Supplementary Information for

Photonic Band Gaps and Plasmonic Behaviors of Ag Inverse Opals with Different Ag Filling Fractions Prepared with Electrochemical Etching

Cheng Ling, Ming Fu*, Haiyan Sun, Caixia Li, Jie Long, Dawei He, Yongsheng Wang*

Key Laboratory of Luminescence and Optical Information, Ministry of Education, Institute of Optoelectronic Technology, Beijing Jiaotong University, Beijing 100044, P. R. China

* Fax: +861051688018; Tel: +861051688018; E-mail: mfu@bjtu.edu.cn, yshwang@bjtu.edu.cn

This supplemental document is composed of the following sections:

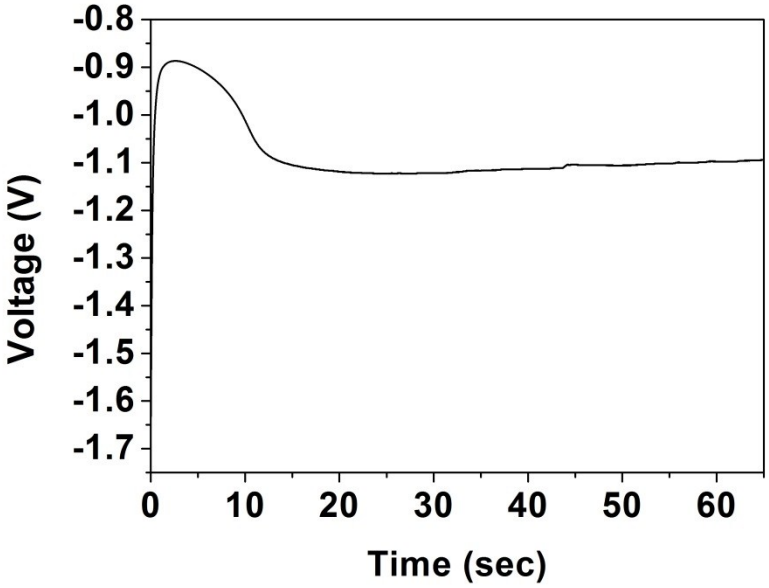


Figure S1. Potential *vs.* time curve for Ag electrodeposition at current density of 1 mA/cm^2 using colloidal crystal template.

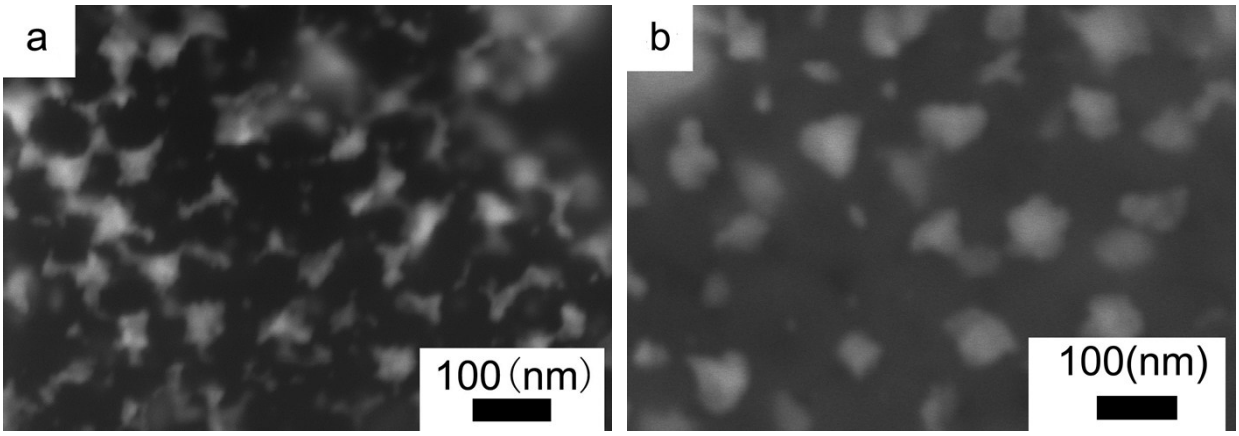
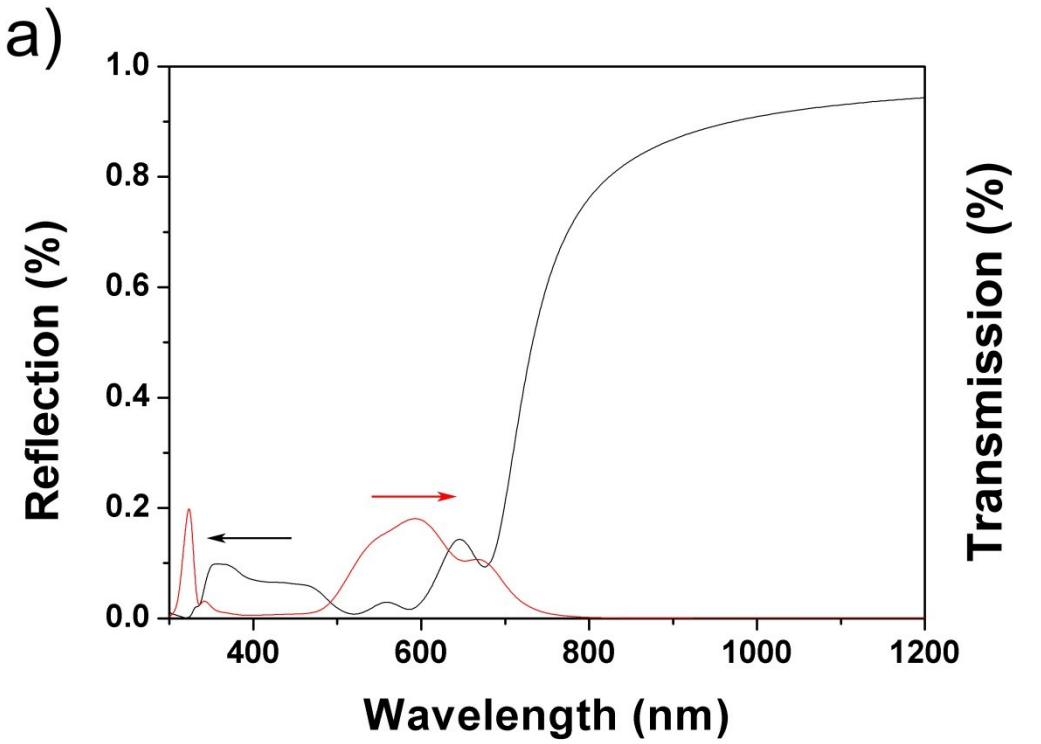
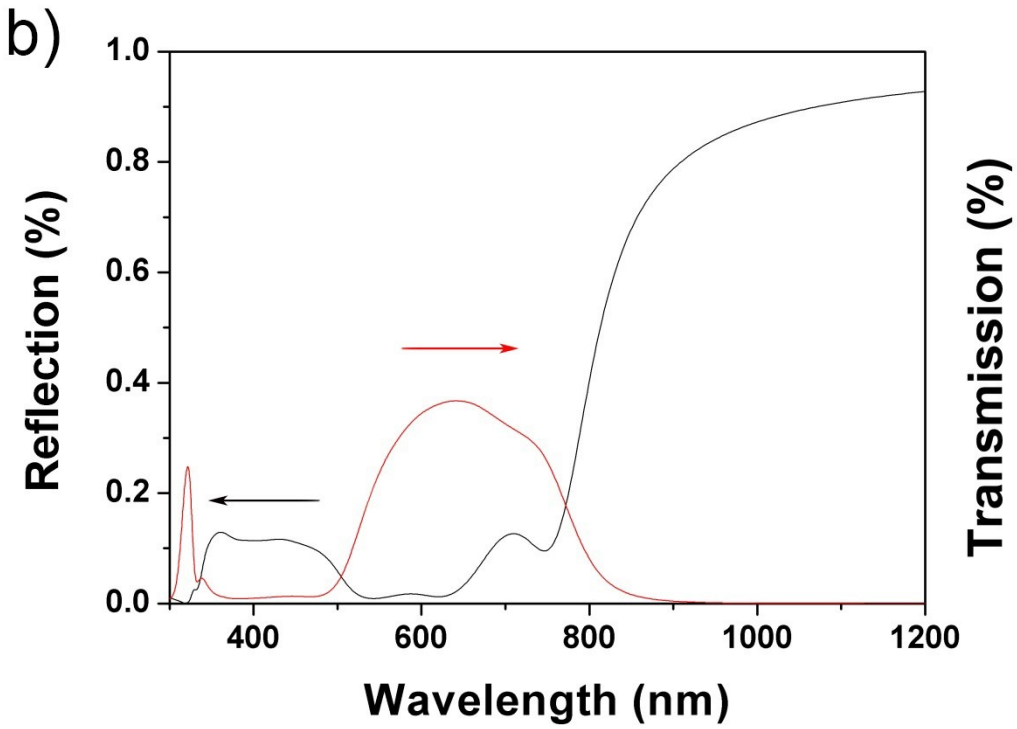
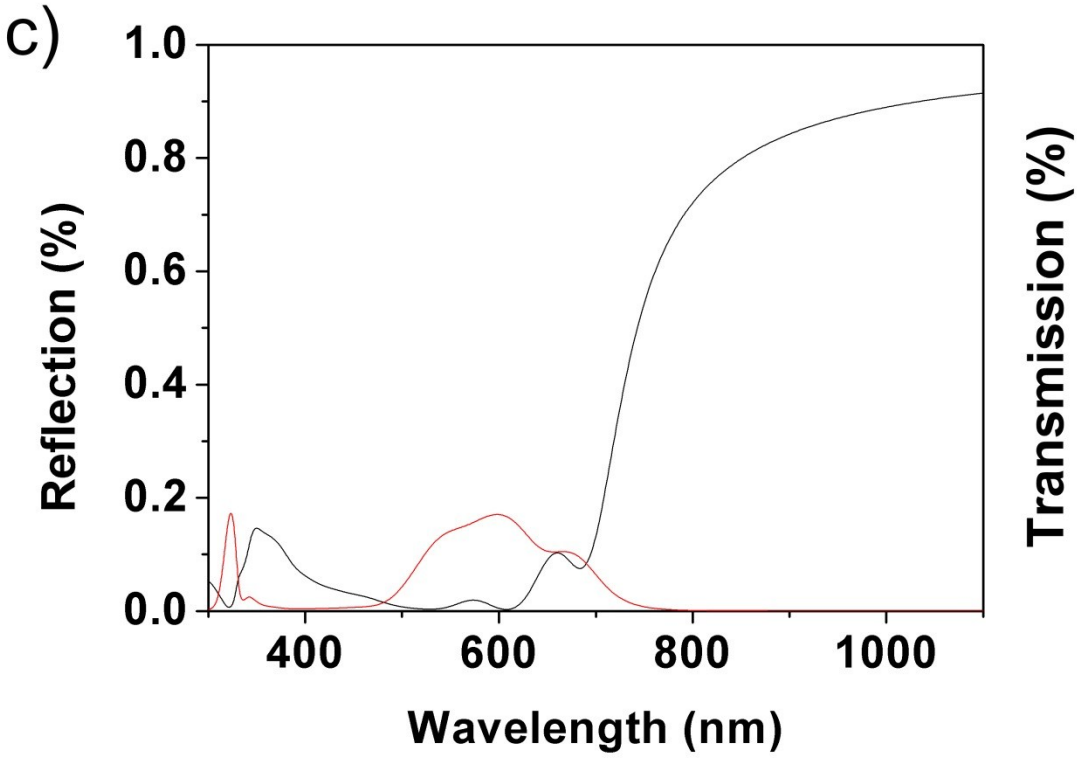
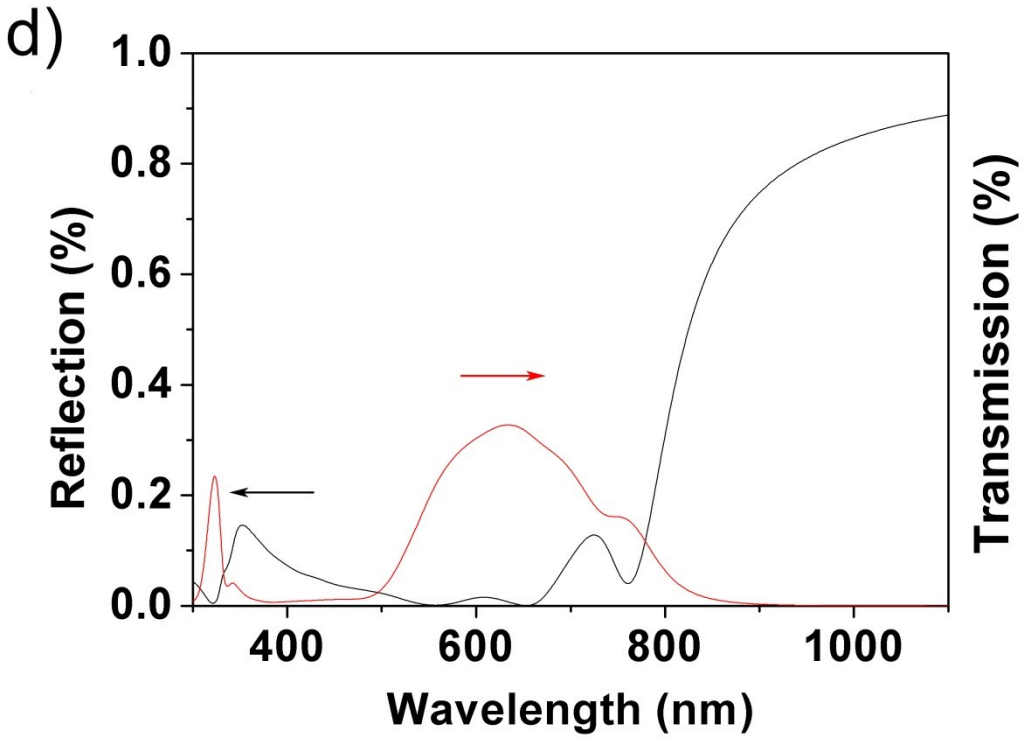


Figure S2. The SEM image of Ag inverse opals using colloidal crystal template with diameter of (a)238 nm, and (b)394 nm after excessive electrochemical etching of cycles. The structures were then broken into small segments on the ITO templates


a)
1.0
0.8
0.6
0.4
0.2
0.0
Reflection (%)
Transmission (%)
400
600
800
1000
1200
Wavelength (nm)


b)
1.0
0.8
0.6
0.4
0.2
0.0
Reflection (%)
Transmission (%)
400
600
800
1000
1200
Wavelength (nm)


c)
1.0
0.8
0.6
0.4
0.2
0.0
Reflection (%)
Transmission (%)
400
600
800
1000
Wavelength (nm)


d)
1.0
0.8
0.6
0.4
0.2
0.0
Reflection (%)
Transmission (%)
400
600
800
1000
Wavelength (nm)

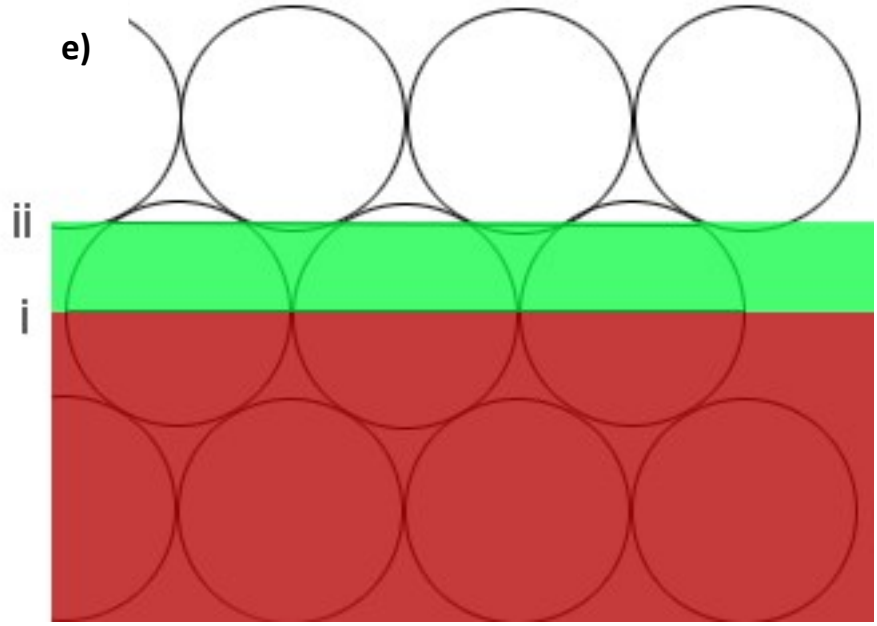


Figure S3. The reflection and transmission spectra using FDTD simulation of the Ag inverse opals with periodicity of 238nm. The radius of etch spheres for Ag inverse opals were 127nm for (a) and (c), and 130nm for (b) and (d). The surface topographies were at position i for (a-b), and position ii for (c-d).

Part 4.

Estimation about the effective refractive index of hydrogel with swelling effects

The effect refractive index of hydrogel filled inside Ag inverse opals were estimated using the experimental data on swelling ratio. First of all, The weight of the hydrogel after synthesis and completed dried were measured. The solid ratio of PAM (f) in hydrogel we synthesized were about 50 %.

The effect refractive index of hydrogel in ethanol was simply estimated as $n_{eff}^2=f*n_{PAM}^2+(1-f)*n_{ethanol}^2$

The swelling ratio of PAM hydrogel (s) in Ag inverse opal in water solution was about 81 % weight as we measured and compared the weights of as-synthesized hydrogel and hydrogel after immersing in water. The effect refractive index was estimated as $n_{eff}^2=(f*n_{PAM}^2+(1-f+s)*n_{water}^2)/(1+s)$. The effect refractive index of hydrogel in ethanol/water solution were estimated using similar methods. The effective refractive index of the hydrogels was estimated to be 1.402, 1.393, 1.386, 1.382, 1.367, respectively, in these five different ethanol water mixtures as the ethanol ratio decreased.