Multimode assembly of phenanthroline nanowires decorated with gold nanoparticles

Marek Grzelczak,[a] Niksa Kulisic,[a,b,c] Maurizio Prato[a]* and Aurelio Mateo-Alonso[b,c]*

[a] *Center of Excellence on Nanostructured Materials, (CENMAT), and INSTM, unit of Trieste, Dipartimento di Scienze Farmaceutiche, Università degli Studi di Trieste, Piazzale Europa 1, 34127 Trieste, Italy, E-mail: prato@units.it*
[b] *Freiburg Institute for Advanced Studies (FRIAS), School of Soft Matter Research, Albert-Ludwigs-Universität Freiburg, Albertstrasse 19, D-79104 Freiburg i. Brsg., Germany, E-mail amateo@frias.uni-freiburg.de*
[c] *Institut für Organische Chemie und Biochemie, Albert-Ludwigs-Universität Freiburg, Albertstrasse 21, D-79104 Freiburg i. Brsg. ,Germany, E-mail amateo@frias.uni-freiburg.de*

Experimental Section

Phenanthroline **1** was prepared according to: P. Lincoln, A. Broo and B. Norden, *J. Am. Chem. Soc.*, 1996, **118**, 2644-2653.

S-NWs. Water (2.5 mL) was added under vigorous magnetic stirring to a solution of **1** in MeOH (2.5 mL, 0.125 mM) at room temperature. Magnetic stirring was stopped after 5 min, and the solution was kept steady for 1 h to form yellow precipitate.

L-NWs. A solution of **1** in MeOH (1 mL, 0.625 mM) was heated up to 60 ºC for 5 min and cooled to to 20 ºC. Water (9 mL) was added under vigorous stirring. After 1h of incubation, the resulting dispersion was centrifuged (9000 rpm, 60 min) the supernatant was decanted and the solid residue was redispersed in water (10 mL). This solution was later used as stock for preparation of Au@L-NWs.

Au@S-NWs. An aqueous solutions of AuNPs (2.5 mL; either 0.9, 2.5, or 4.8 nM) was added under vigorous magnetic stirring to a solution of **1** in MeOH (2.5 ml, 0.125 mM). The resulting dispersion was centrifuged (4000 rpm, 20 min), the supernatant was decanted and the solid residue was redispersed in water (5 mL).

Au@L-NWs. The above-mentioned aqueous stock solution of L-NWs (2.5 mL) was added under magnetic stirring to an aqueous solution of AuNPs (either 0.5, 1, or 4 mL; 5nM). After 10 minutes of incubation (no stirring), the dispersions were centrifuged (9000 rpm, 10 min), the supernatant was decanted, and the solid residue and redispersed in 5 mL of water.

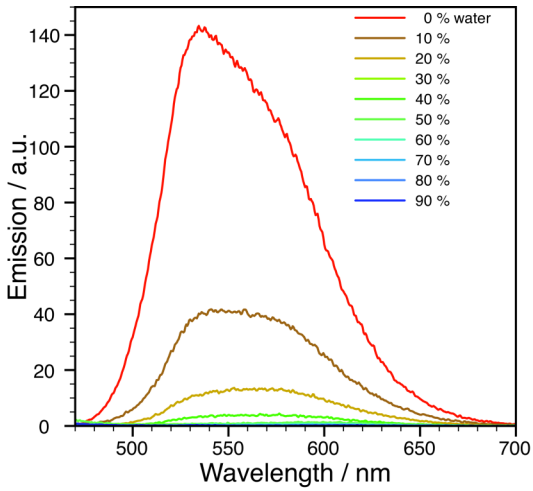

Figure S1. Emission spectra of the wires in different H_2O/MeOH volume ratios.

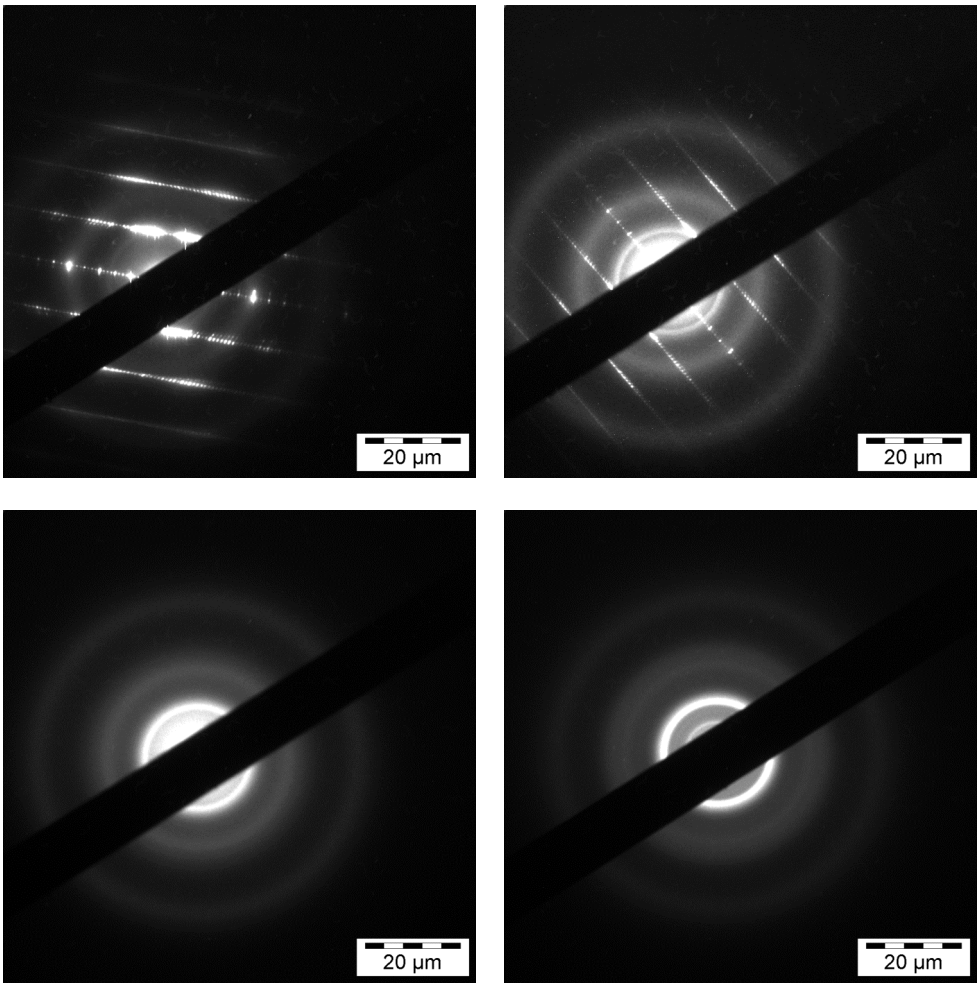

Figure S2. SAED measurements of areas containing **L-NWs** (90% H_2O v/v) (top-left), (b) **S-NWs** and **L-NWs** (90% H_2O v/v) (top-right), **S-NWs** (90% H_2O v/v) (bottom-left), and **S-NWs** (50% H_2O v/v) (bottom-right).

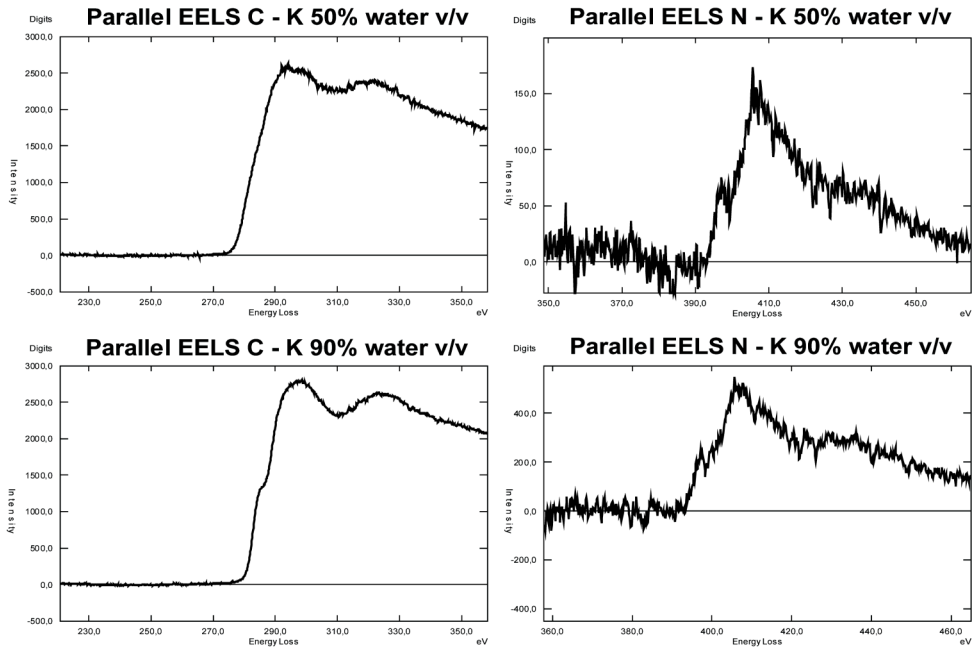

Figure S3. EELS spectra of **S-NWs** (Top) and **L-NWs** (Bottom) displaying the C and N signals.

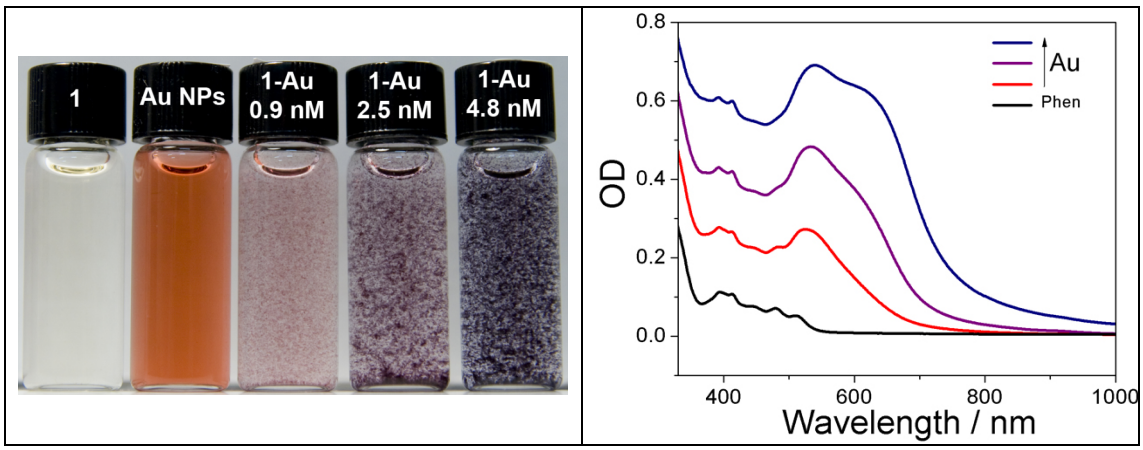

Figure S4. NP Concentration dependence studies on H_2O/MeOH 50% v/v mixtures. NP solutions with different concentrations (0.9, 2.5, and 4.8 nM in H_2O) were mixed with equal volumes of a solution of **1** (125 μM in MeOH) (**Au@S-NWs**).

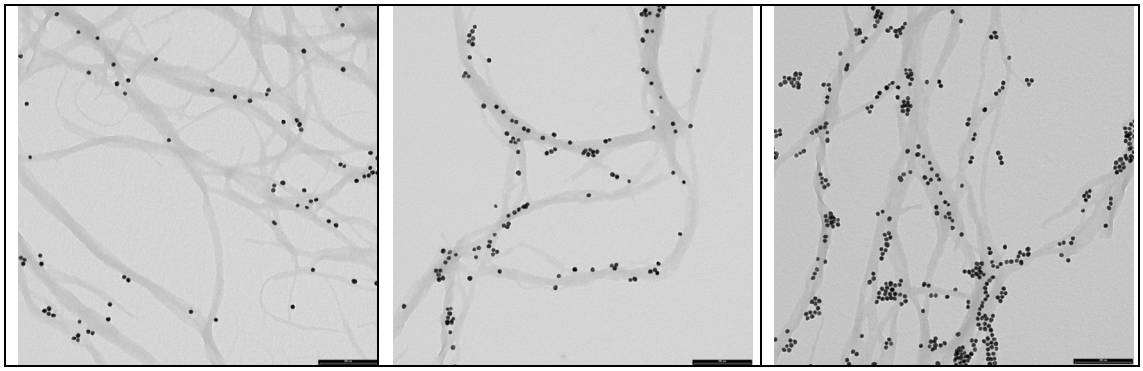

Figure S5. TEM micrographs of the dispersions shown in figure S4 (**Au@S-NWs**) with increasing NP concentration from left to right.

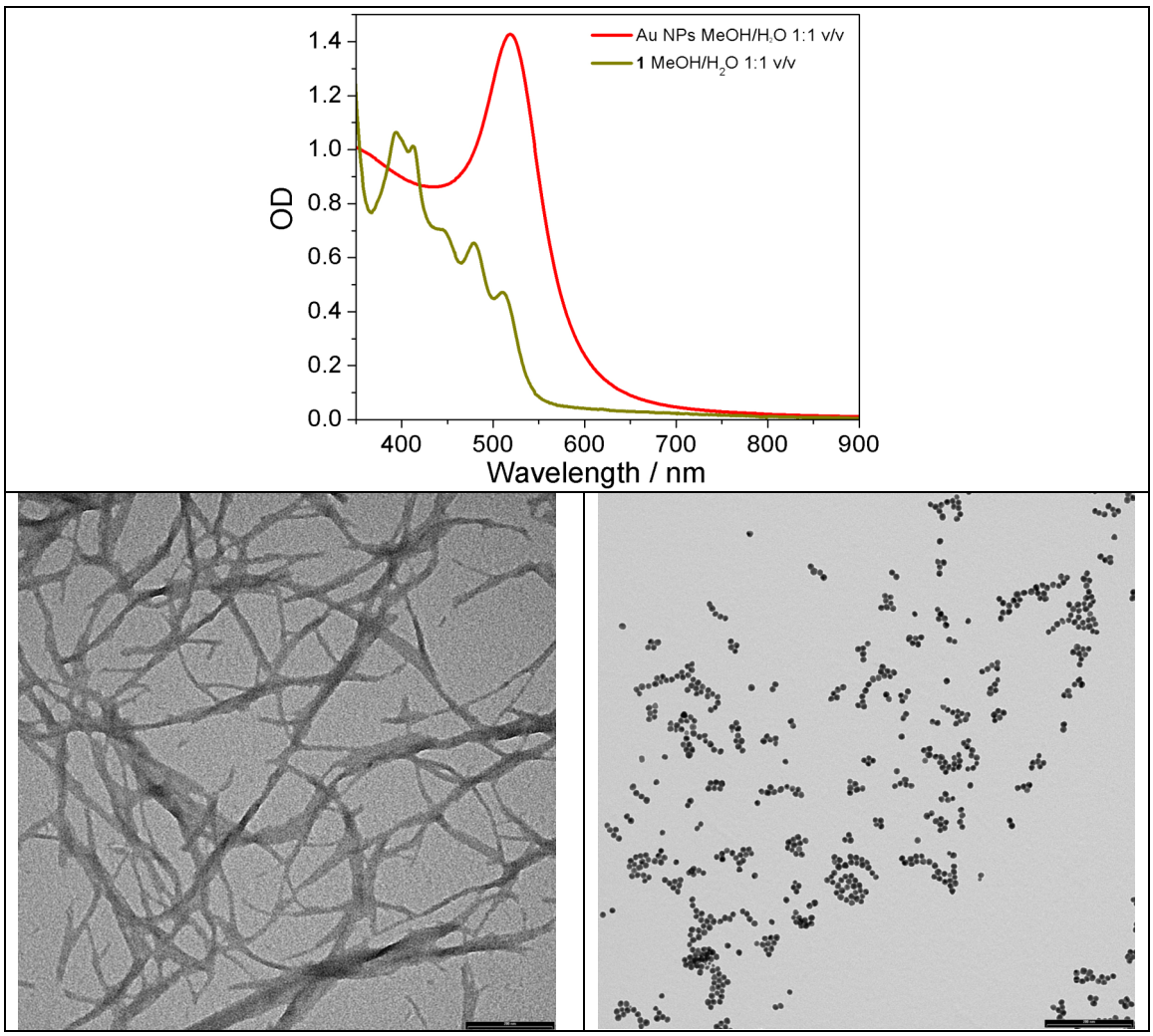

Figure S6. UV-vis spectra of both control tests displaying only NPs and phenanthroline (top). TEM micrographs of methanolic solution of **1** mixed with water 1:1 v/v in the absence of NPs (bottom left). Au NPs aqueous solution mixed with methanol 1:1 v/v (bottom right).

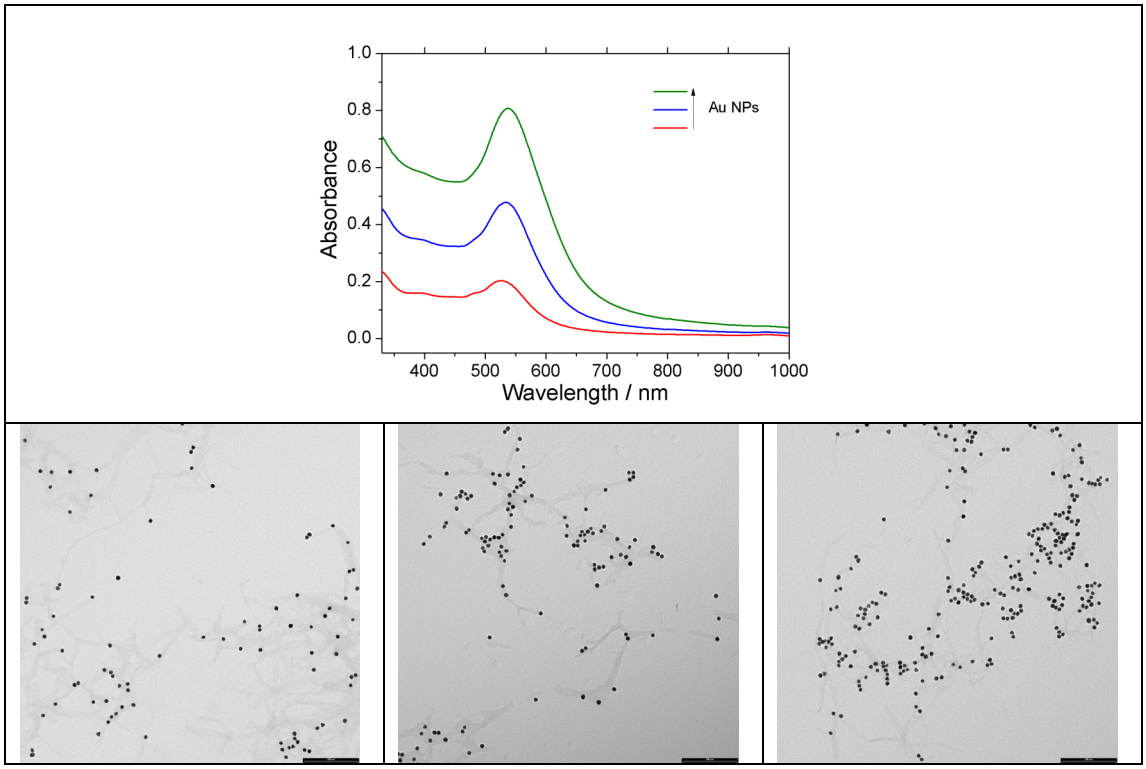

Figure S7. UV-vis spectra (top) and TEM (bottom) of NP solutions (0.5, 1.4, 2.5 nM in H_2O) mixed with a solution of **1** (500 µM in MeOH) in 1:9 v/v H_2O v/v (**Au@S-NWs**).

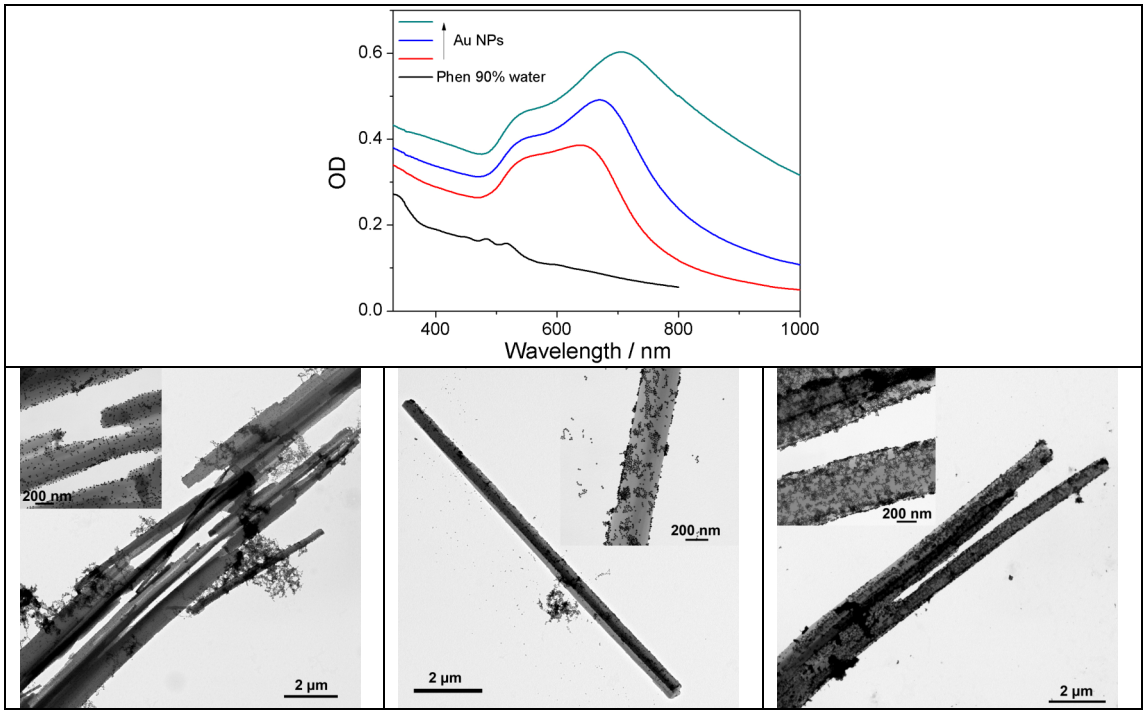

Figure S8. UV-vis (top) and TEM (bottom) of solutions of increasing volumes of a NP solution (5 nM in H_2O) and large NWs (50 µM in H_2O) in 1:5, 1:1 and 8:2 v/v (**Au@L-NWs**).