

SUPPLEMENTARY INFORMATION

Free carrier enhanced depletion in ZnO nanorods decorated with bimetallic AuPt nanoclusters

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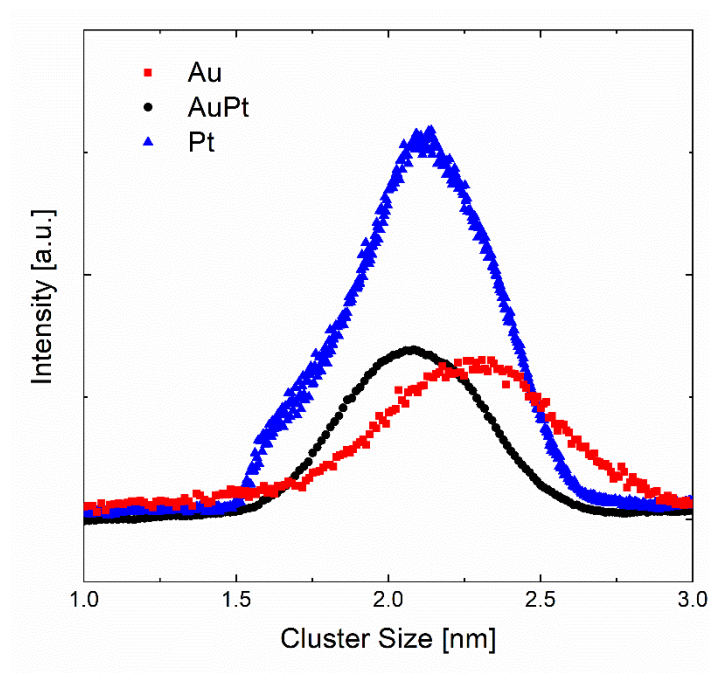


Figure S1: Cluster size distribution measured by reflection time of flight spectrometry for gas-phase clusters before deposition on the sample.

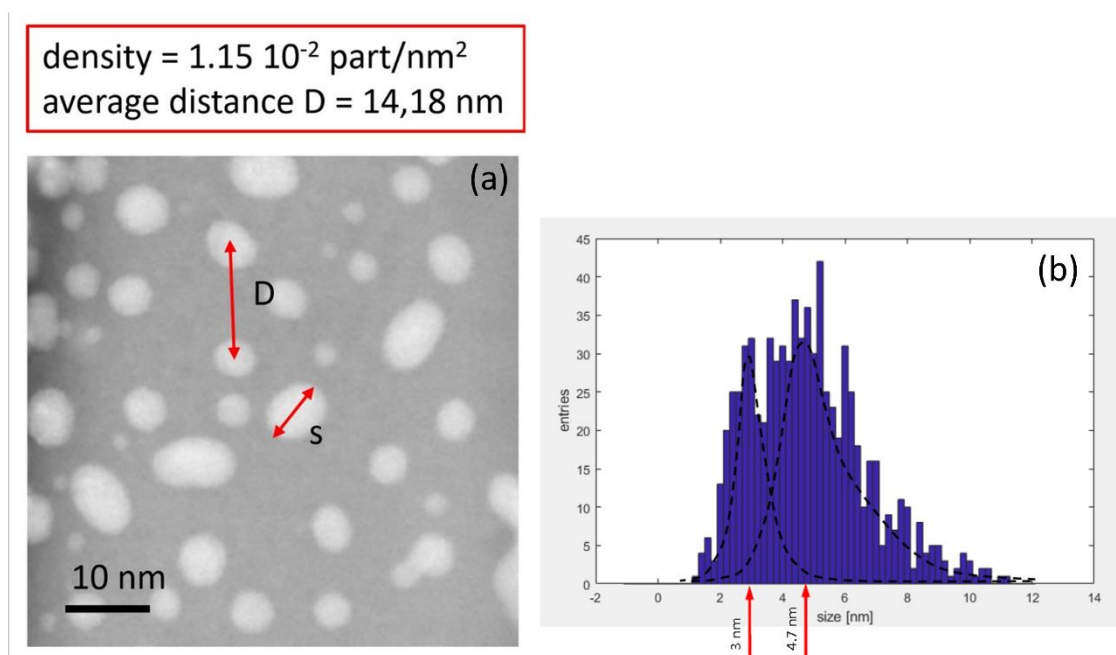
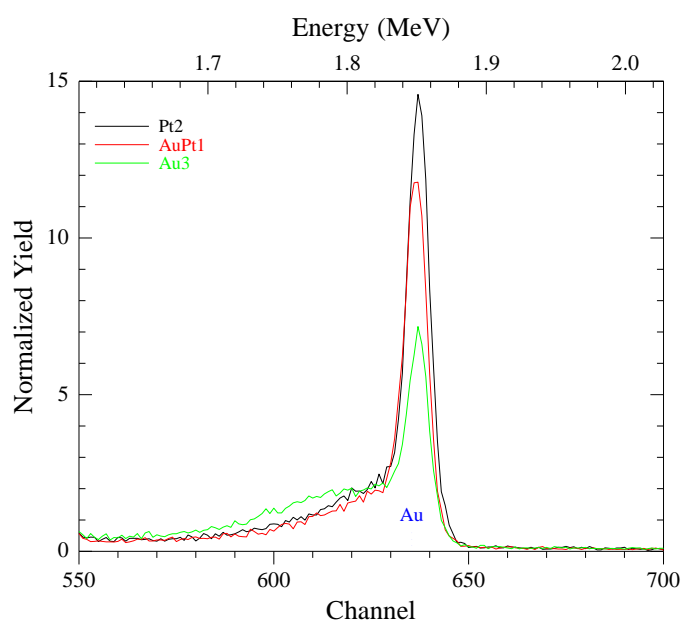


Figure S2: Representative high-resolution STEM micrograph used to determine size distribution and distance of Au clusters deposited on ZnO NR surface (a) and size distribution population of Au clusters (b).



Name	Metal dose [E15/cm ²]
AuPt1	5.1±0.2
Pt2	6.5±0.1
Au3	3.0±0.2

Figure S3: RBS spectra of Au, Pt and AuPt clusters deposited on ZnO NRs. The area of the peaks in the 1.75 – 1.9 MeV gives the metal dose (in at/cm²) deposited.

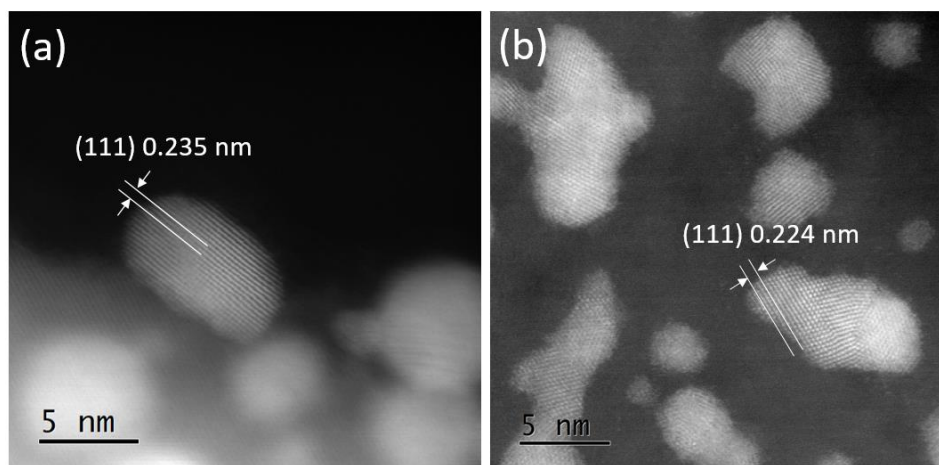


Figure S4: High resolution STEM micrographs for (a) Au and (b) Pt clusters. The measured inter-planar space for (111) planes are indicated.

To get a condition as close to the experimental one as possible we estimated the electric field to be applied to a single NR. The resistance measured for Au sample is about 1 G Ω , which would be that of a NR 10 nm long. If the experimental voltage of 0.8 V was applied to such a NR, the electric field would have been 80 V/m. Thus, a voltage bias of $4 \cdot 10^{-5}$ V along the NR axis (500 nm long) is considered for resistance simulation. An equivalent resistance (R_{eq}) for the NR is computed by extracting the current flowing along it, with Au clusters at different spacing values. For a bare ZnO NR the resistance (R_0) results to be 39.8 k Ω , and it increases up to almost 3 times for 10 nm spaced Au clusters.

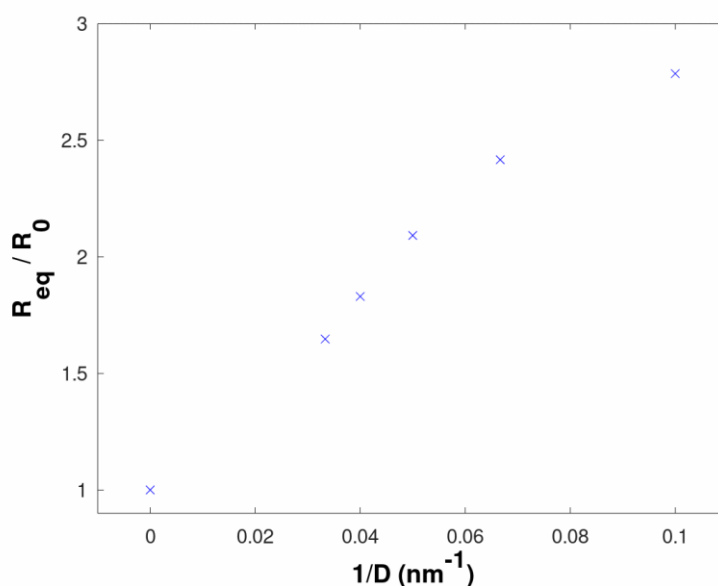


Figure S5: Simulation of the equivalent resistance of a NR with Au clusters spaced by D

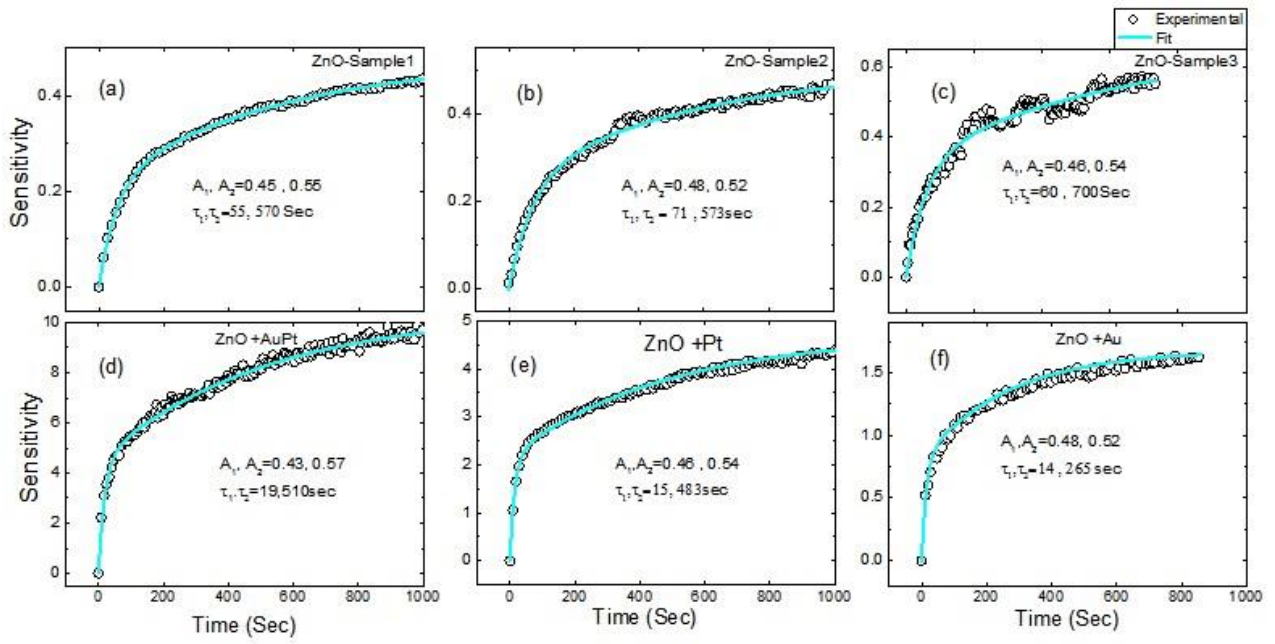


Figure S6: Numerical fit of the transient photocurrent curves for the pristine [(a) to (c)] ZnO NRs and decorated with AuPt (d), Pt (e) and Au (f) clusters.

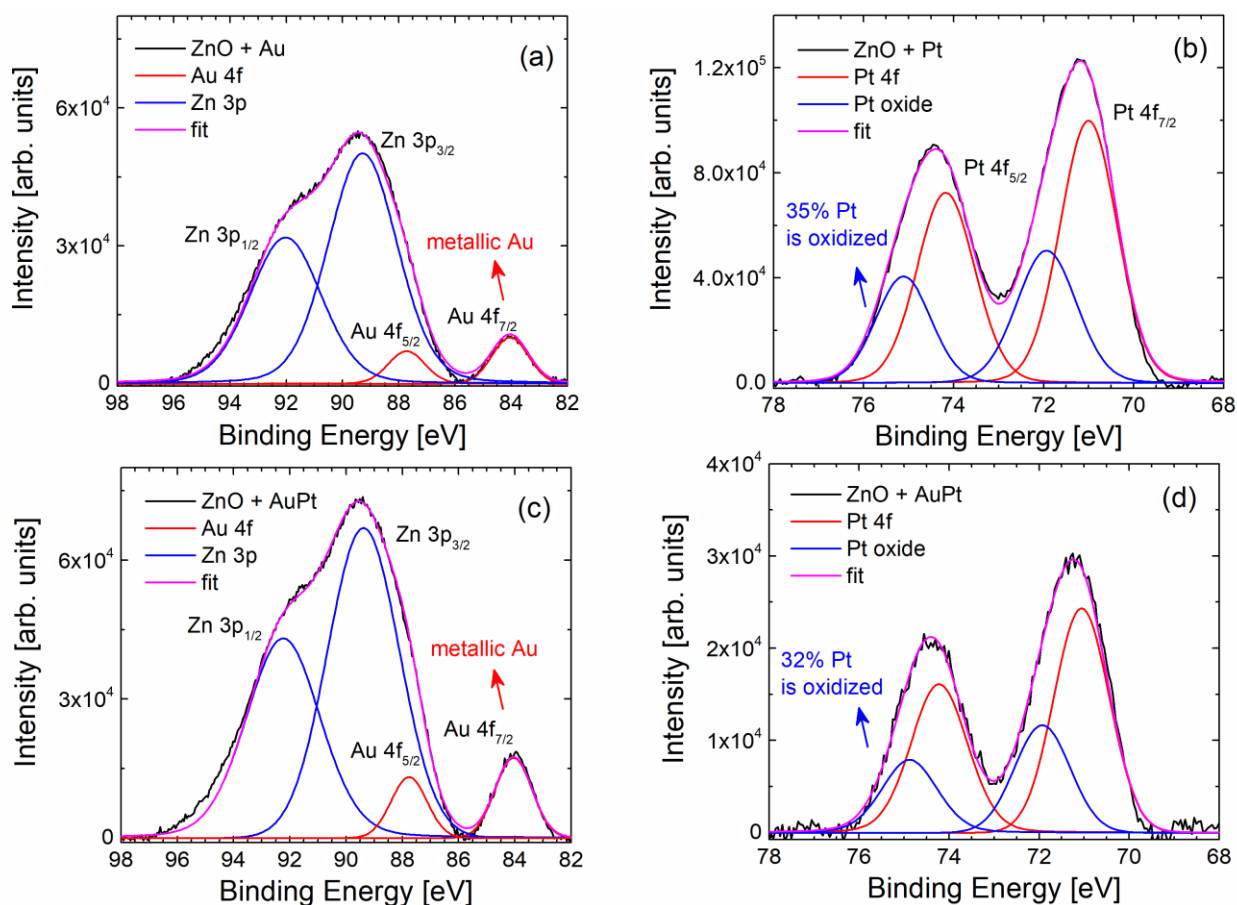


Figure S7: XPS spectra of Au and Pt region in decorated samples. Peaks were deconvoluted by taking into account the split-orbit separation of Au4f, Pt4f and Zn3p. Au clusters deposited on ZnO show no sign of oxidation. For Pt and AuPt on ZnO NRs, around 32-35% of the atoms are bonded with oxygen.

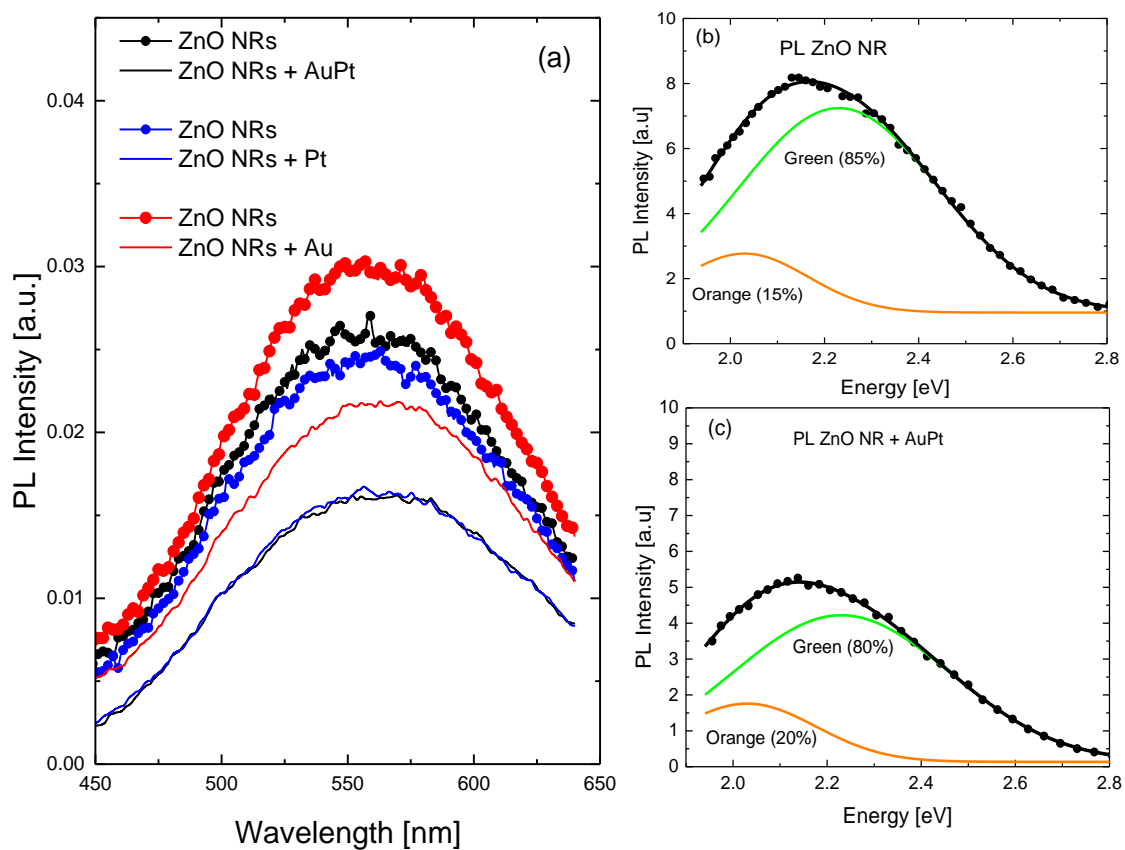


Figure S8. PL spectra in the visible region for pristine ZnO NRs and after cluster decoration (a). The two-component Gaussian fit shows that emission states (orange and green) in ZnO are not altered after cluster decoration.