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Title : Gold Nanoparticles for Physics, Chemistry, Biology and Medicine

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Abstract

The illumination of gold nanoparticles (Au-NPs) sets off a cascade of complex processes that are morphology dependent and lead them to act as **nanosources of light, heat and hot-carriers**. Our research activities concentrate on the **synthesis and assembly of gold NPs and nanohybrids** with tunable sizes and shapes, to provide original materials for research in plasmonics ⁽¹⁻⁷⁾, plasmon-driven chemistry, biology and medicine through collaborations.

We synthesize commercial and **non-commercial Au-NPs** such as cubes, prisms, stars, octahedra, nano/microplates, of various sizes and thicknesses and ultra-small nanorods. **Hot-spots** are prepared through spontaneous 3D self-assembly, by simply evaporating concentrated monodisperse solutions on non-patterned substrates.

According to literature, perfect spheres and cubes on top of Au-film are very attractive for several spectroscopies within the gap. Triangular shaped NPs are particularly promising for ultrasensitive sensing and biomedicine. Au-NPs alone without photosensitizer can generate singlet oxygen (¹O₂) for PDT. Hot spots coming from Au-NPs or aggregates on Au-mirror are currently used to study a large number of plasmon-driven chemical reactions. Nano- and microplates can spontaneously self-assemble in ordered 1D-columnar aggregates or 2D-metasurfaces; their large atomically flat facets are used for F.I.B. fabrication of monocrystalline structures.

References

- 1-S. Mitiche *et al.*, J. Phys. Chem. C, **2017**, "Near-Field Localization of Single Au Cubes, a Predictive Group Theory Scheme."
- 2-M. Pellarin *et al.*, ACS Nano, **2016**, "Fano Transparency in Rounded Nanocube Dimers Induced by Gap Plasmon Coupling."
- 3-C. Molinaro *et al.*, J. Phys. Chem. C, **2016**, "Two-photon luminescence of single colloidal gold nanorods: revealing the origin of plasmon relaxation in small nanocrystals"
- 4-E. Le Moal *et al.*, Physical Review B, **2016**, "Engineering the emission of light from a scanning tunneling microscope using the plasmonic modes of a nanoparticle"
- 5-E. Le Moal *et al.*, Nano Letters, **2013**, "An Electrically Excited Nanoscale Light Source with Active Angular Control of the Emitted Light"
- 6-C. Deeb *et al.*, J. Phys. Chem. C, **2012**, "Mapping the Electromagnetic Near-Field Enhancements of Gold Nanocubes"
- 7-M. Haggui *et al.*, ACS Nano, **2012**, "Spatial Confinement of Electromagnetic Hot and Cold Spots in Gold Nanocubes"