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Plasmonic coupling with most of the transition metals: a new family of broad band and near infrared nanoantennas

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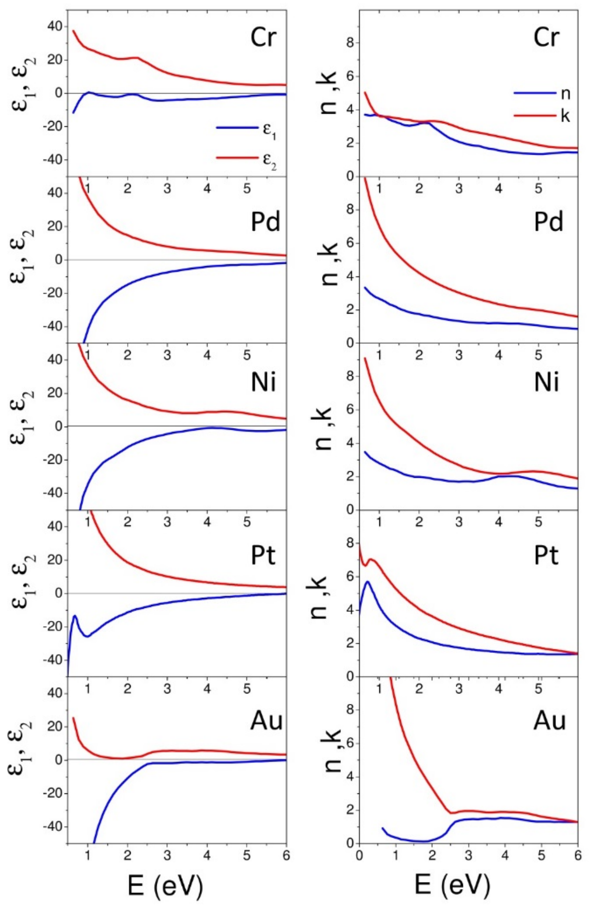

Figure SI1: dielectric functions $\varepsilon=\varepsilon_1+i\varepsilon_2$ (left) and corresponding optical indexes ñ=n+ik (right) of various metals (Cr, Pd, Ni, Pt, Au) (from references [1, 2] and [3] for Pt)

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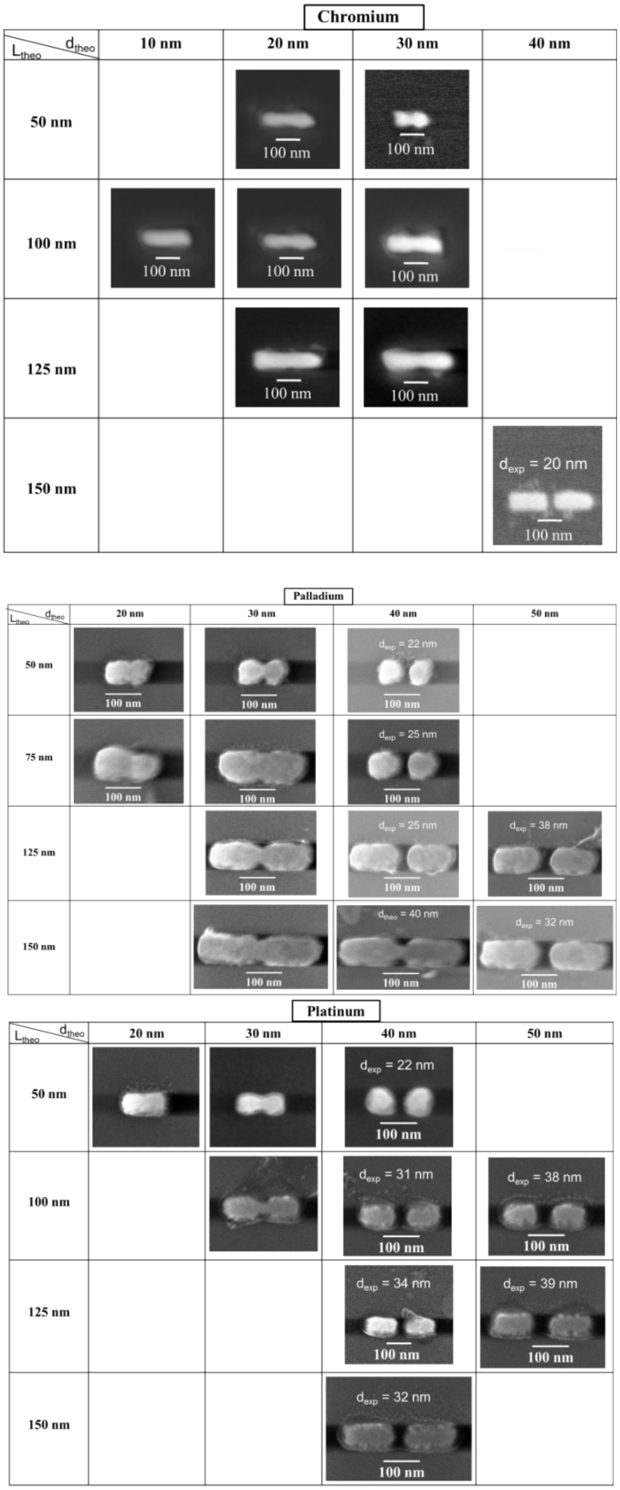

Figure SI2: SEM images of parallelepipedal dimers elaborated by nanolithography. For theoretical interparticle distances d_{theo} lower than 30 nm, the parallelepipeds are in contact, whereas for theoretical interparticle distances larger than 40 nm, the parallelepipeds do not touch.

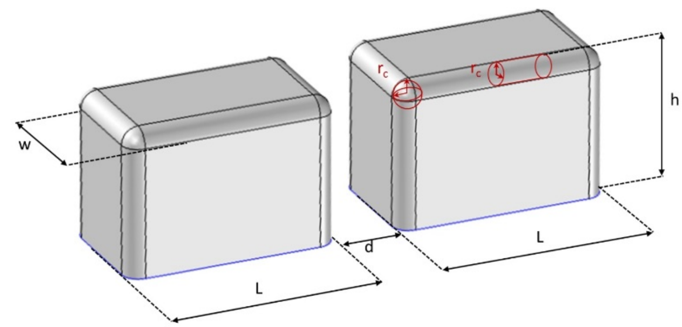

Figure SI3: parameters characterizing the parallelepipedal monomers and dimers involved in calculations: Length *L*, width *w*, height *h*, rounding parameter r_c, interparticle distance *d*.

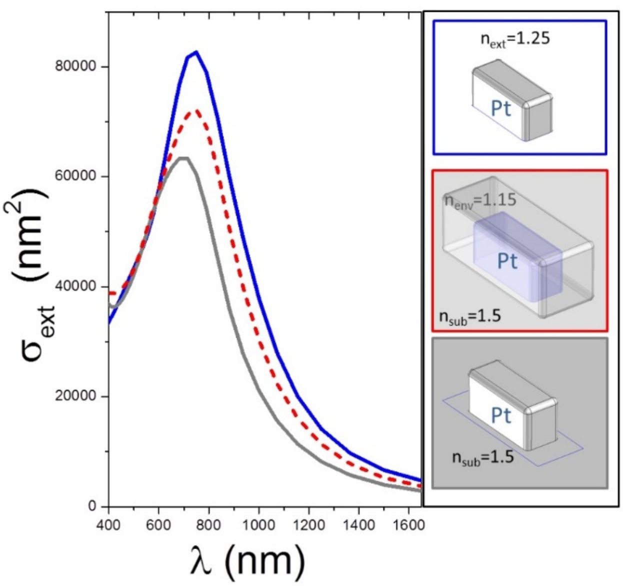

Figure SI4: calculated extinction cross-sections for a platinum parallelepiped (L=150 nm, w=60 nm, h=70 nm, r_c=8 nm) :

(blue): NA in a homogeneous medium (n_{ext}=1.25) ; (red):NA on a substrate (n_{sub}=1.5) surrounded from its bottom by a local medium defined as a parallelepiped of dimensions: L_e=250 nm, w_e=100 nm, h_e=100 nm, r_{ec}=8 nm and of optical index n_{env}=1.15 ; (gray) : NA on a substrate of optical index n_{sub}=1.5

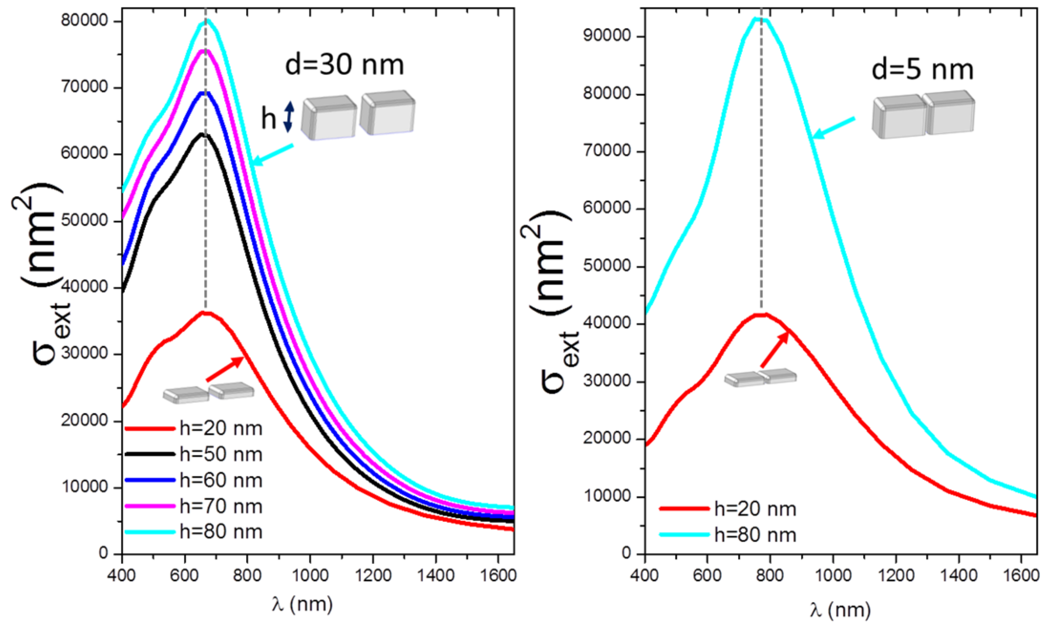

Figure SI5: influence of the height *h* of the parallelepipeds (*L*=100 nm, *w*=60 nm, r_c=*8* nm) on the extinction cross-sections ((left): *d*=30 nm, (right): *d*=5 nm). The reducing of the height of the parallelepipeds induces a damping of the LSPR, but no spectral shift is observed, even for small interparticle distances

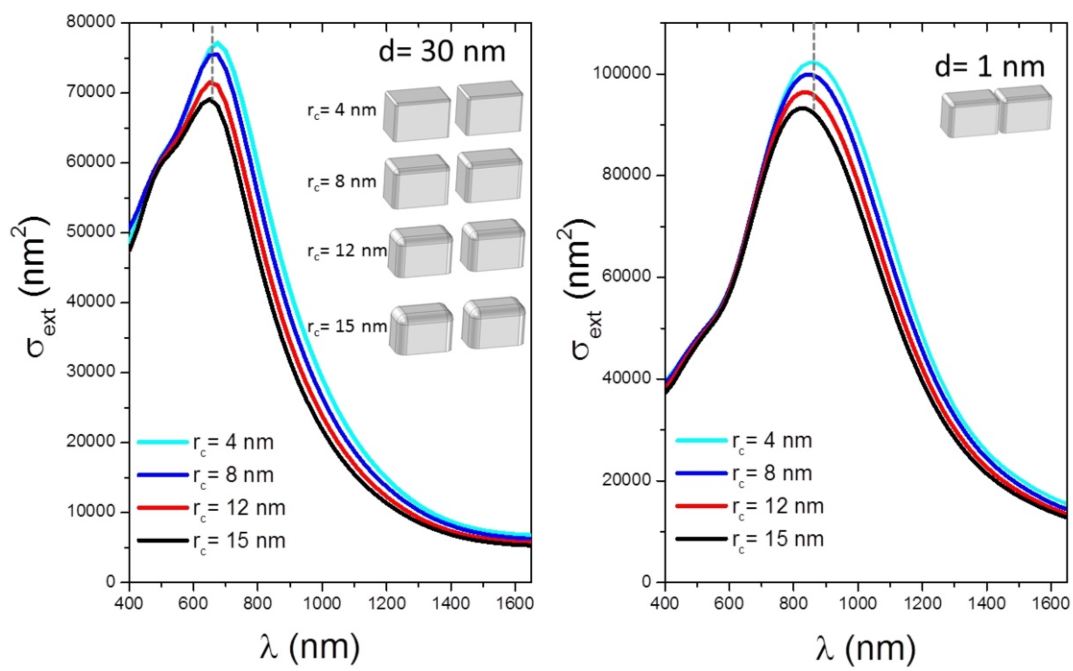

Figure SI6: influence of the rounding parameter r_c characterizing the parallelepipeds (*L*=100 nm, *w*=60 nm, *h*=70 nm) on the extinction cross-sections (left: d=30 nm, right: d=1 nm)

For large interparticle distances, the influence of the rounding is very small. It induces a slight decreasing and redshift of the LSPR maximum. It is only for very small interparticle distances that its influence cannot be neglected (out of range of the experimental interparticle distances)

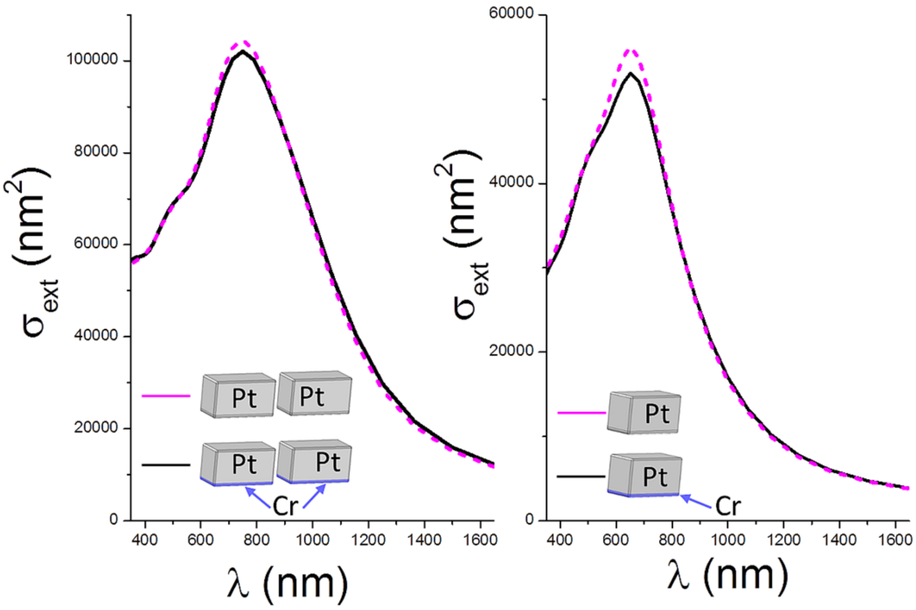

Figure SI7: calculated optical extinction cross-sections of parallelepipedal dimers and monomers (L=125 nm, w=60 nm, h=70 nm, r_c=3 nm) made of pure platinum (magenta dotted line, h=70 nm) or platinum over chromium (black line, h_{Pt}=64 nm, e_{Cr}=6 nm). For the dimers, the interparticle distance is d=35 nm. The optical index of the surrounding medium is n_{ext}=1.35.

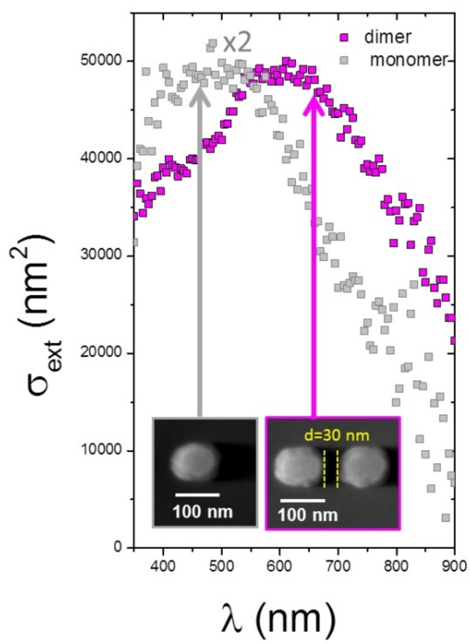

Figure SI8: comparison between platinum monomer and dimer extinction cross-sections for L=75 nm. The monomer cross-section (gray squares) is multiplied by 2. The shift in the LSPR of the dimer as compared to the monomer clearly evidences the coupling effect.

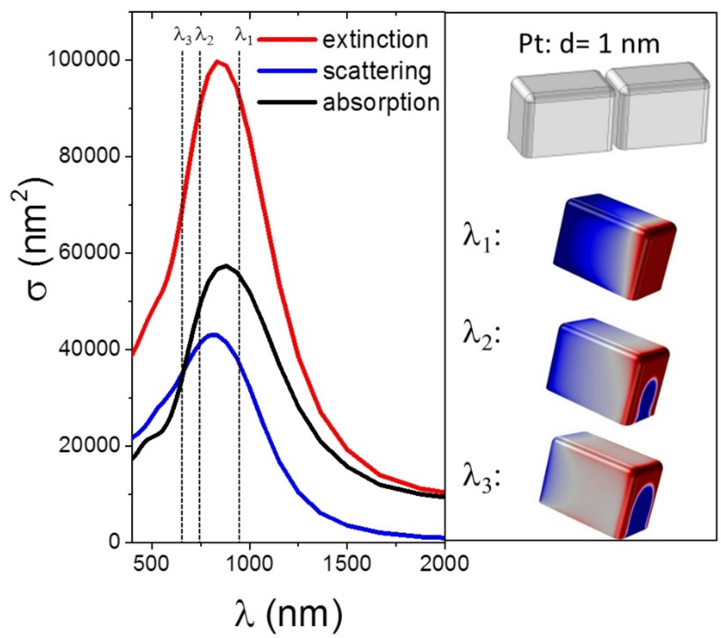

Figure SI9: (left) Calculated extinction (red), scattering (blue) and absorption (black) cross-sections for a dimer of parallelepipeds (L=100 nm, w=60 nm, h=70 nm, d=1 nm); (right): corresponding charge distribution on one of the parallelepiped surface for the three wavelengths $\lambda_1, \lambda_2, \lambda_3$ reported on the spectra.

Notes and references

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