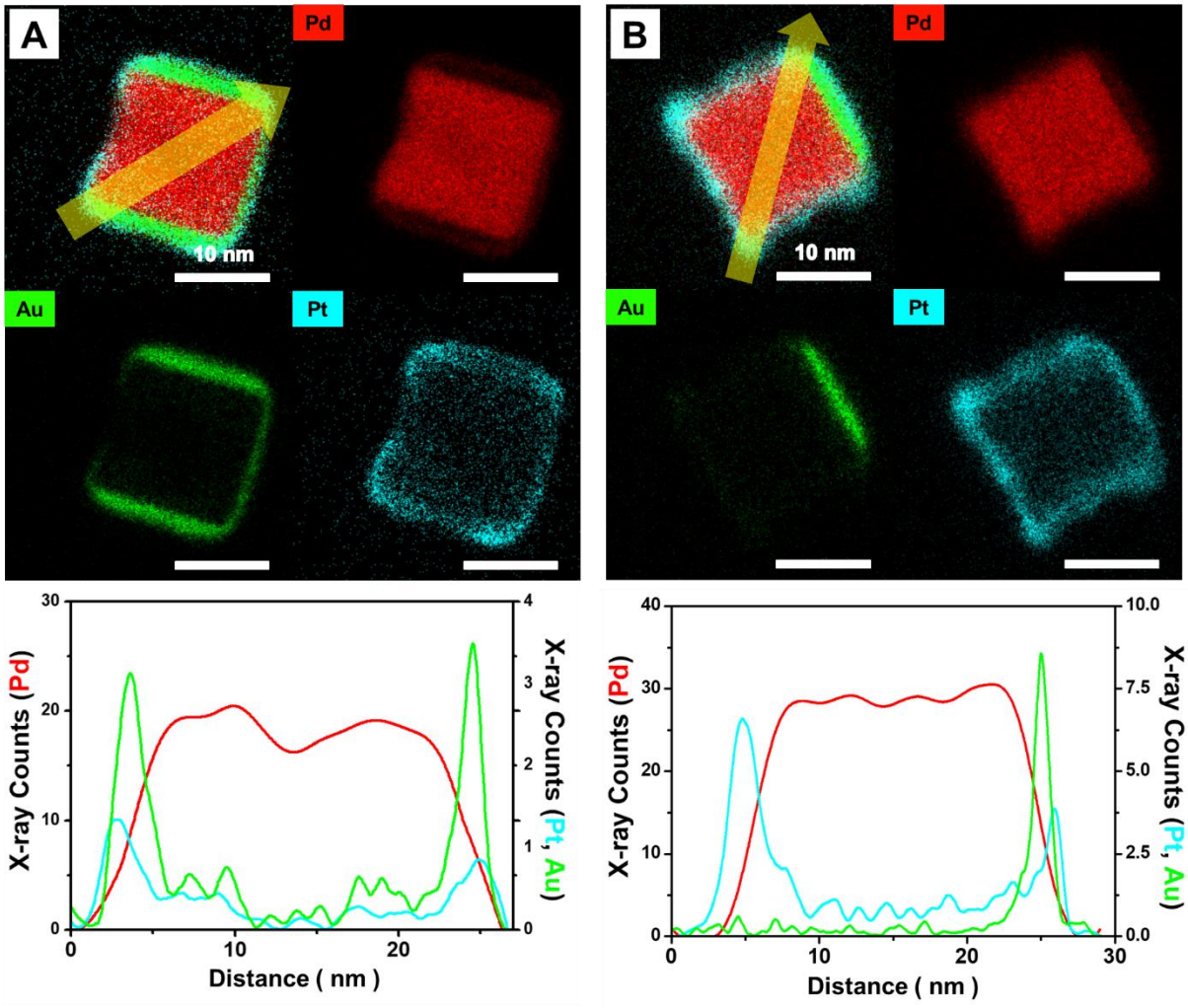

Figure S4. EDS images and line profile of each elements, such as Pd, Au, and Pt, in Pd@AuPt nanoparticles synthesized with the molar fraction ratio of Au:Pt = (A) 25:5 and (B) 5 mol% : 25 mol%, respectively. The yellow arrows indicate the directions of the EDS line profiles.

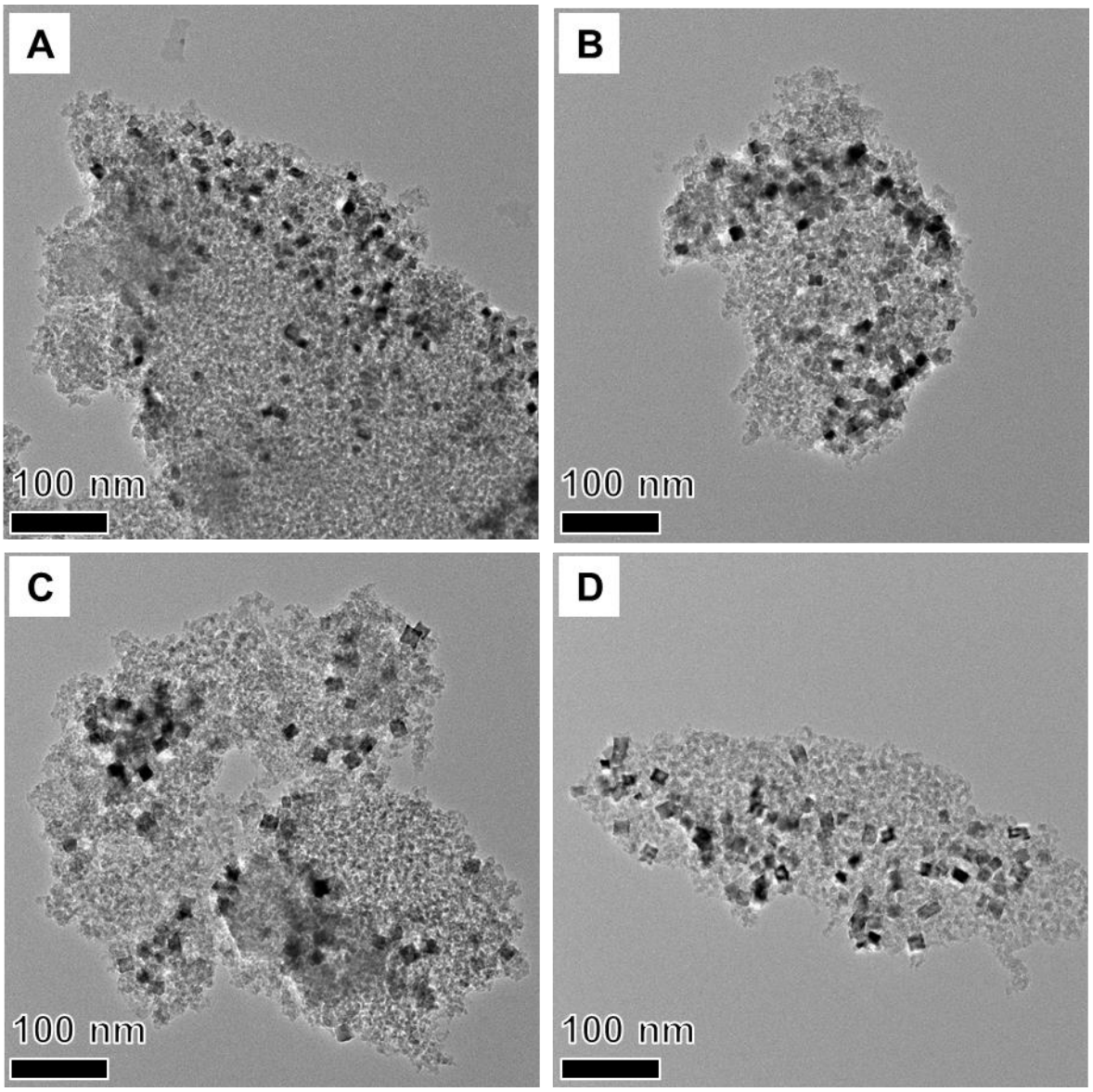

Figure S5. TEM images for the SiO_2-supported Pd@AuPt nanoparticles. The mol% of Au:Pt were (A) 3.75:3.75 (B), 2.5:5.0, (C), 1.9:5.6, and (D) 1.5:6.0, respectively.

Table S1. Elemental composition of the Pd@AuPt core–shell nanoparticles characterized using ICP.

	ICP	ICP (mole)		
Catalyst	**Mole ratio**	**Pd**	**Au**	**Pt**
25:5	1:0.1932:0.0471	0.0766	0.01480	0.00360
5:25	1:0.0343:0.1812	0.08232	0.00282	0.01492
5:2.5	1:0.0376:0.0237	0.07715	0.00290	0.00183
2.5:5	1:0.0198:0.0453	0.07837	0.00155	0.00355
2:1	1:0.0115:0.0082	0.05272	0.00060	0.00043
1:2	1:0.0074:0.0169	0.094907	0.00070	0.00160
3.75:3.75	1:0.0350:0.03881	0.07621	0.00267	0.00296
1.9:5.6	1:0.0141:0.0502	0.41158	0.00579	0.02066
1.5:6	1:0.0125:0.0619	0.4989	0.00625	0.03086

Table S2. Numeric information of catalytic activities for Pd@Au-Pt catalysts.

Au:Pt ratio of Pd@Au-Pt catalyst	H_2 conversion (%)	H_2O_2 selectivity (%)	Production rate ($mmol_{H2O2} \cdot g_{metal}^{-1} \cdot h^{-1}$)
3.75:3.75	6.7	85.0	795.2
2.5:5.0	9.1	70.9	914.8
1.9:5.6	9.2	52.6	680.4
1.5:6.0	12.0	39.1	657.6

Table S3. Comparison of catalytic activities developed in this study

Catalysts	Reactor type	Support	Production rate ($mmol_{H2O2} \cdot g_{metal}^{-1} \cdot h^{-1}$)
2:1 AuPt@Pd	Fast-screening	None	262
1:2 AuPt@Pd	Fast-screening	None	256
5:2.5 AuPt@Pd	Fast-screening	None	298
2.5:5 AuPt@Pd	Fast-screening	None	281
25:5 AuPt@Pd	Fast-screening	None	267
5:25 AuPt@Pd	Fast-screening	None	190
Pd cube	Fast-screening	None	93
3.73:3.75 AuPt@Pd	Typical reactor	SiO_2	795
2.5:5.0 AuPt@Pd	Typical reactor	SiO_2	915
1.9:5.6 AuPt@Pd	Typical reactor	SiO_2	680
1.5:6.0 AuPt@Pd	Typical reactor	SiO_2	658

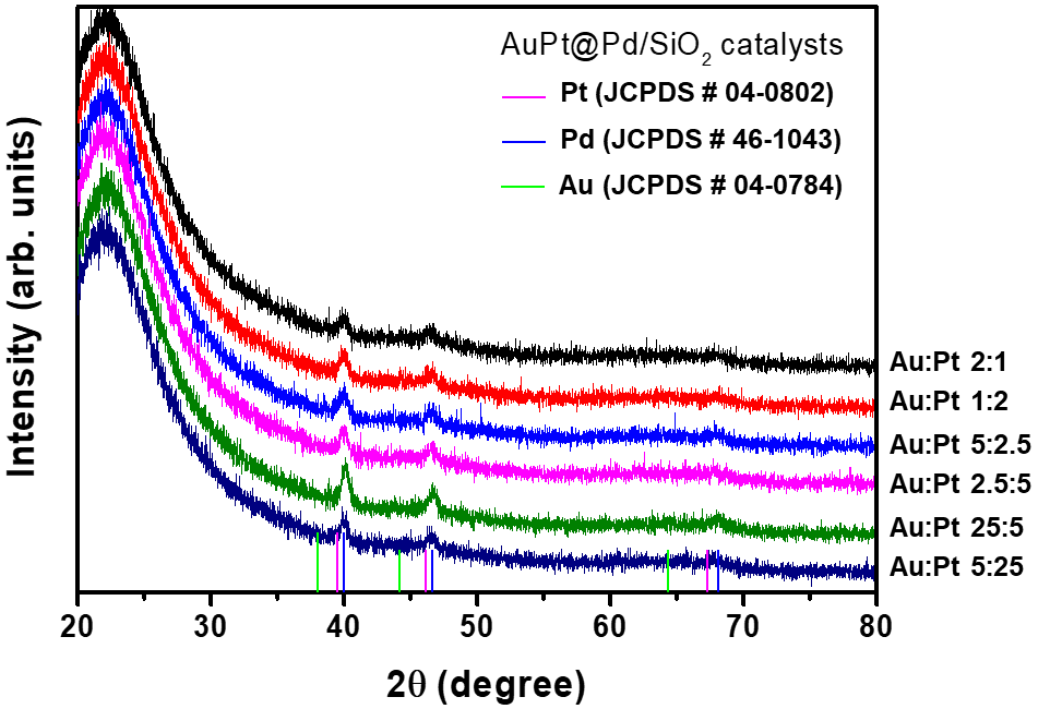

Figure S6. XRD data for the SiO_2-supported Pd@AuPt nanoparticles.