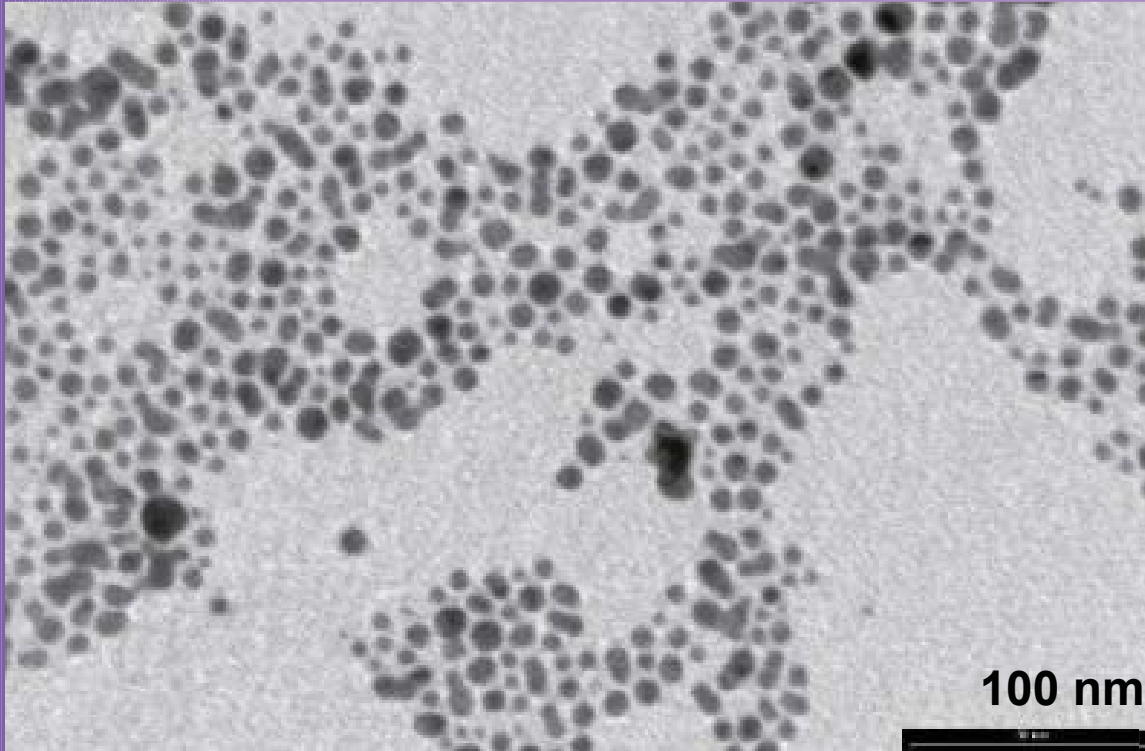


# ***Produzione di Nanoparticelle Metalliche per Applicazioni Ambientali e Biomediche***

**Maurizio Muniz-Miranda**

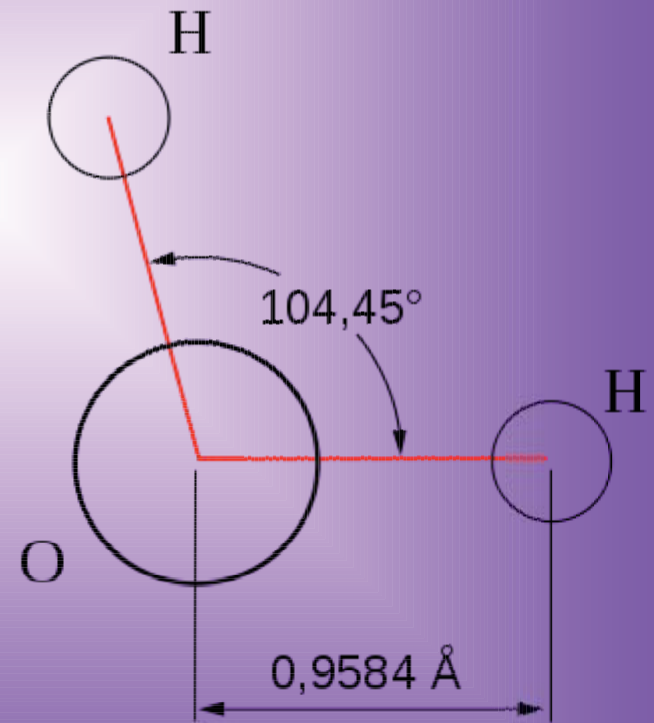
**Dipartimento di Chimica, Università di Firenze  
Via della Lastruccia 3, Sesto Fiorentino (Italy)  
E-mail: [muniz@unifi.it](mailto:muniz@unifi.it)**

# Il mondo a dimensione nanometrica



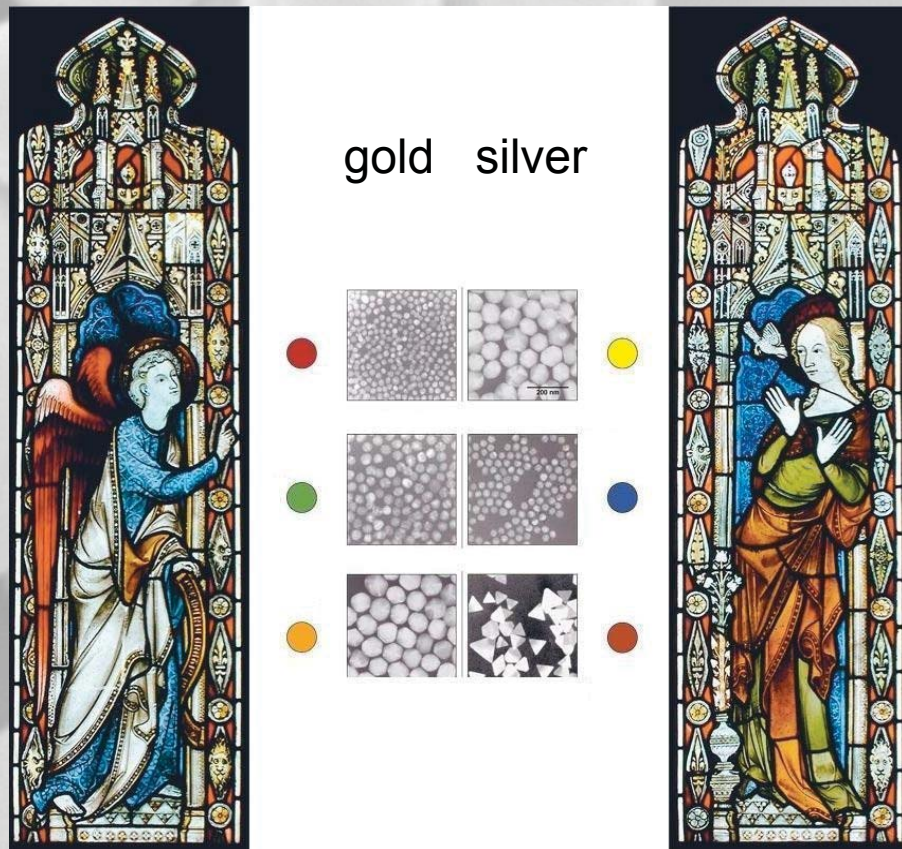
1 nanometro =  $1 / 100.000.000 \text{ m} = 10 \text{ \AA}$

Molecola di acqua,  $\text{H}_2\text{O}$





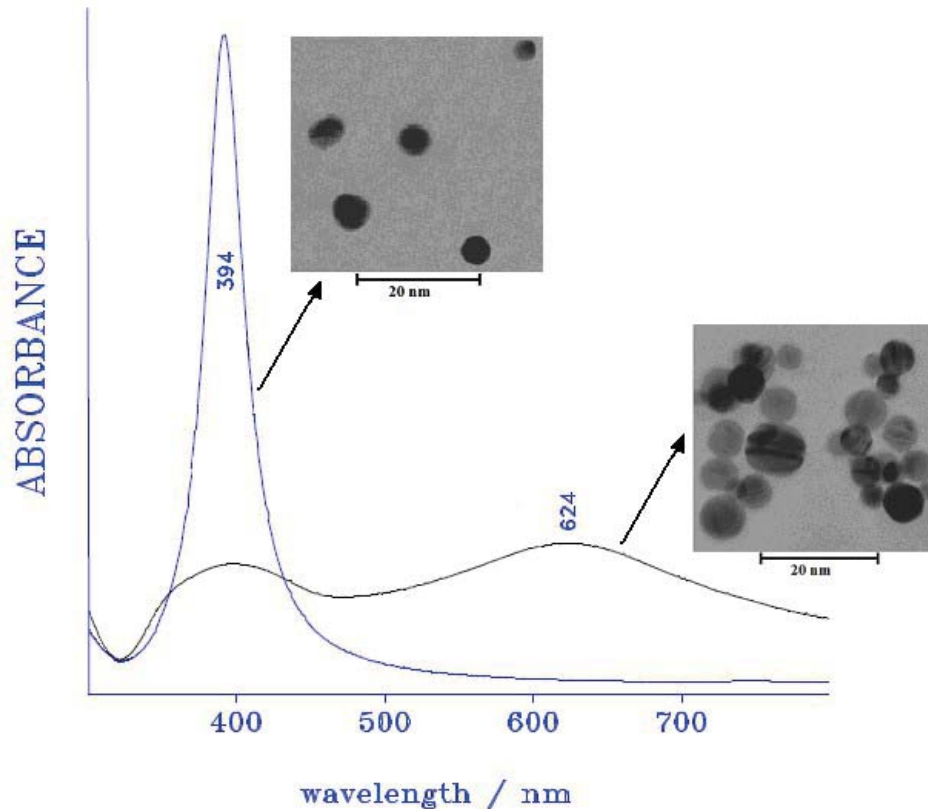
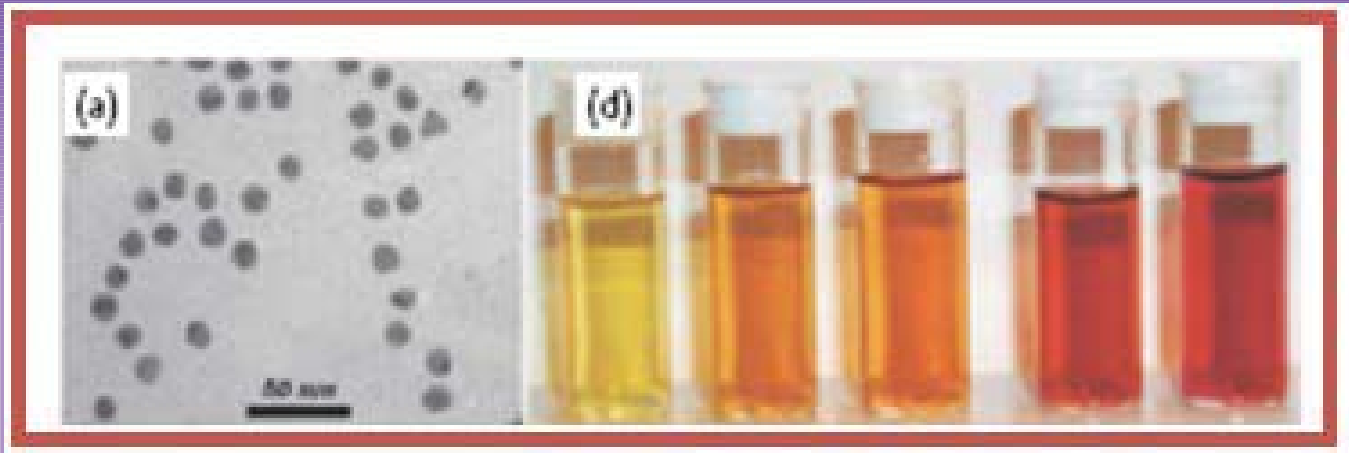
# PLASMONI



Vetrare artistiche

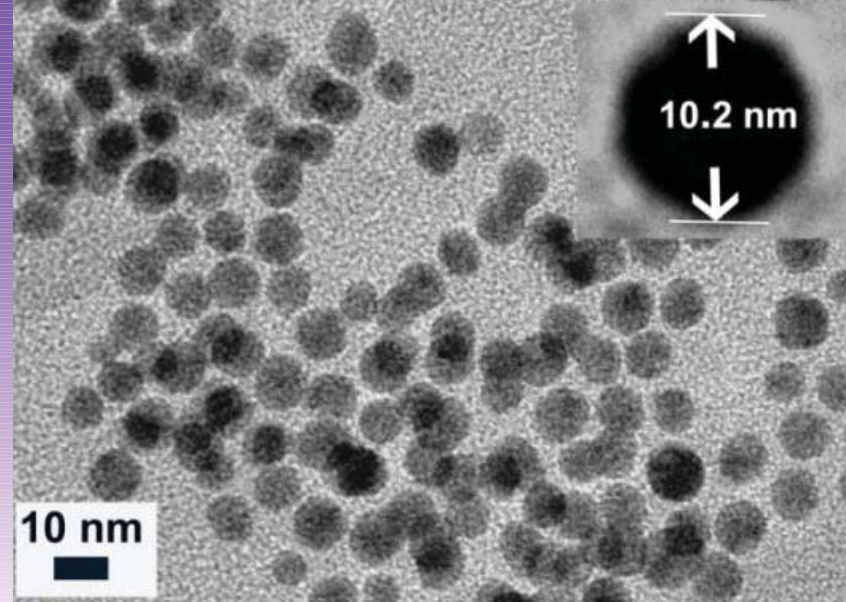
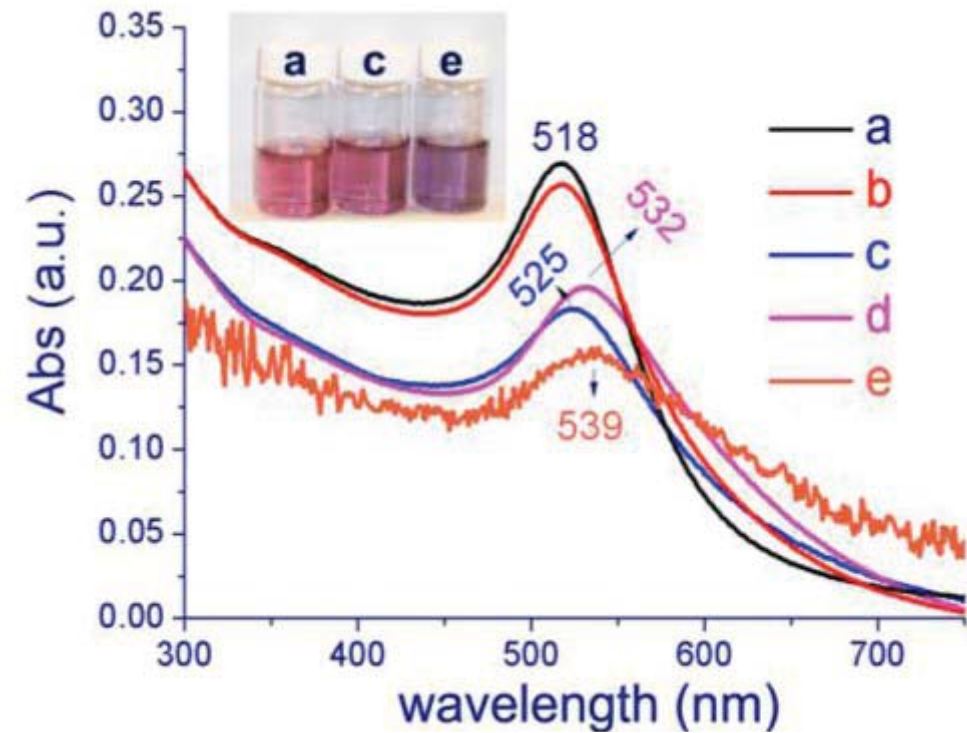


Coppa di Licurgo Arte  
Romana IV secolo D.C.

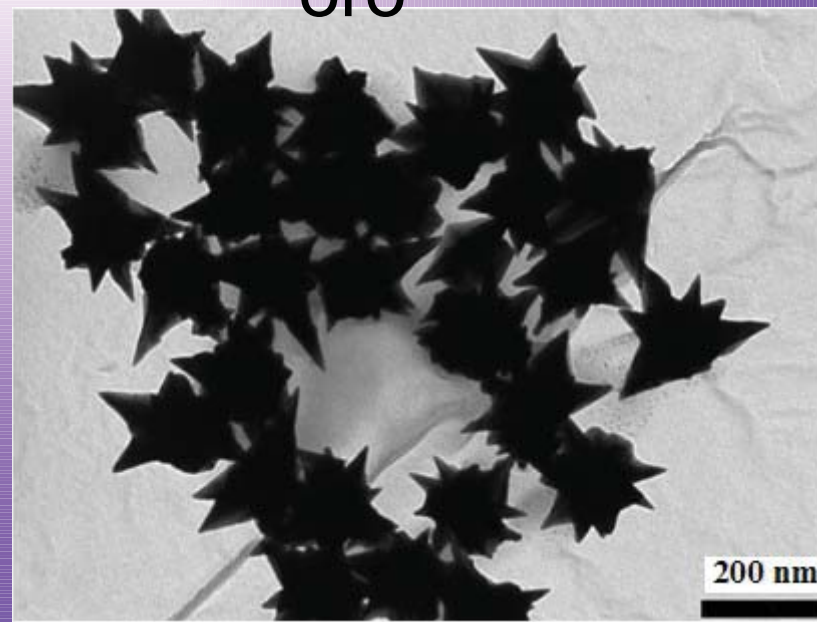
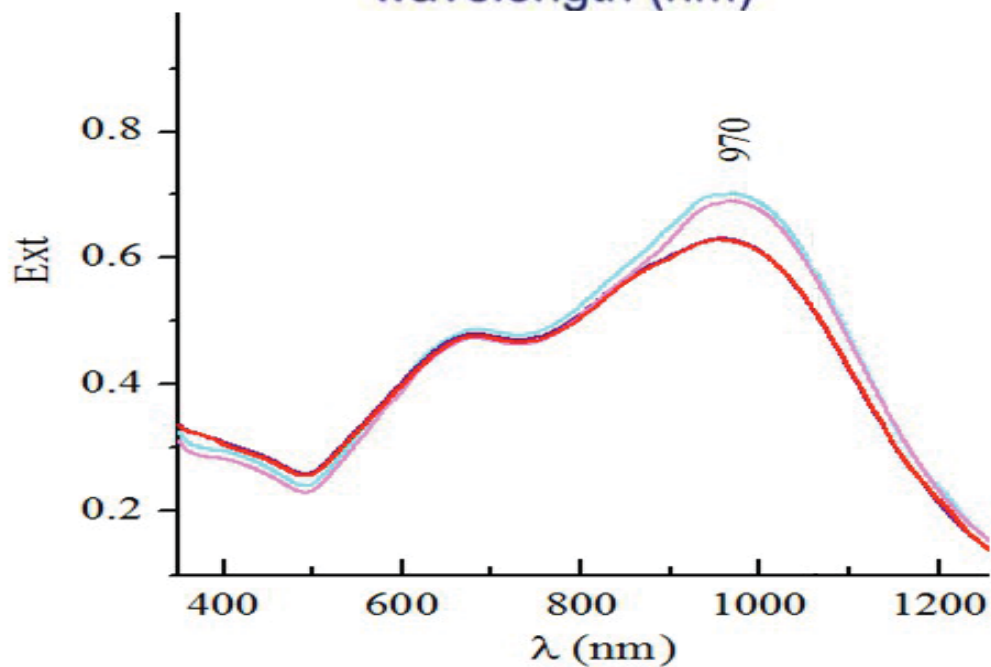


Nanoparticelle  
di argento



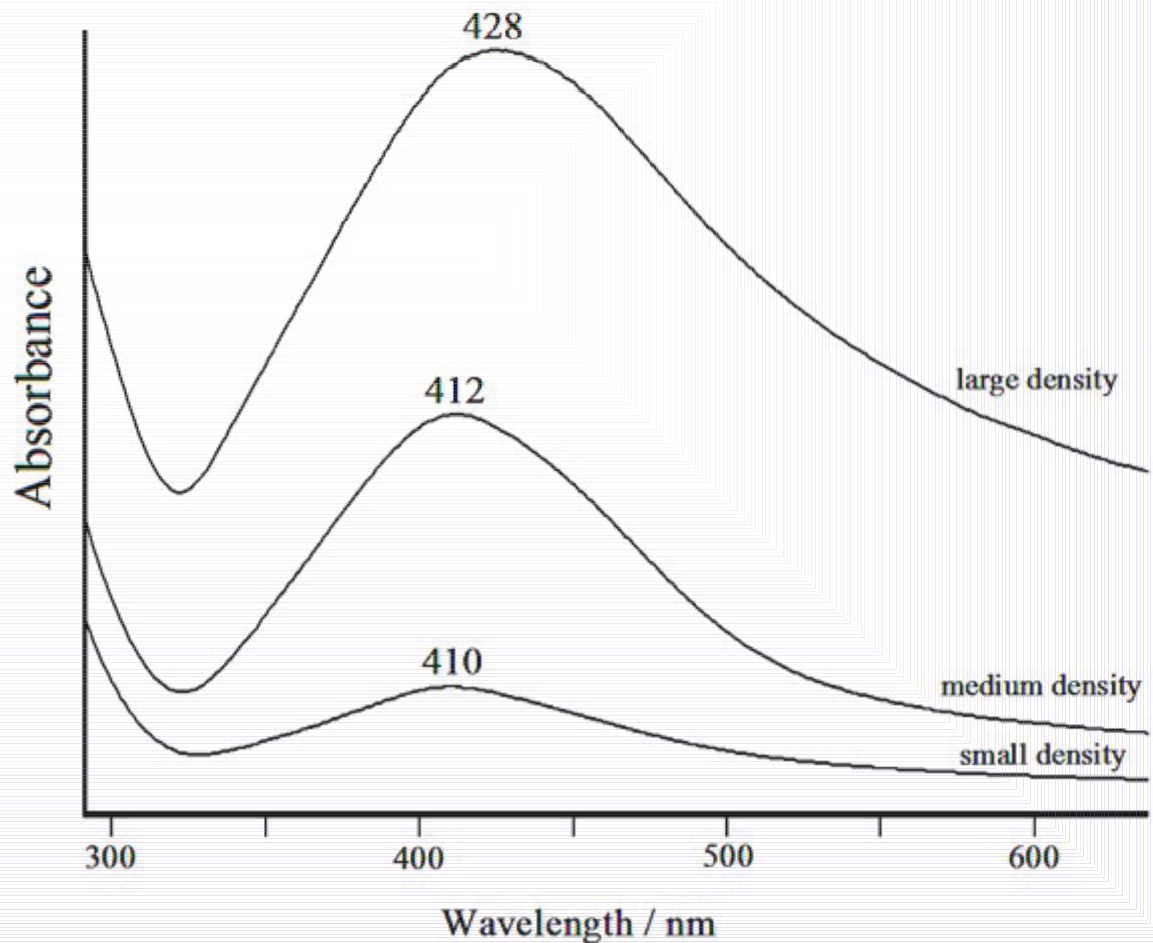
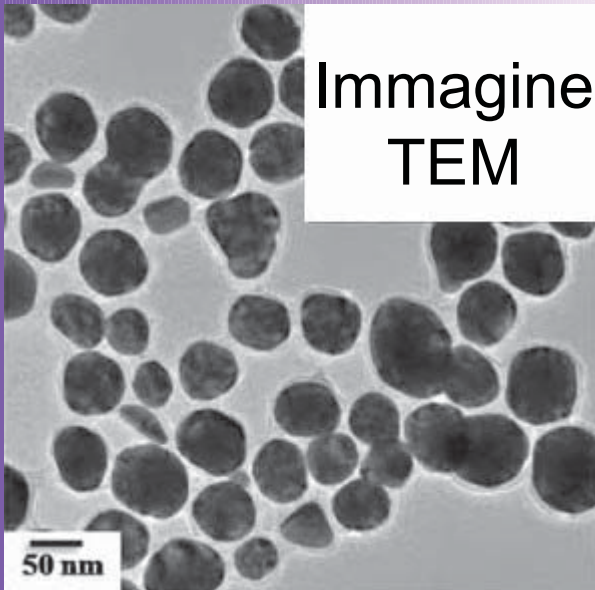


Nanoparticelle di  
oro

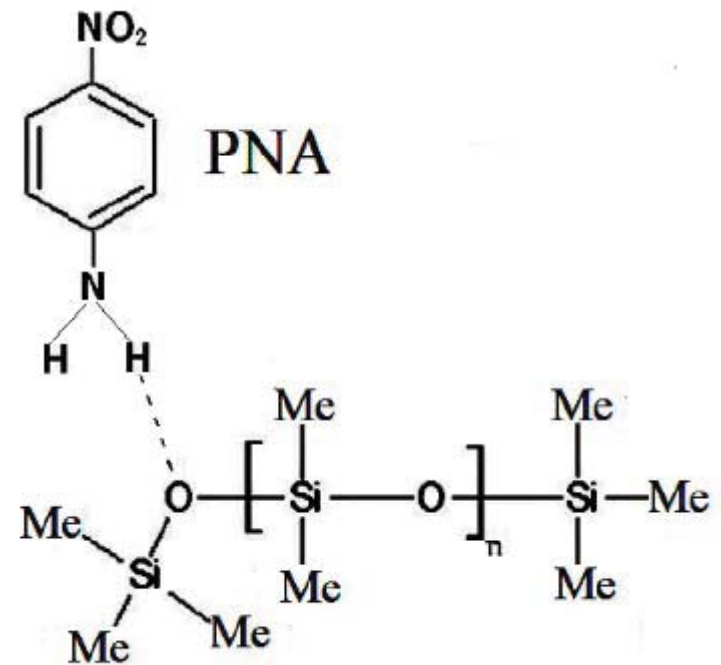
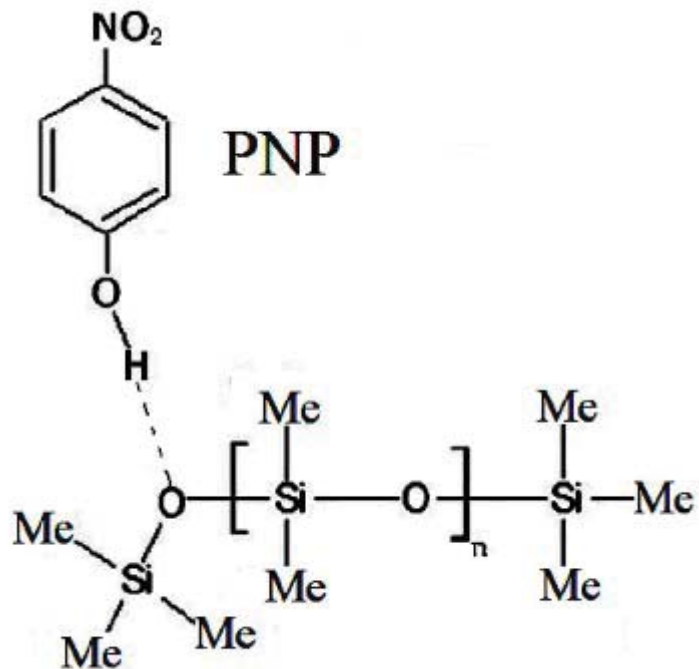


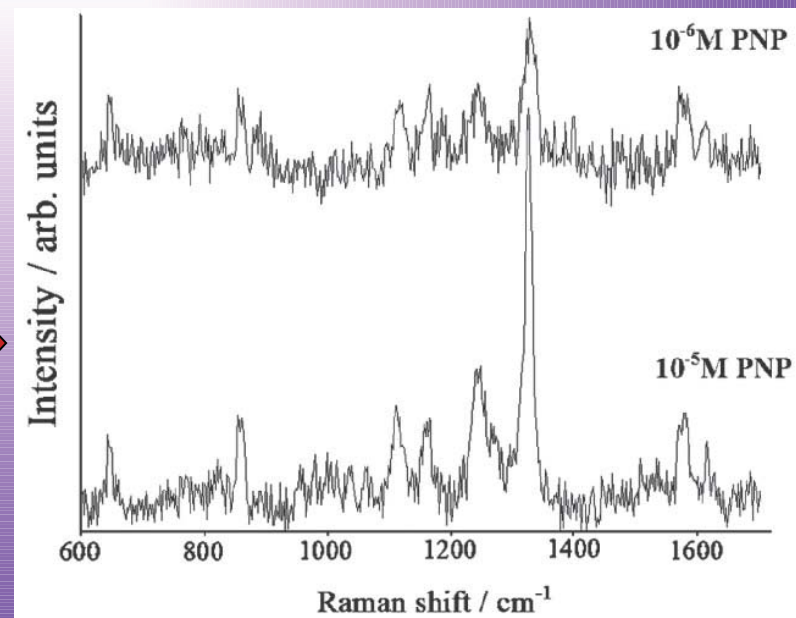
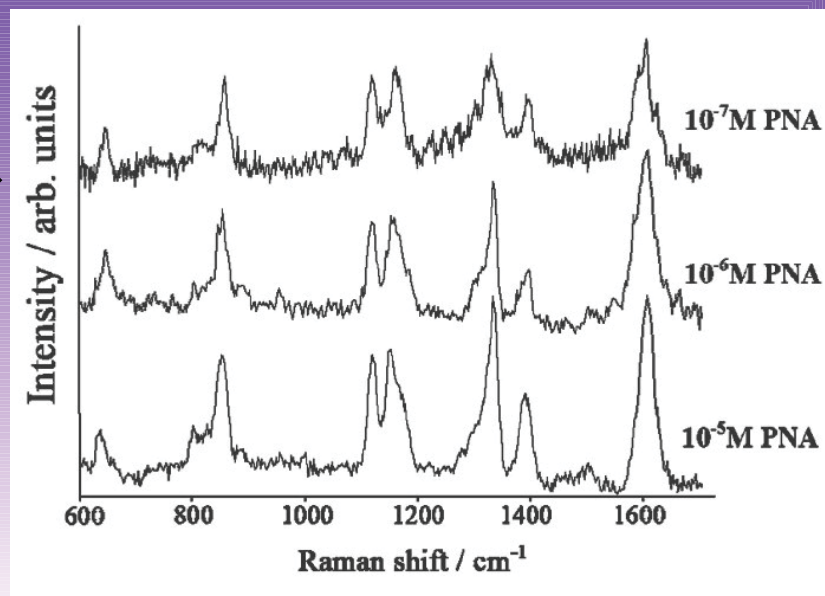
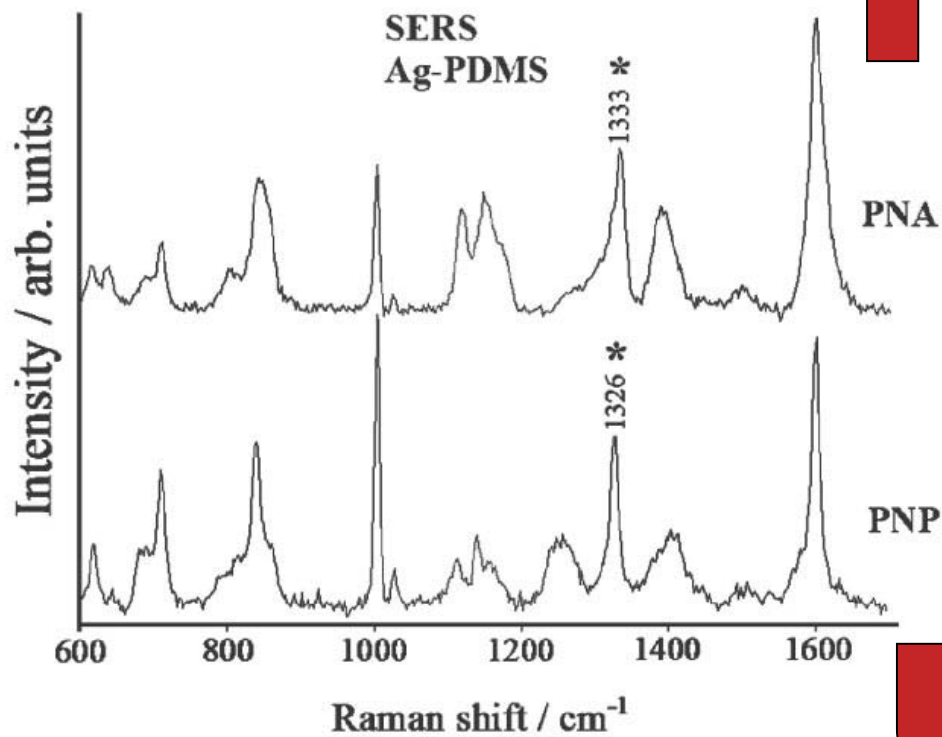
# Nanoparticelle di argento in polisilossano

Immagine TEM



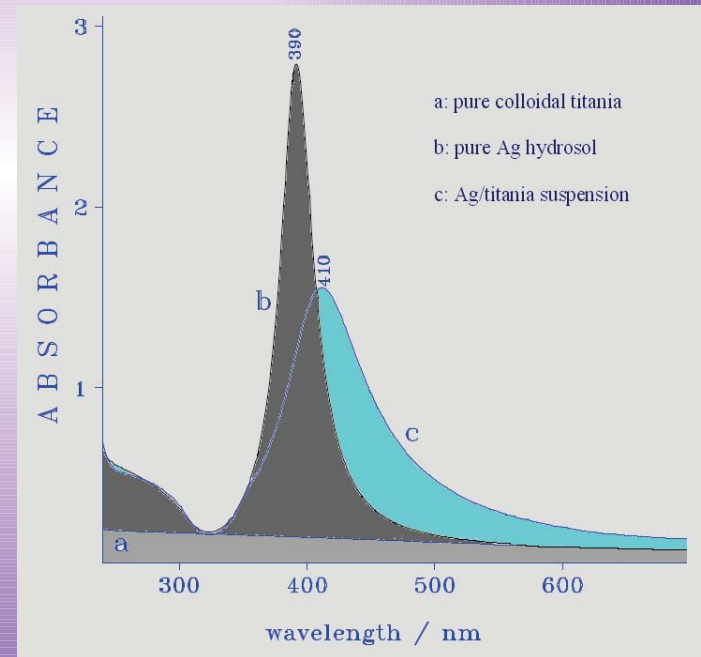
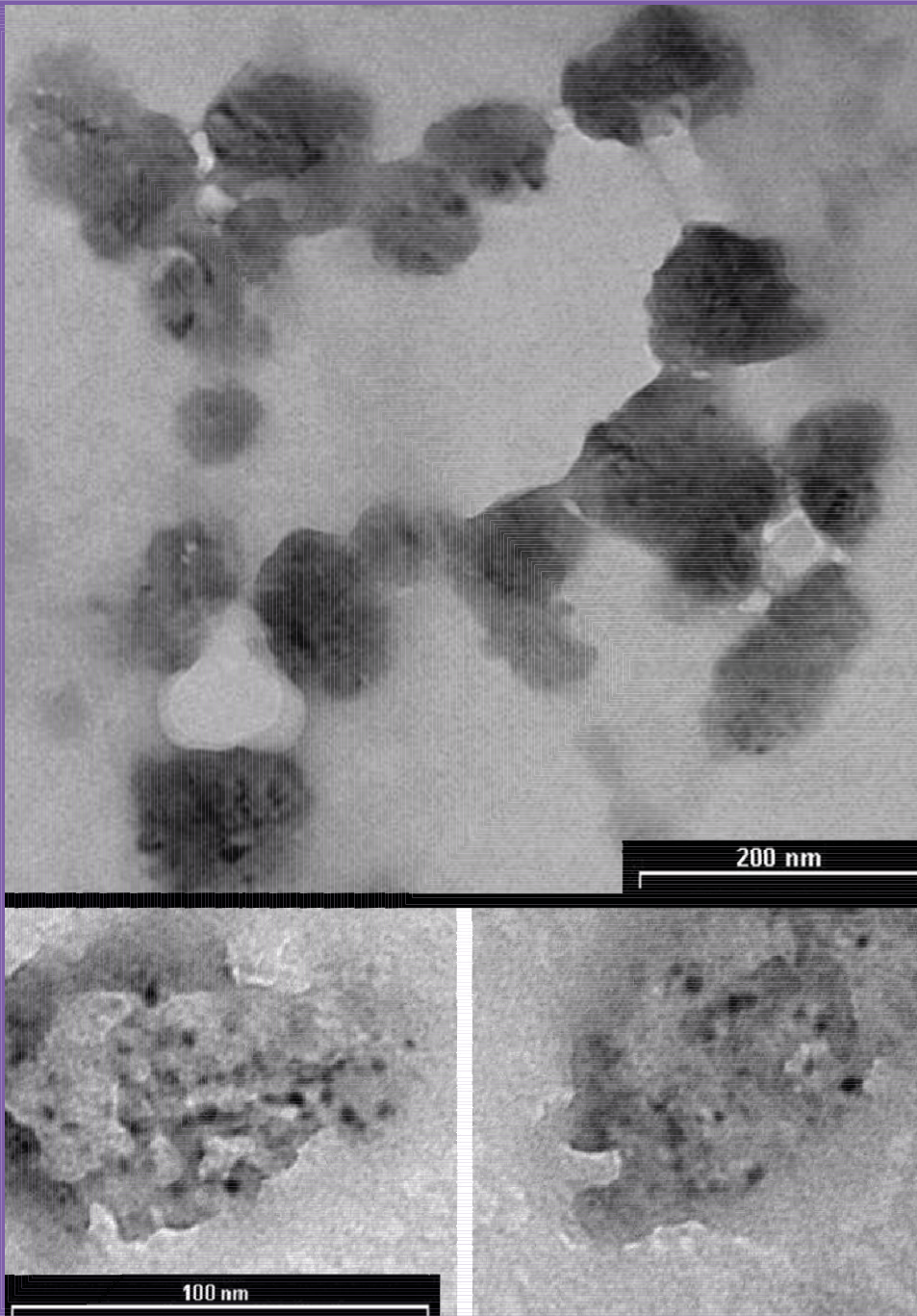
# RICONOSCIMENTO DI INQUINANTI NITRODERIVATI AROMATICI





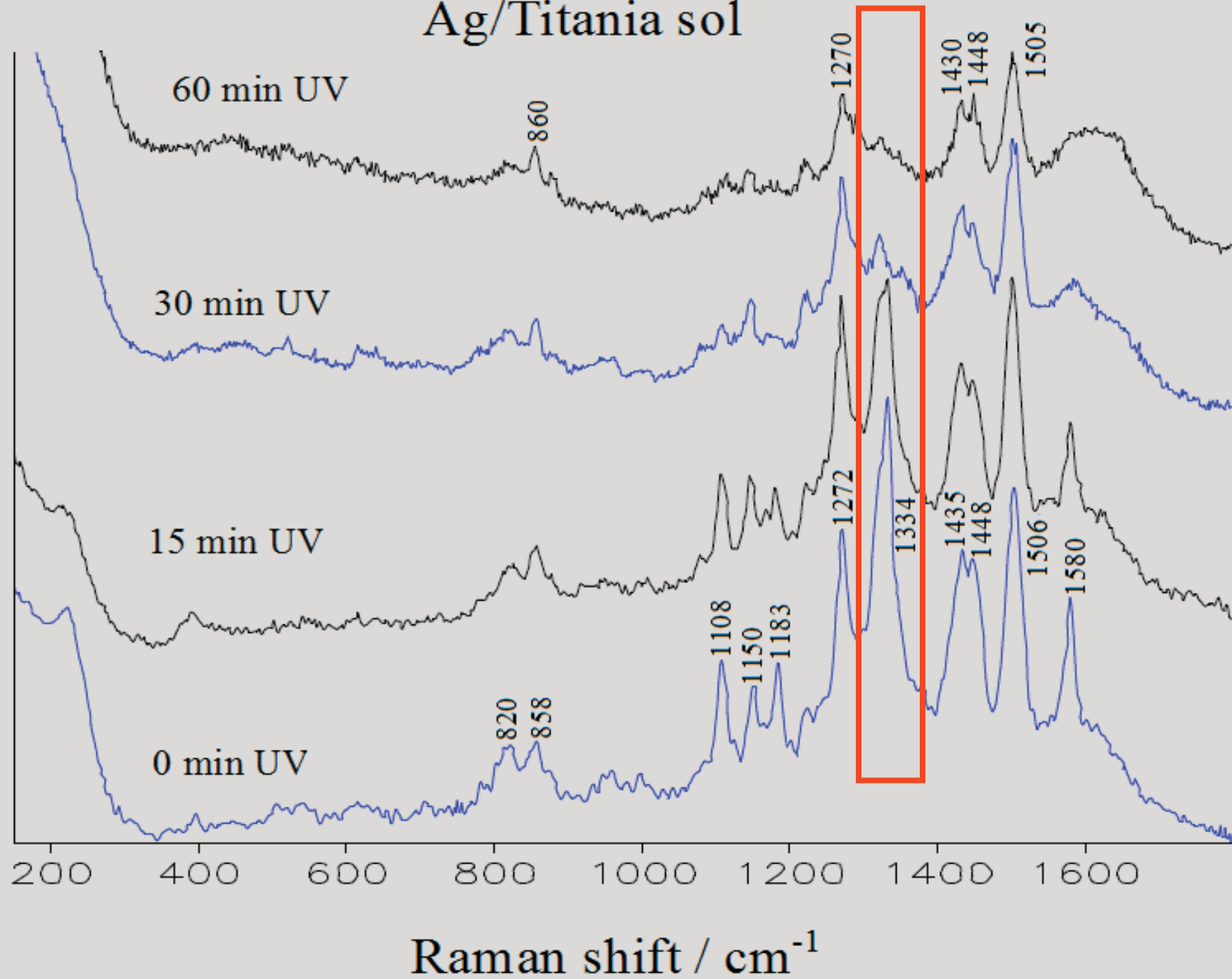


## Ossido di Ti (II) – Titania anatase drogata con nanoparticelle di Ag



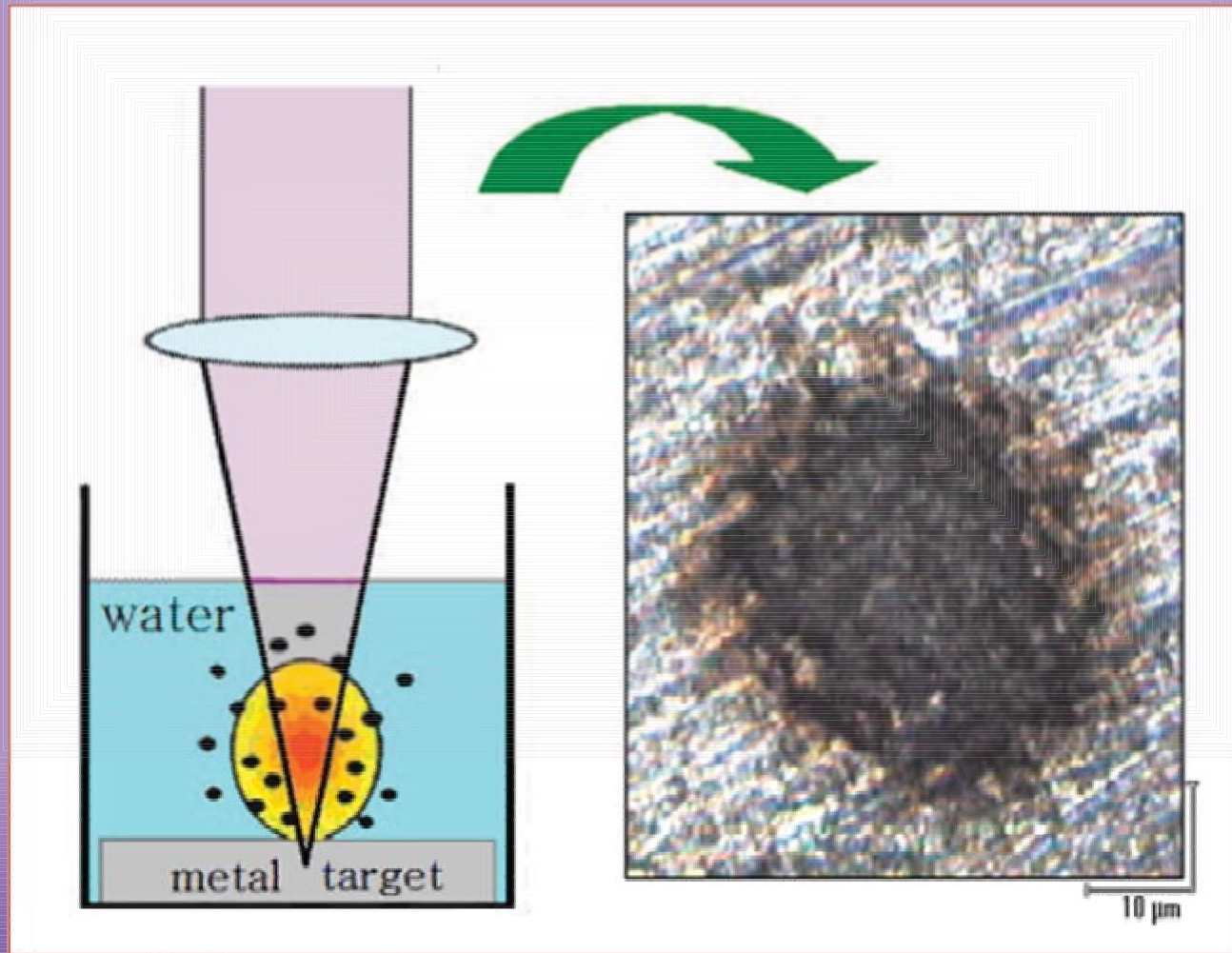
# Ag/Titania sol

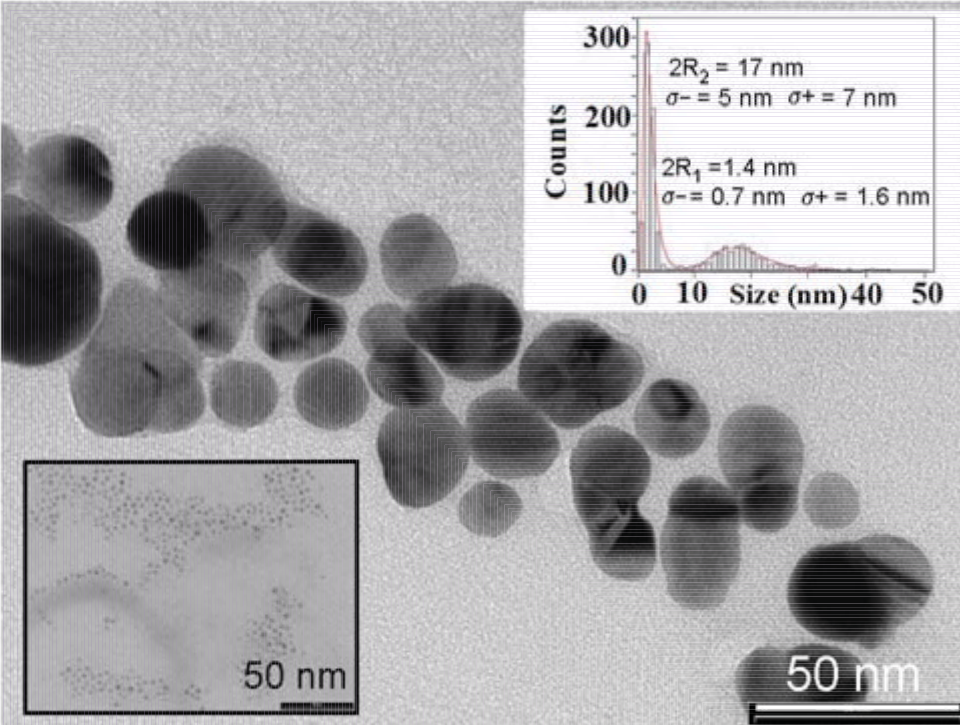
INTENSITY





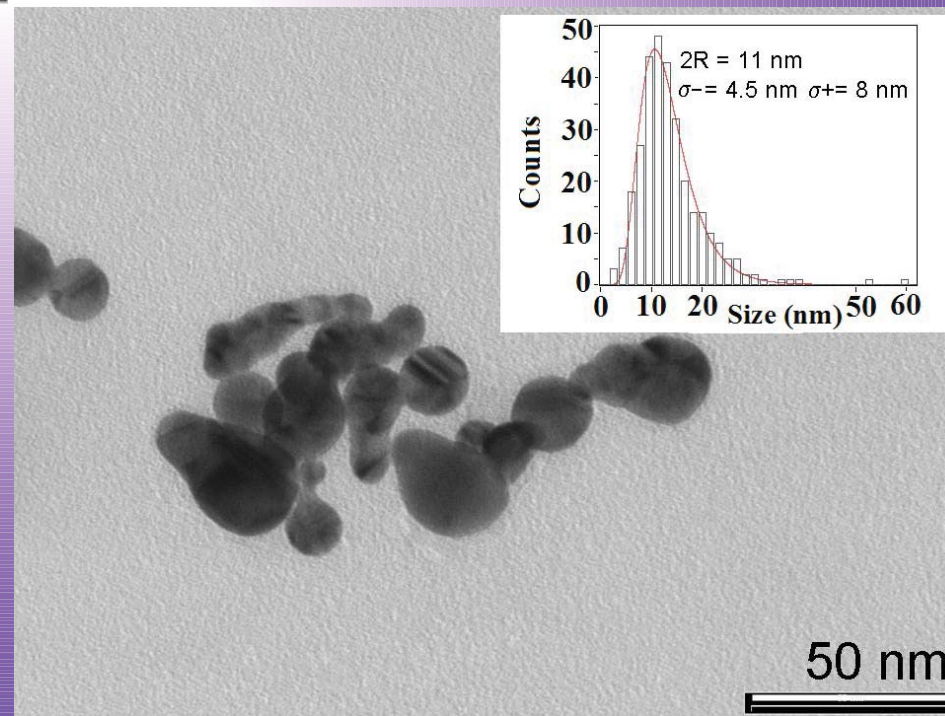
# ABLAZIONE LASER DI TARGET METALLICI IN LIQUIDI DISPERDENTI



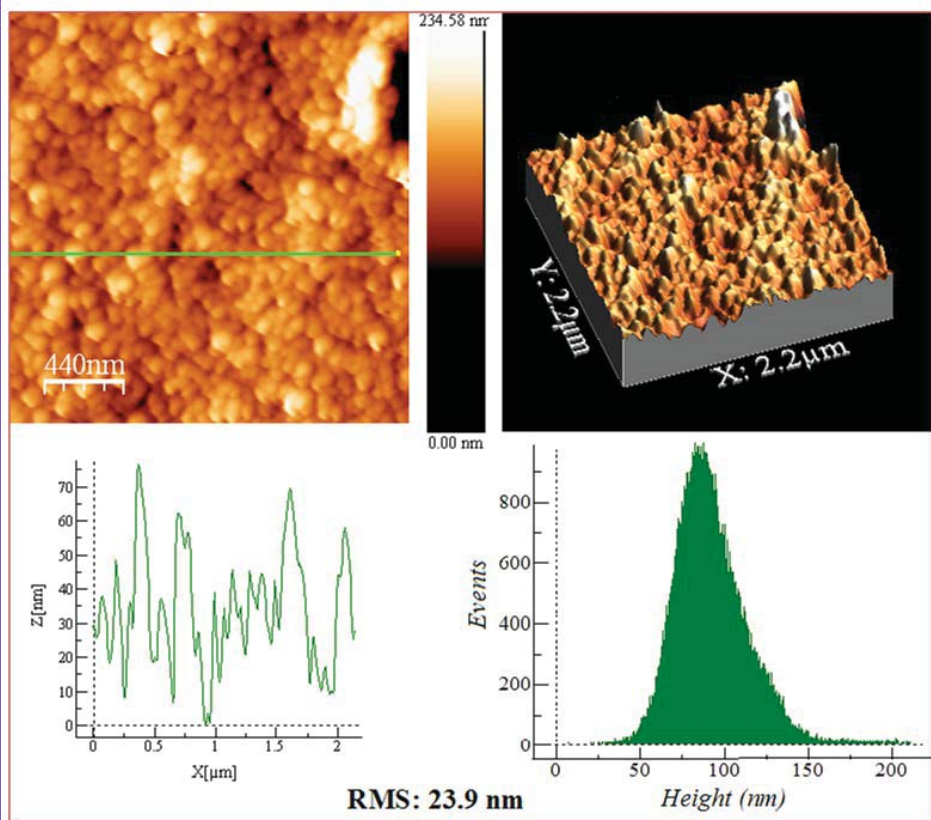


## Nanoparticelle di argento

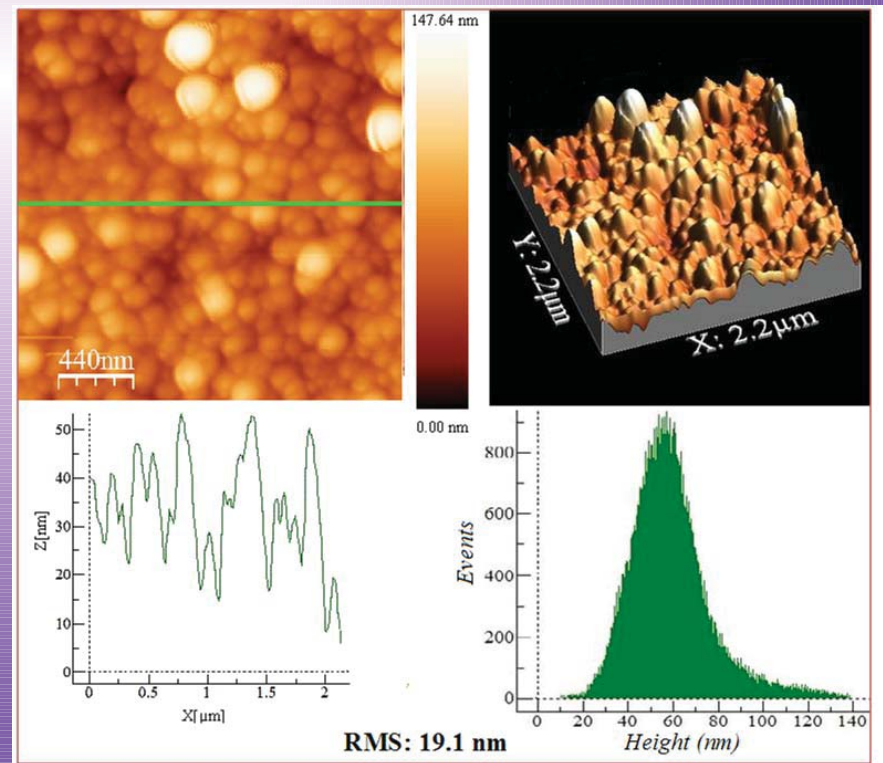
## Nanoparticelle di oro



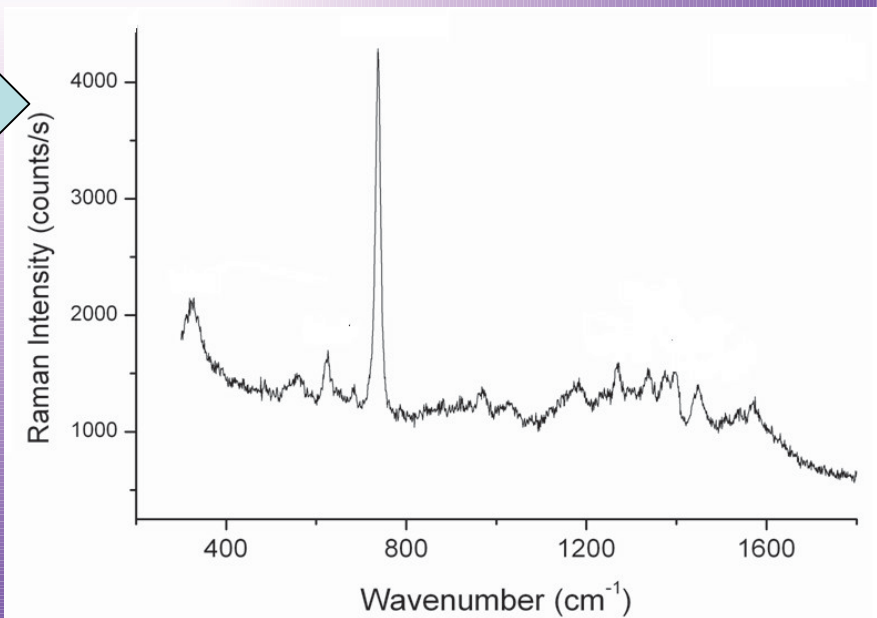
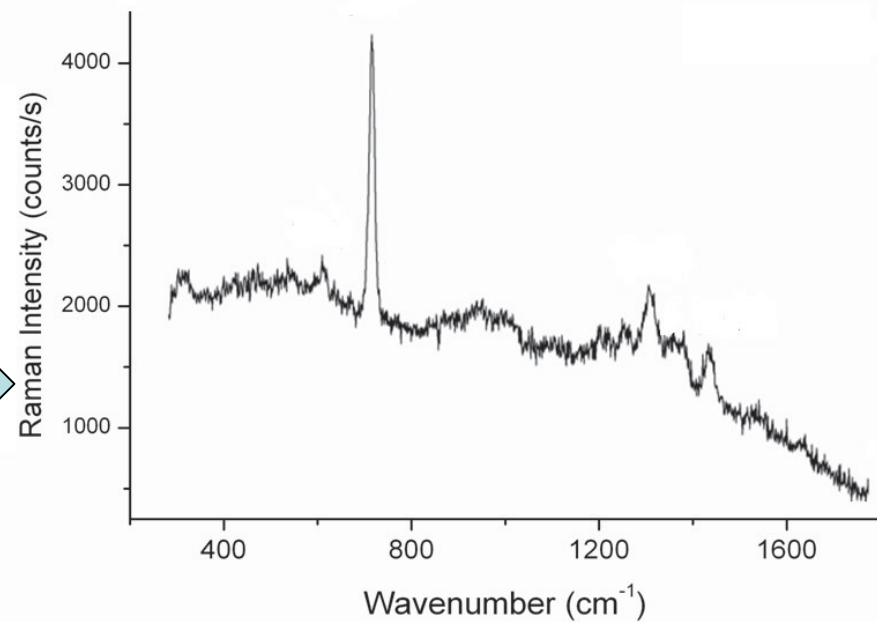
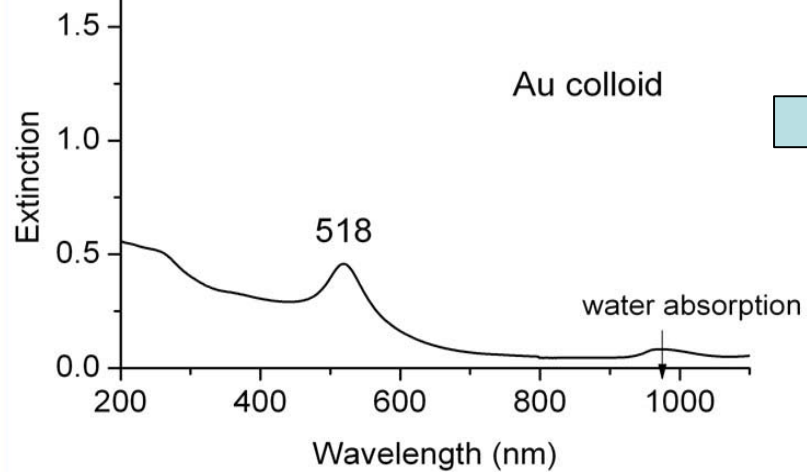
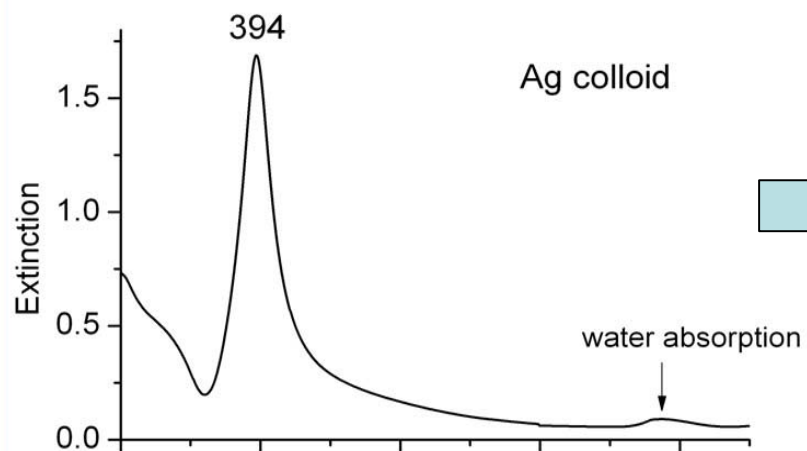
# Nanoparticelle di argento filtrate su allumina



# Nanoparticelle di oro filtrate su allumina







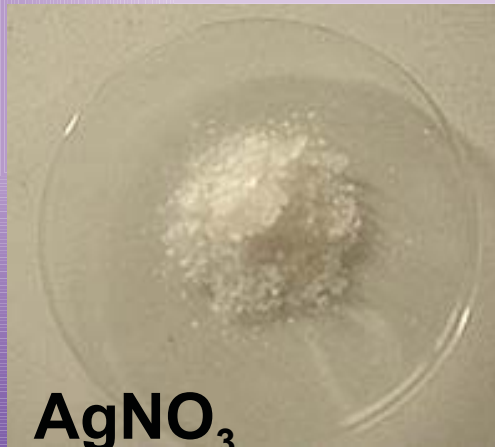


# Argento come agente antimicrobico

Nel XX secolo l'uso dell'argento come antimicrobico diminuisce insieme con la scoperta e sviluppo degli antibiotici



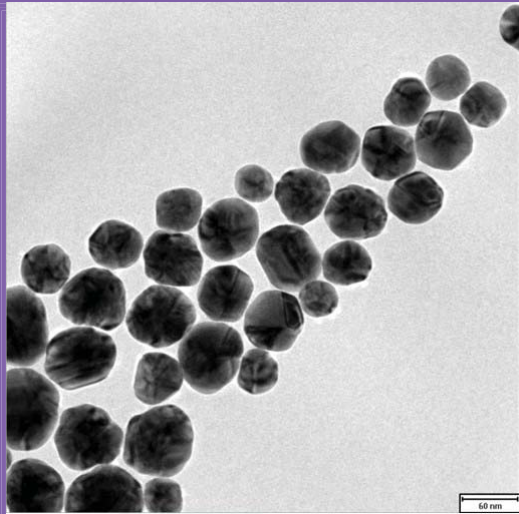
- ✓ L'uso di sali di argento è nocivo
- ✓ per la salute umana



$\text{AgNO}_3$

Argyria





Con l'avvento dei  
nanomateriali ritorna  
l'interesse per  
l'argento sotto forma  
di nanoparticelle

Batteri resistenti agli antibiotici  
Bassa nocività rispetto ai sali di argento  
Bassi costi di produzione

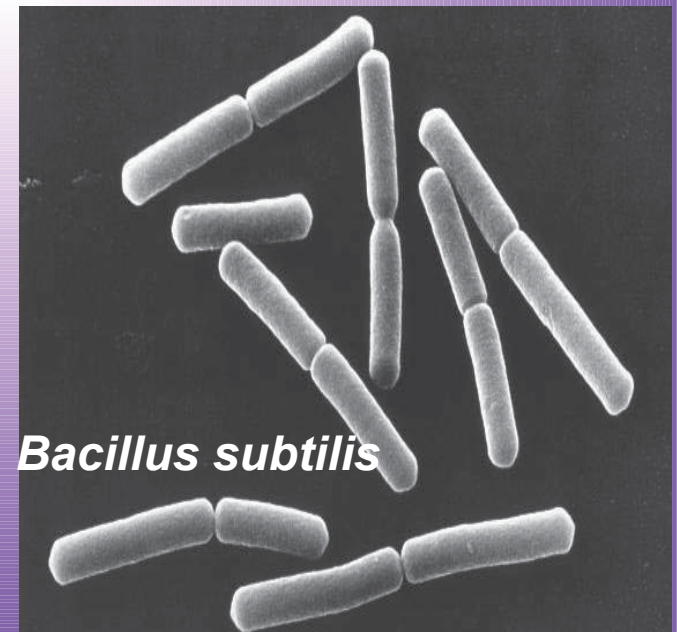


*Escherichia coli*



*Escherichia coli*

Gram-negative



*Bacillus subtilis*

Gram-positivi

## Valori MIC e MBC ( $\mu\text{g/ml}$ )

Minimum Inhibitory Concentration (MIC)

Minimum Bactericidal Concentration (MBC)

|                                    | <i>E. coli</i> |       | <i>B. subtilis</i> |            |
|------------------------------------|----------------|-------|--------------------|------------|
|                                    | MIC            | MBC   | MIC                | MBC        |
| <i>Np</i>                          | 1.2            | 1.6   | $\leq 1.2$         | $\leq 1.2$ |
| <i>Penicillin G</i>                | 50.0           | 50.0  | 50.0               | 75.0       |
| <i>Ampicillin</i>                  | 14.5           | 14.5  | 50.0               | 75.0       |
| <i>Gutarowska<br/>et al., 2012</i> | 11.3           | 22.5  | 22.5               | >45.0      |
| <i>Egger et al.,<br/>2009</i>      | 62.5           | 125.0 | 250.0*             | 500.0*     |

\**Bacillus cereus*



***Grazie per  
l'attenzione***

# Produzione di nanoparticelle metalliche per applicazioni sensoristiche e catalitiche

**M. Muniz-Miranda – Università di Firenze**

info @ 0554573091 muniz@unifi.it

Preparazione, per sintesi chimica,  
irraggiamento e ablazione laser, di:

**Nanoparticelle metalliche:** Ag, Au, Cu, Pd, Ni, Ti

**Nanoparticelle bimetalliche:** Ag@Au, Ag@Cu, Au@Cu,

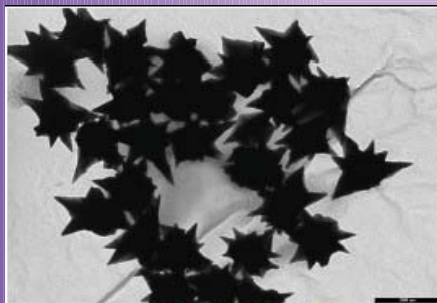
Ag@Pd, Au@Pd, Ag@Ni, Ag@Ti

**Nanocompositi:** Ag@SiO<sub>2</sub>, Ag@TiO<sub>2</sub>

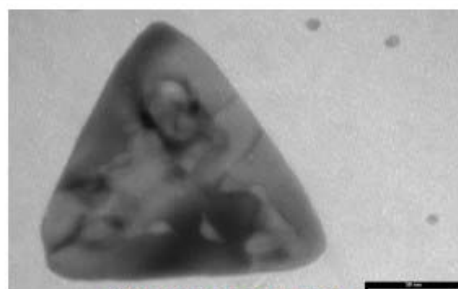
**Nanostelle e nanoprismi di oro e argento**

**Applicazioni sensoristiche mediante spettroscopia SERS**  
(**surface enhanced Raman scattering**): riconoscimento  
inquinanti;  
identificazione oligopeptidi e microRNA

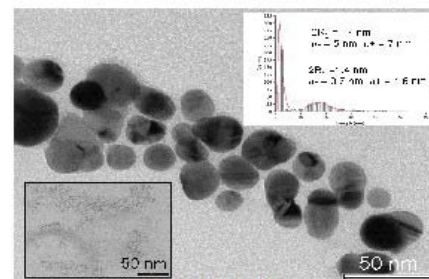
**Applicazioni catalitiche delle nanoparticelle metalliche,**  
**mediante rivelazione SERS:**  
reazioni di nitro-derivati in azo- e amino-derivati\_



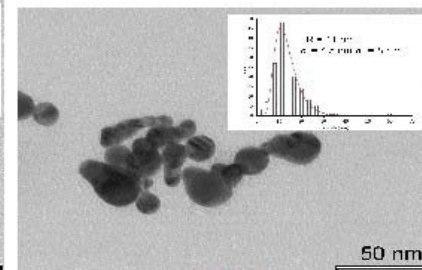
NANOSTELLE DI ORO



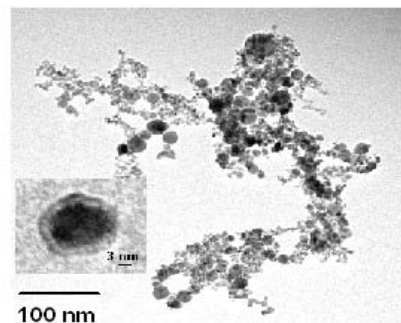
NANOPRISMI DI ARGENTO



ARGENTO

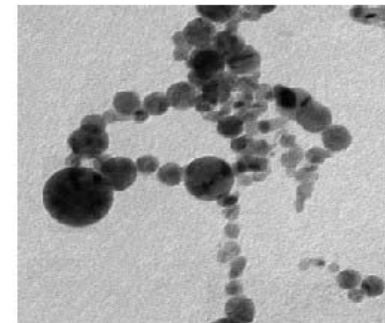


ORO

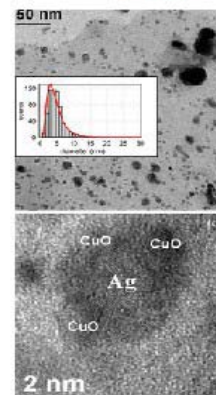


100 nm

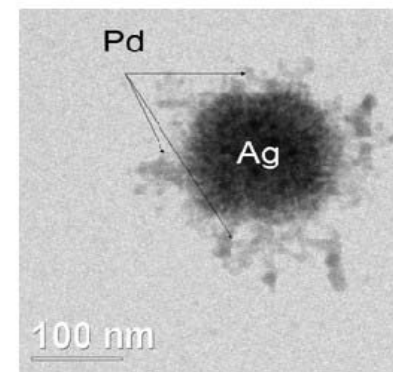
RAME



PALLADIO



ARGENTO@RAME



ARGENTO@PALLADIO