Supporting information

Solvent/UV driven Information Encryption Based on Multilayer Quasi-amorphous Photonic Heterostructure

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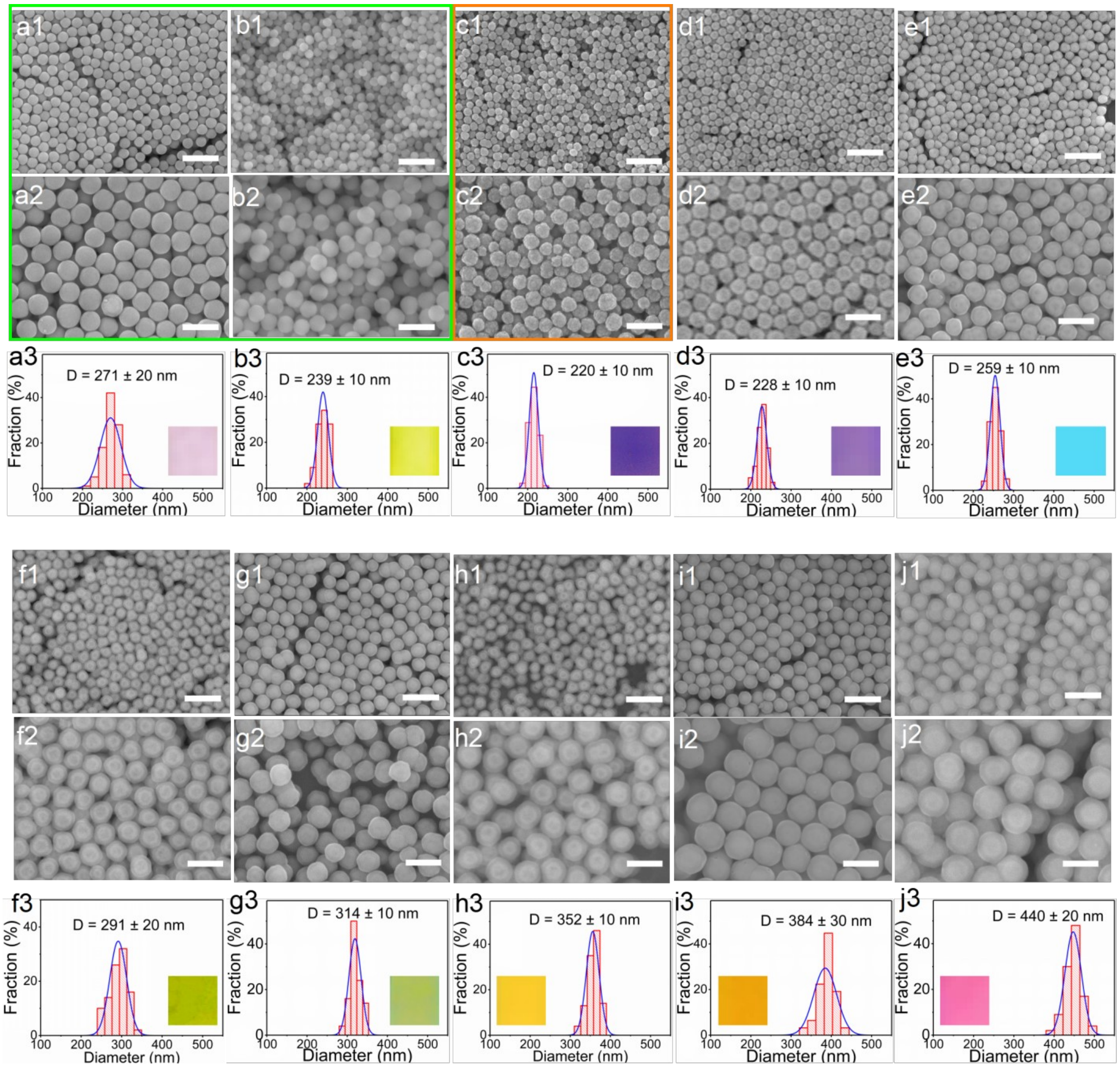

Figure S1. (a1-j1, a2-j2, a3-j3) Low-magnification, high-magnification SEM images and particle size distribution of SiO_2 (a-b), Fe_3O_4 (c) and $Fe_3O_4@SiO_2$ (d-j) particles, respectively. The inserts in a3-j3 indicate the structural colors of the corresponding coatings. The scale bars in (a1-j1) and (a2-j2) are 1 μm and 500 nm, respectively.

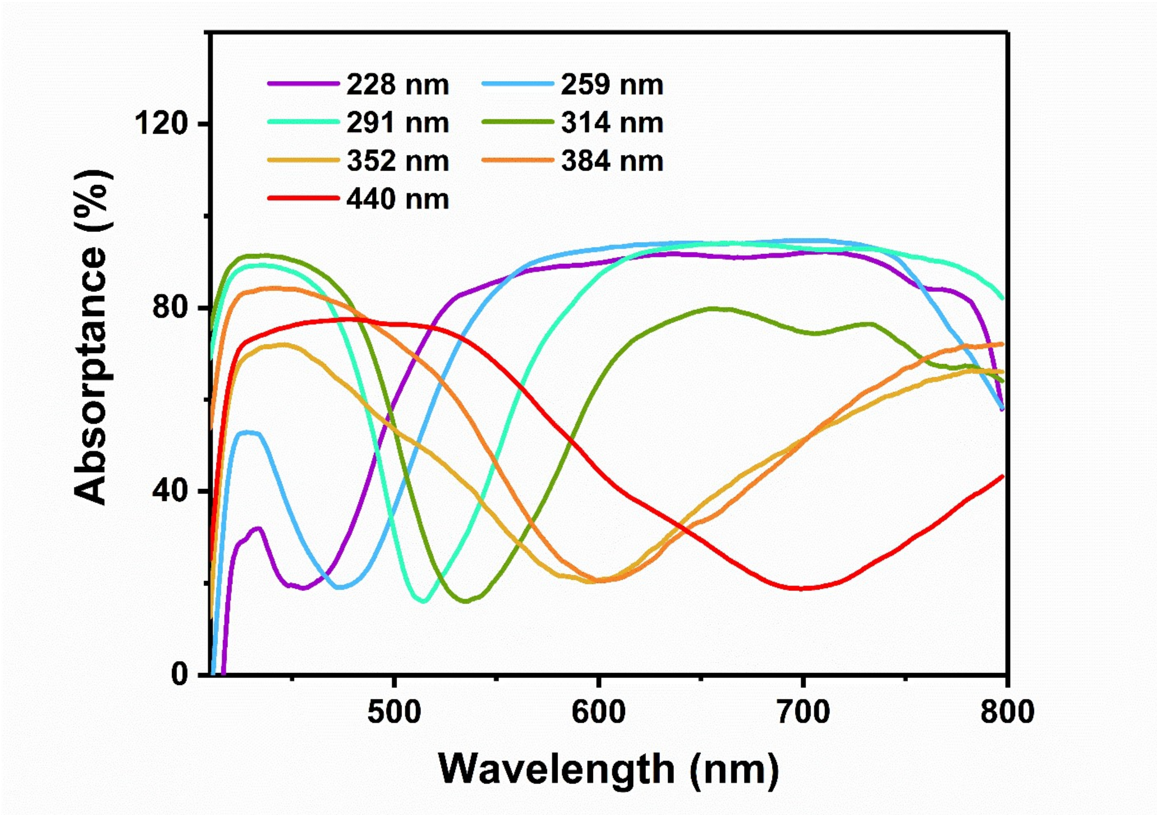

Figure S2. Absorption spectra of Fe_3O_4@SiO_2 QAPS heterostructure with different particle sizes.

Refractive index of Fe_3O_4@SiO_2 particles

The effective refractive index of Fe_3O_4@SiO_2 can be calculated by the following equation:

$$n_{eff} = n_{Fe_3O_4}(r/R)^3 + n_{SiO_2}[1-(r/R)^3]$$

Where $n_{Fe_3O_4}$ and n_{SiO_2} are the refractive index of Fe_3O_4 and SiO_2, *r* and *R* represent the radii of Fe_3O_4 cores and Fe_3O_4@SiO_2 core@shell particles, respectively. Here, the radii of Fe_3O_4 core is 220 nm. According to this formula, the effective refractive index of Fe_3O_4@SiO_2 with particle sizes of 228 nm, 259 nm, 291 nm, 314 nm, 352 nm, 384 nm, and 440 nm are 2.32, 2.11, 1.87, 1.78, 1.68, 1.63, and 1.58, respectively. Although the effective refractive index of Fe_3O_4@SiO_2 particles becomes smaller as the SiO_2 coating layer becomes thicker, the Fe_3O_4@SiO_2 QAPS coating still exhibits bright structural color due to the absorption of stray light by black Fe_3O_4.

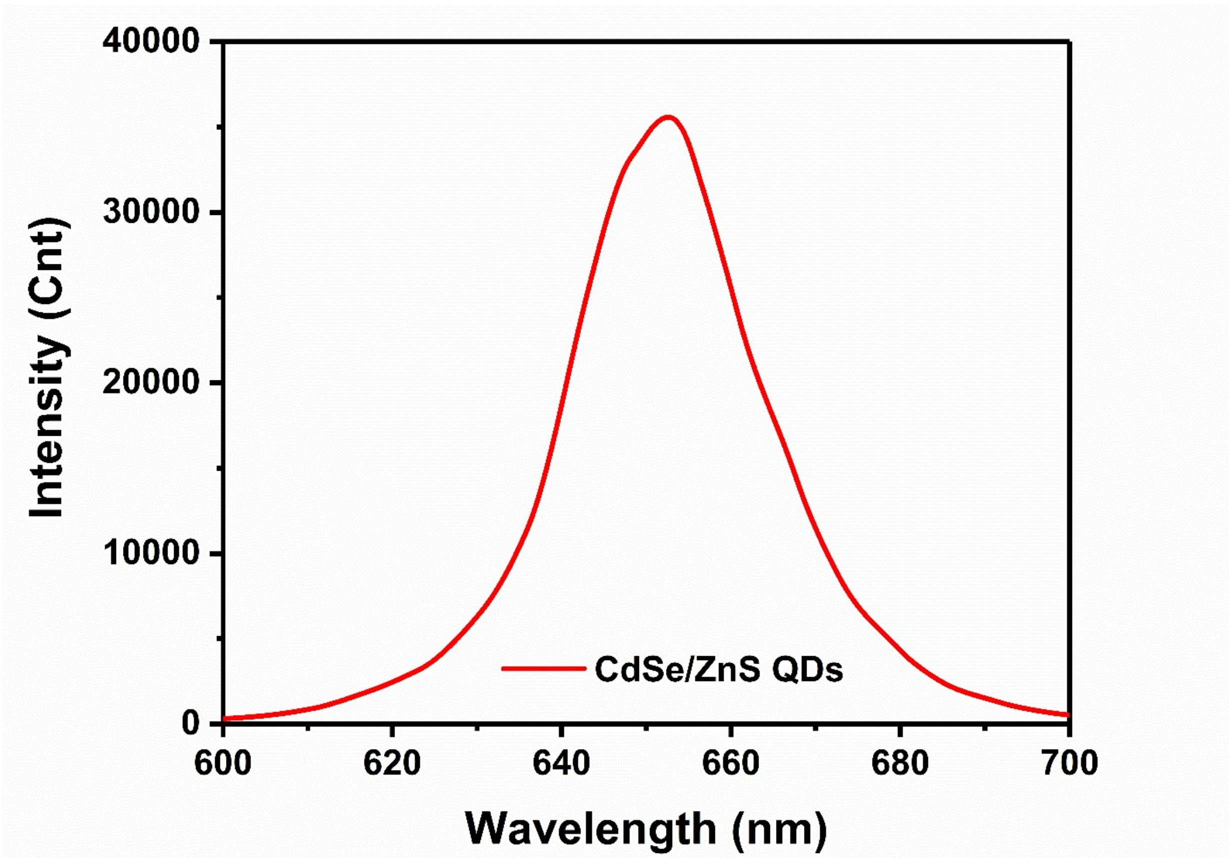

Figure S3. The photoluminescence spectra of CdSe/ZnS QDs.

Resolution of encrypted patterns

The boundary resolution is determined by the distance between the substrate and the mask, and reducing the distance helps to obtain a high-resolution pattern.[1] By measuring the blur distance of the edges of the pattern prepared with the mask tightly contacted with substrate, the resolution of the encrypted patterns is estimated to about 120 μm, as shown in Figure S4.

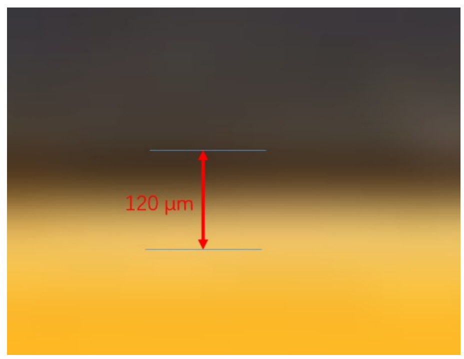

Figure S4. Resolution of the pattern.

Notes and references

1 Y. Hu, D. Yang and S. Huang, *ACS Omega*, 2019, **4**, 18771-18779.