Peptide Directed Synthesis of Silica Coated Gold Nanocables

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Supporting Information

Materials and Experimental procedures

Chemicals and peptides:

$HAuCl_4 \cdot 3H_2O$ and TMOS were purchased from Aldrich (St. Louis, MO). Nanopure water used was prepared by using the Milli-Q system (Millipore, Billerica, MA) and autoclaved to avoid microbial contamination. All peptides used were purchased from Any Gen Co. Ltd. (Gwangju, Korea).

Synthesis of gold nanoribbons and nanoplatelets:

All procedures for synthesis of the gold nanoribbons and nanoplatelets were followed by previous description.[1] The gold nanoribbons were synthesized by 0.2 mg/ml of the peptide Midas-11 dissolved in deionized water with 30 mM of $HAuCl_4$ at pH 5.4 for 3 d incubation at 37 °C in the absence of light. The initial pH condition was adjusted with 5 M NaOH prior to the addition of the peptide solution into deionized water containing $HAuCl_4$. The gold nanoplatelets were synthesized by 0.2 mg/ml of the peptide Midas-11_C dissolved in deionized water with 0.5 mM of $HAuCl_4$ at pH 3.0 for 3 d incubation at 37 °C in the absence of light. All reaction volume was 1 ml. After reaction, samples were centrifuged (9,300 x g, 5 min), washed

twice and re-suspended with 100 µl of deionized water.

Attachment of peptide to gold nanostructures: The synthesized template gold nanoribbon (50 µl) and the gold nanoplatelet (10 µl) were incubated with 1 mg of the peptide Si#6-C for 24 hr at room temperature. After 24 hr incubation, supernatants which contain the unbounded peptide Si#6-C were discarded by centrifugation at 9,300 x g for 5 min (Centrifuge 5415D, Fisher Scientific, Pittsburgh, PA).

Covering gold nanostructures with silica: The gold nanoribbons and nanoplatelets bound by the peptide Si#6-C were reacted in 50 mM phosphate buffer (pH 7.5) with 50 mM of TMOS for 3 hr at 20 °C to form silica layers. Stock solution of TMOS was freshly prepared in 1 M dissolved in 1 mM HCl. After reactions, samples were washed twice with deionized water and resuspended in deionized water for further analyses.

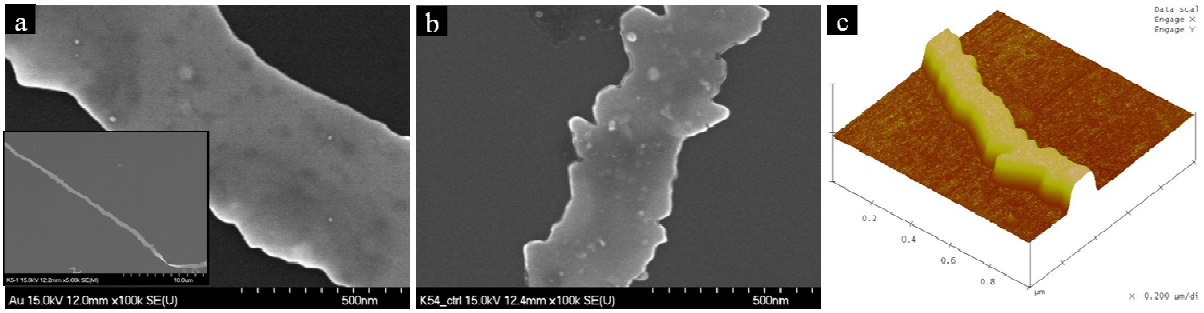
Binding affinity test of peptide Si#6-C with fluorescent dye-labeled: The synthesized gold nanoribbons were incubated with 1 mg of the peptide FAM-Si#6 or FAM-Si#6-C for 24 hr at room temperature. After reactions, samples were centrifuged and washed twice with deionized water. Light intensity for binding affinity of the designed peptides was analyzed by CLSM (LSM5, Zeiss, Germany).

Characterization of materials: The synthesized nanocables and nanoplatelets were characterized by SEM, FE-TEM, EDX, and AFM. The samples for SEM analyses using Hitachi S-4700

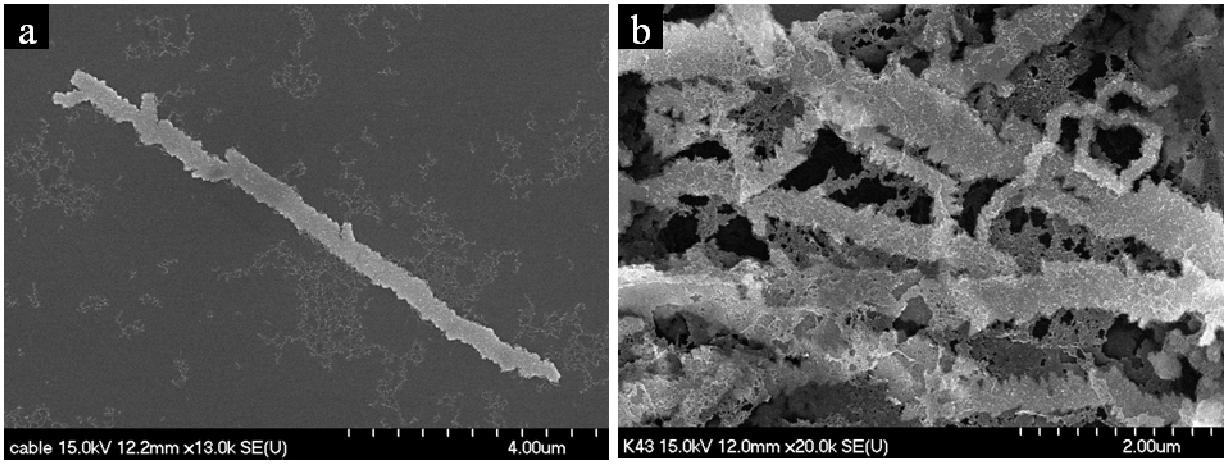
(Tokyo, Japan) at an accelerating voltage of 10 kV were prepared by placing ~5 μL of the suspension and drying in the air on a silicon wafer. The SEM samples were also subjected to AFM analyses using NanoMan D-3100 (Veeco, Plainview, NY). TEM analyses were conducted on a Tecnai F20 FE-TEM (Philips Electron Optics, Eindhoven, The Netherlands) at an accelerating voltage of 200 kV equipped with EDX. The samples were prepared by depositing a droplet of water suspension of the gold crystals onto carbon-coated Cu support grids that were subsequently dried in air.

Reference

1. J. Kim, Y. Rheem, B. Yoo, Y. Chong, K. N. Bozhilov, D. Kim, M. J. Sadowsky, H.-G. Hur and N. V. Myung, *Acta Biomater.*, 2010, in press.



Supplementary Fig. S1. (a) SEM images of bare gold nanoribbon formed by peptide Midas-11, and (b) bare gold nanoribbon reacted with precursor TMOS without peptide Si#6-C, and (c) AFM image of bare gold nanoribbon formed by peptide Midas-11.



Supplementary Fig. S2. (a) SEM images of a whole view of a single nanocable coated by silica and (b) nanocables coated by silica in a single reaction.