Supplementary Material (ESI) for Soft Matter

Supporting information

CONTROLLED GROWTH OF SILVER NANOPARTICLE ARRAYS GUIDED BY A SELF-ASSEMBLED POLYMER-PEPTIDE CONJUGATE

Isabel Díez, Harald Hahn, Olli Ikkala, Hans G. Börner and Robin H. A. Ras

Materials

Silver nitrate was supplied from Riedel-de Haën, (> 99.8%) and poly(methacrylic acid) (PMAA) was supplied from Polysciences (MW=100 000). Chemicals were used as received. Water was purified by a Milli-Q system (Millipore).
The synthesis and the subsequent self-assembly of the PEO-peptide conjugate were reported previously [D. Eckhardt, M. Groenewolt, E. Krause and H. G. Borner, Chem. Comm., 2005, 2814-2816].

Sample preparation

First approach: AgNP directly synthesized in PEO-peptide conjugates by irradiation with visible light.

- For figures 2a and 2b:

50 µl of PEO-peptide (1 mg/ml) and 100 µl of silver nitrate solution (80 mg/ml) were mixed and irradiated under stirring for 2 hours.

- For figures 2c and 2d:

16µl of PEO-peptide (1 mg/ml) were diluted into 84 µl of water under stirring. Then 80 µl of silver nitrate solution (60 mg/ml) were diluted with 20 µl water. Both solutions were then mixed and irradiated under stirring for one hour.

Second approach: Fluorescent few-atom silver nanoclusters (AgFNC) spontaneously assembled in PEO-peptide conjugates.

Fluorescent silver nanocluster solution was prepared as described elsewhere [Díez et al. Angew. Chem. Int. Ed. 2009, *48*, 2122-2125]. A solution of poly(methacrylic acid) (5 mg/ml) and a solution of silver nitrate (molar ratio Ag:acrylate 3:1) were mixed and irradiated with a desk lamp until pink color and fluorescence appeared.

- For figures 3a and 3b:

15 µl of PEO-peptide (1 mg/ml) were diluted into 200 µl of water under stirring. Then 5µl of fluorescent silver nanoclusters water solution were added.

- For figure 3c:

Two films from PEO-peptide solution (1 mg/ml) were casted and dried in vacuum for 24 hours. Then one of the films was immersed in a fluorescent silver nanocluster solution for 24 hours. After that, the film was rinsed with water and dried. The images were taken by illuminating the samples with a UV lamp (380 nm).

- For figure 3d:

Absorption spectra of a solution prepared by irradiation of silver salt in the presence of PEO-peptide (black, first approach), was recorded from the same solution used in Figures 2c and 2d.
Absorption spectra of a solution of AgFNC formed in PMAA (green, reactant in second approach) was recorded from a diluted solution 50% silver nanocluster solution, 50% water.
Absorption spectra of a solution prepared by mixing PEO-peptide with AgFNC (pink, second approach) was recorded from a solution prepared by mixing 60 µl of peptide (1 mg/ml) with 100 µl water and adding 20 µl of silver nanocluster solution with 140 µl water.

Characterization

Optical absorption spectra of the Ag clusters solutions were acquired using a Perkin Elmer Lambda 950 UV/Vis/NIR spectrophotometer. All spectra were recorded with quartz cells of 10 mm path length.

Transmission electron microscope (TEM) images were taken on Tecnai 12 Bio Twin TEM operated at 120kV. A Gatan Ultrascan 1000 and a camera (2048*2048 px) for higher resolution were used for digital recording. For imaging, the solutions were dropped onto a TEM grid (Carbon films 400 mesh Au).