

# SR-XPS and NEXAFS Investigation of Colloidal Networks of Gold Nanoparticles Interconnected by Organometallic Rod-like Oligomers

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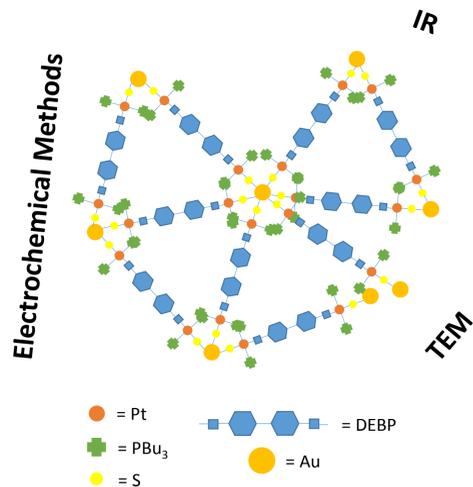
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## 5) Conclusions and Future Perspectives

RS-AuNPs (R = CH<sub>3</sub>COS-(PtDEBP)<sub>n</sub>-) with different length were prepared. Combined XPS and NEXAFS results suggest a layer of sulphur ions bridging the thiol chains to the Au atoms of the NP surface. Further experiments and analysis are planned in future research work.



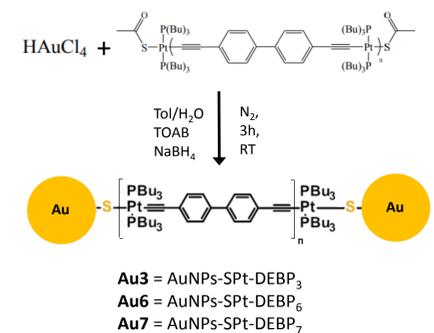
## 1) Introduction

Colloidal gold networks are covalently linked size- and shape-controlled **gold nanoparticles (AuNPs)** assemblies in the form of colloidal particles<sup>[1]</sup>, that can exhibit different physical and chemical properties from both individual nanoparticles and their bulk assemblies. These systems have potential applications as **chemical sensors, biosensors, catalysis and information storage**<sup>[1]</sup>. Since the optical properties of colloidal networks strongly depend on the interparticle distance, it would be extremely interesting to interconnect the AuNPs with organic or organometallic spacers of controlled length. Moreover, the possibility to connect the gold nanoparticles not only structurally but also electronically through molecular wires would open new perspectives in the field of **optoelectronics**.

## 2) Synthesis

Synthesis of CH<sub>3</sub>COS-(PtDEBP)<sub>n</sub> are reported elsewhere<sup>[2],[3],[4]</sup>.

Gold nanoparticles stabilized with CH<sub>3</sub>COS-(PtDEBP)<sub>n</sub> (n=3,6,7) were prepared using **Two-phase Schiffrin-Brust** reaction of **Fig.1**. The size control of the Au nanoparticles was achieved by careful control of synthesis parameters.



**Fig. 1** Scheme of the synthesis of Au<sub>3</sub>, Au<sub>6</sub>, Au<sub>7</sub>.

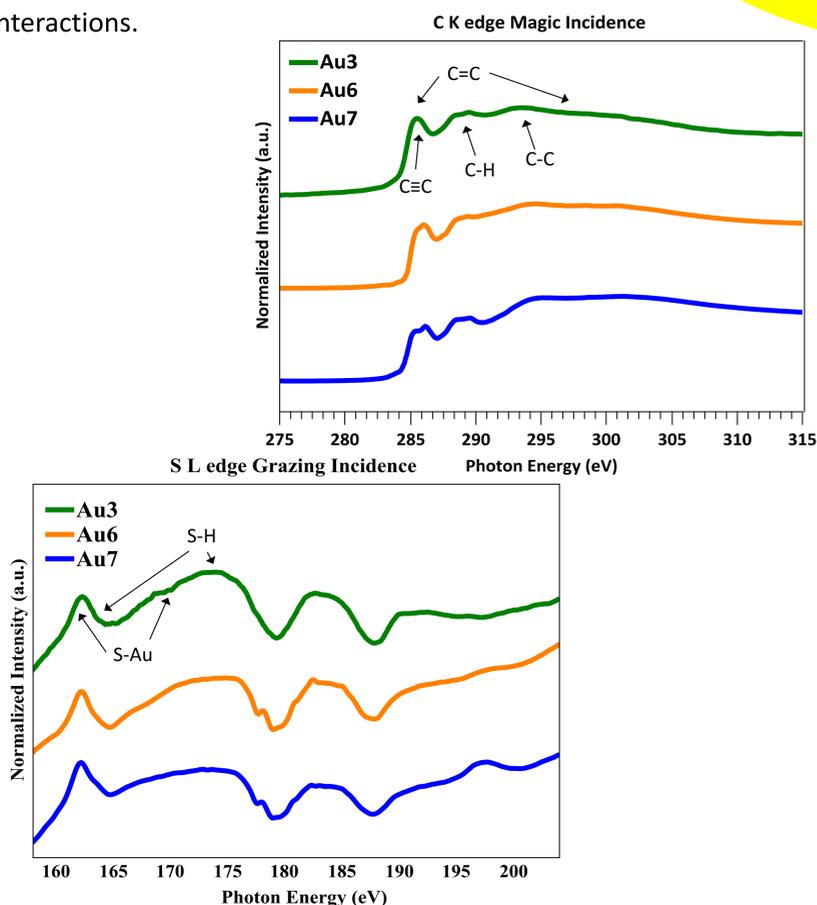
## The synthesis

### and characterization of gold nanoparticle network interconnected by rod-like organometallic dithiols (*trans,trans*-[dithiodibis(tributylphosphine)diplatinum(II)-4,4'-diethynyl biphenyl]))

RS-AuNPs (R=CH<sub>3</sub>COS-(PtDEBP)<sub>n</sub>-) of controlled length has been carried out. The hybrids were characterized by means of synchrotron radiation induced X-ray photoelectron spectroscopy (SR-XPS) and near edge absorption fine structure (NEXAFS). **SR-XPS and NEXAFS measurements allowed the assessment of the anchoring of the organometallic thiols onto gold substrates.**

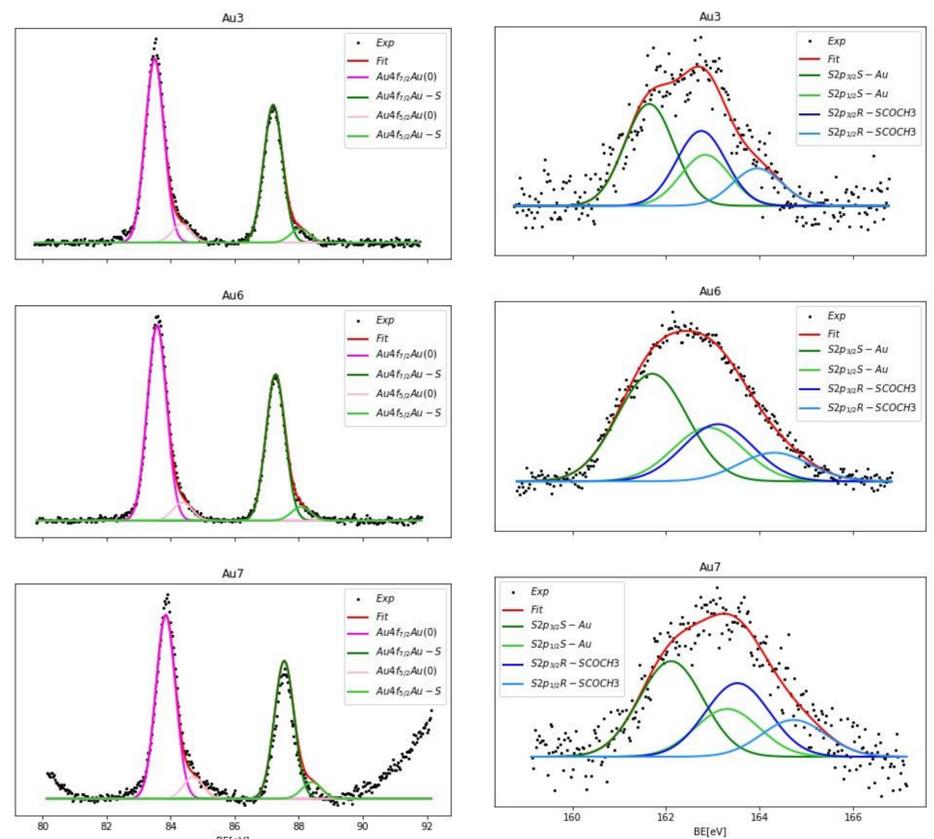
## 4) NEXAFS Results

NEXAFS spectra were performed at the **ELETTRA storage ring at the BEAR beamline (bending magnet for emission absorption and reflectivity)**. The carbon K and sulfur L-edge spectra were collected at normal (90°), grazing (30°) and magic (54.7°) incidence angles of the linearly polarized photon beam with respect to the sample surface. NEXAFS data analysis provide further information about AuNP-thiols interactions.



## 3) SR-XPS Results

SR-XPS experiments were performed at the **BACH (Beamline for Advanced DiChroism) line at the ELETTRA synchrotron facility of Trieste (Italy)**<sup>[5]</sup>. C1s, Au4f, S2p, Pt4f and P2p spectral regions were investigated. SR-XPS measurements allowed the assessment of the covalent attachment of the sulfur atoms as thiolates to the surface of gold.



## References

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 [2] Fratoddi, I.; Venditti, I. et al. *J. Phys. Chem. C* **2011**, 115, 15198. [5] Zangrando, M.; Zacchigna, M. et al. *F. Rev. Sci. Instrum.* **2004**, 75, 31-36.  
 [3] Fratoddi, I.; Battocchio, C. et al. *J. Polym. Sci. A: Polym. Chem.* **2007**, 45, 3311.