Electronic Supplementary Information

"New insights into micro/nanoscale combined probes (nanoAuger, μXPS) to characterize Ag/Au@SiO_2 core-shell assemblies"

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AES Characterization (additional information to section 3.2)

For a given element i, the Auger intensity signal for the ABC transition is approximately proportional to the following parameters:

$$I^{Auger}_{(i)} \cong I_p \beta_{(i)} F T D R,$$

with $\beta_{(i)} = N_{(i)} \sigma_{(i)} \gamma_i (1+r) \lambda \cos\theta$, and I_p as the intensity of the primary electron beam current, $N_{(i)}$ as the number of atoms of element i per unit volume, $\sigma_{(i)}$ as the ionization cross section for the A level of element i, γ_i as the Auger transition probability for the ABC transition of element i, λ as the inelastic mean free path, r as secondary ionization for the A level of element i by scattered electrons(backscatter effect), θ as the angle between Auger electron and the surface normal, F as the analyzer solid angle of acceptance, T as the analyzer transmission function, D as the detector efficiency, and R as the surface roughness factor ($0 < R < 1$).

The Auger transition probability and Auger electron escape depth are independent of the incident electron beam energy, the dependence of the Auger peak intensity is then mainly governed by the ionization cross-section.
Fig. ESI.1 illustrates this effect using two different electron source energies (10 keV and 30 keV). At 30 keV the ionization cross section of Au (M level) is enhanced in comparison with same experiment run at 10 keV (for which the N level cross section then becomes predominant).

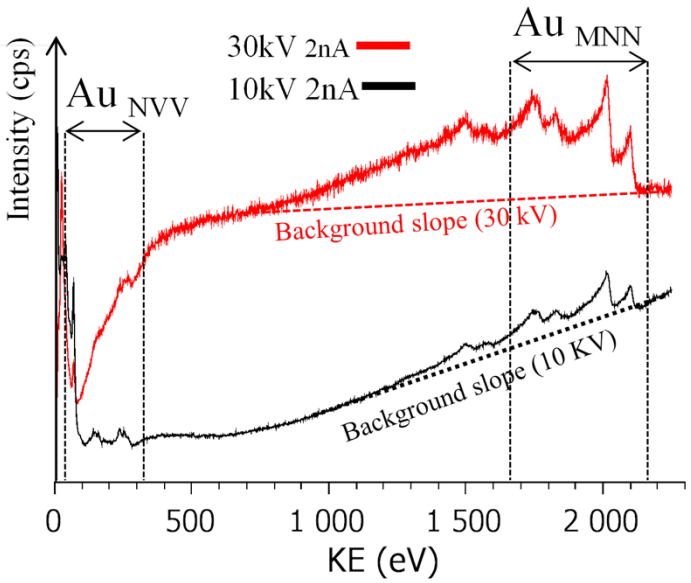

Fig. ESI.1. AES wide kinetic-energy survey spectra (0–2300 eV) of a gold reference sample at different operating conditions (10 kV/2 nA, black curve; 30 kV/2 nA, red curve). Influence of the primary beam energy (E_0) onto the gold ionization efficiency (σ) and onto the background shape/intensity (BG).

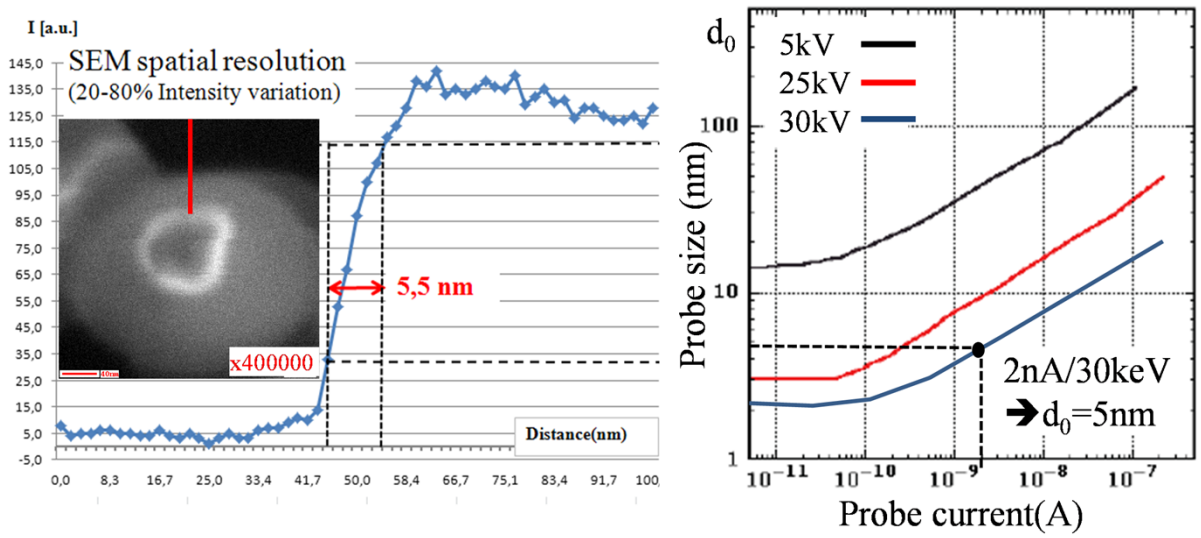

Fig. ESI2. Relationship between SEM "experimental" spatial resolution ("20-80%" intensity variation definition) of a single cross-cut Ag/Au@SiO_2 nanoparticle (left) and JAMP9500F probe size (nm) / probe current (A) (for different voltages (kV)) (right)