

Supplementary Information for

Bio-inspired MXene Integrated Colloidal Crystal Arrays for Multichannel Bio-information Coding

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This PDF file includes:

Figures S1 to S12
Tables S1 to S3
Legend for Movie S1

Other supplementary materials for this manuscript include the following:

Movie S1

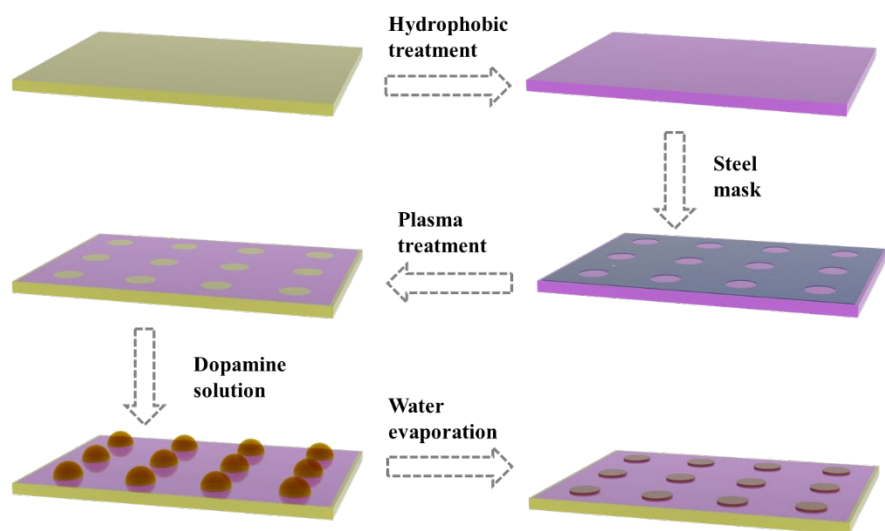


Fig. S1. The fabrication scheme of the MXene integrated PhC arrays.

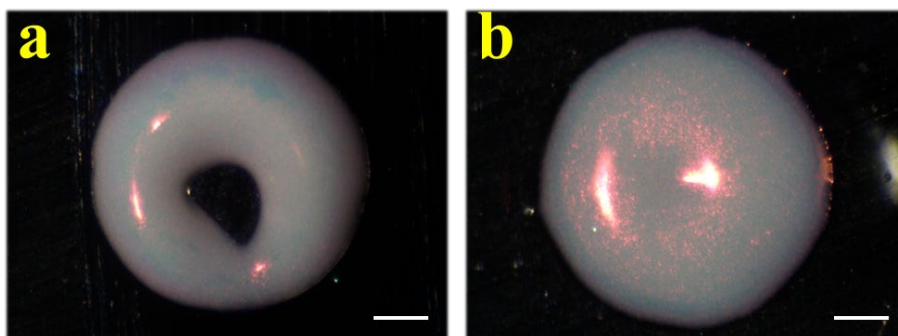


Fig. S2. (a) The "coffee-ring" effect would be produced during the self-assembly of silica colloidal particles into PhC patterns; (b) With the introduction of ethylene glycol, colloidal solution formed flat PhC patterns. Scale bars are 200 μm .

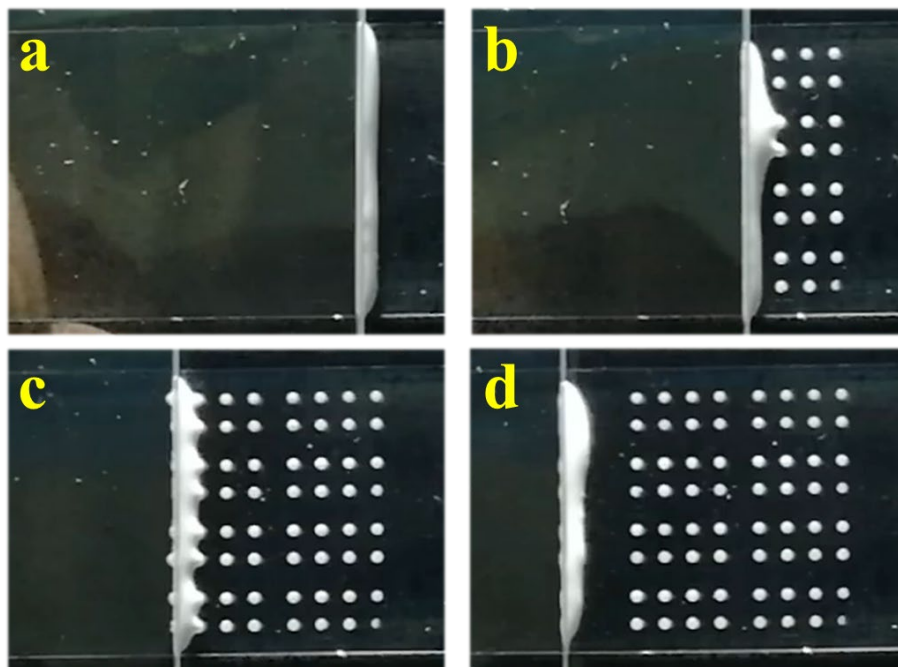


Fig. S3. (a-d) By applying the colloidal solution to the treated glass slides, only the hydrophilic areas can capture the colloidal solution.

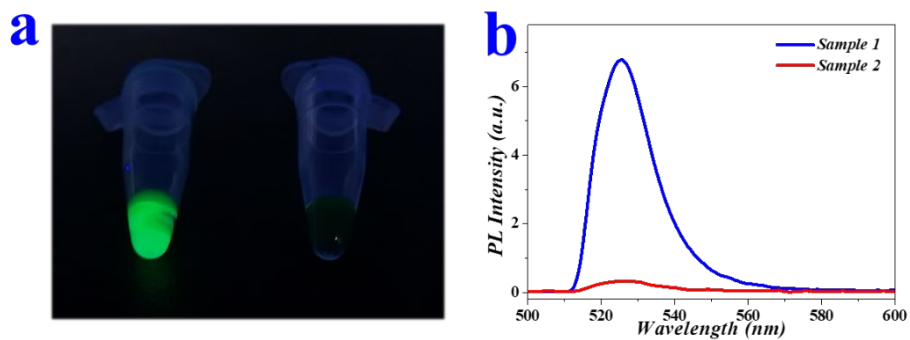


Fig. S4. MXene can quench the fluorescence of the QD-labeled oligonucleotides. **(a)** and **(b)** are the fluorescence images and spectrograms, respectively

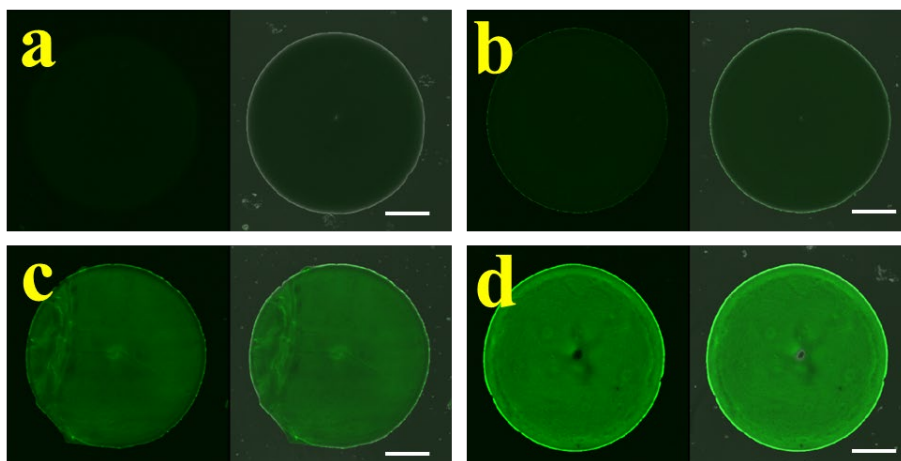


Fig. S5. Laser scanning confocal microscope images of the arrays. With the addition of different concentration of targets, the fluorescence of QD-labeled probe gradually recovered. **(a)** 1 nM target; **(b)** 10 nM target; **(c)** 100 nM target; **(d)** 1000 nM target. Scale bars are 300 μm .

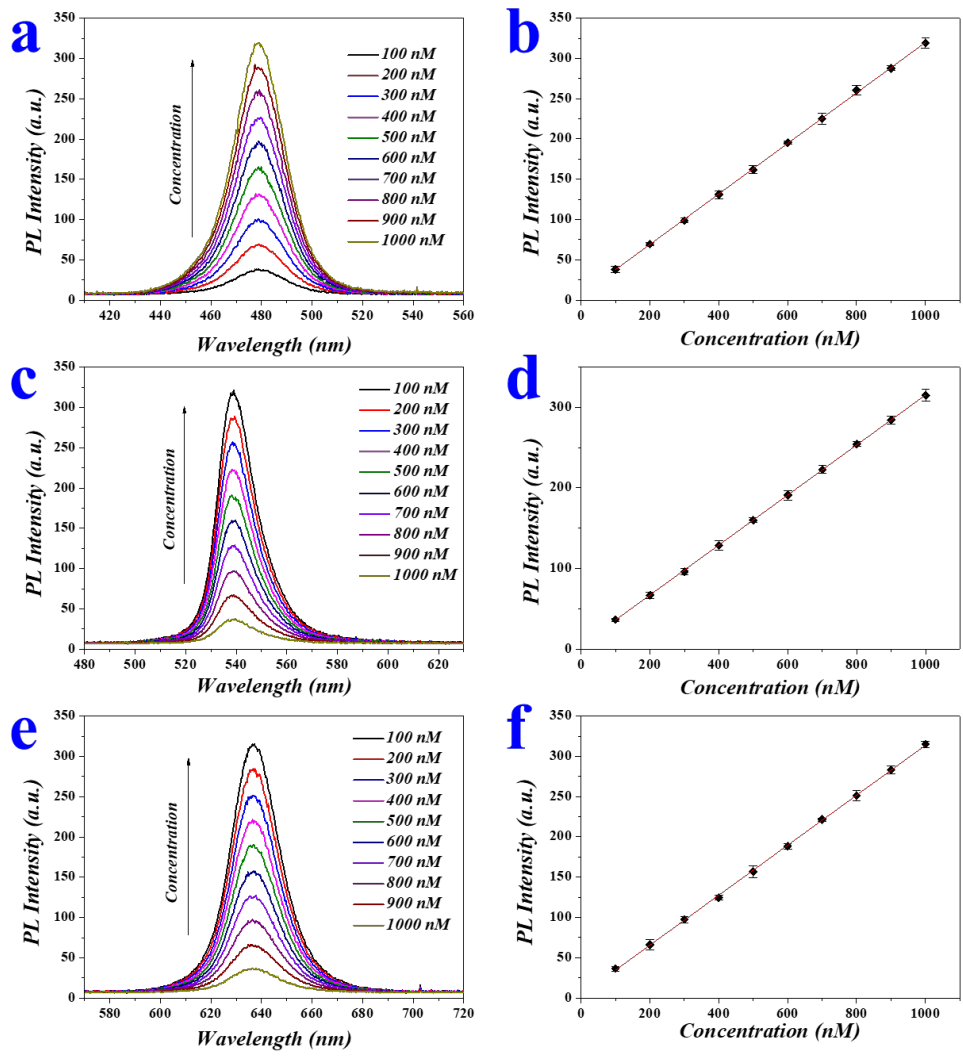


Fig. S6. Spectrogram of different arrays. With the increasing concentration of targets (100 nM to 1000 nM) added, three kinds of fluorescence of QD-labeled probe gradually recovered. (a) The spectrogram and (b) statistical graph of blue QD-labeled probe; (c) the spectrogram and (d) statistical graph of green QD-labeled probe; (e) the spectrogram and (f) statistical graph of red QD-labeled probe.

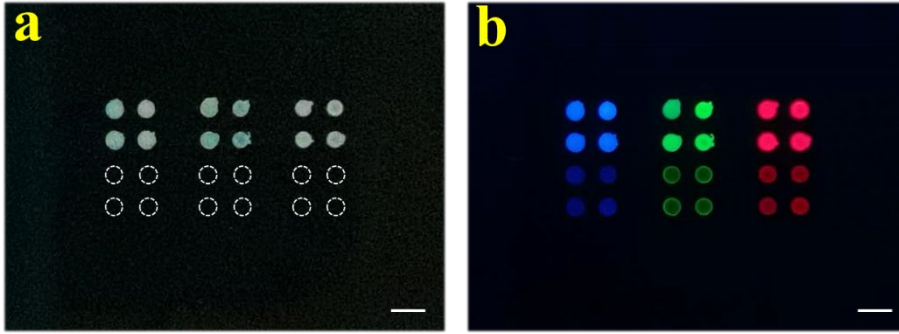


Fig. S7. The fluorescence contrast between photonic crystals dots and bare dots. **(a)** Bright field image; **(b)** fluorescence field image. Scale bars are 2mm.

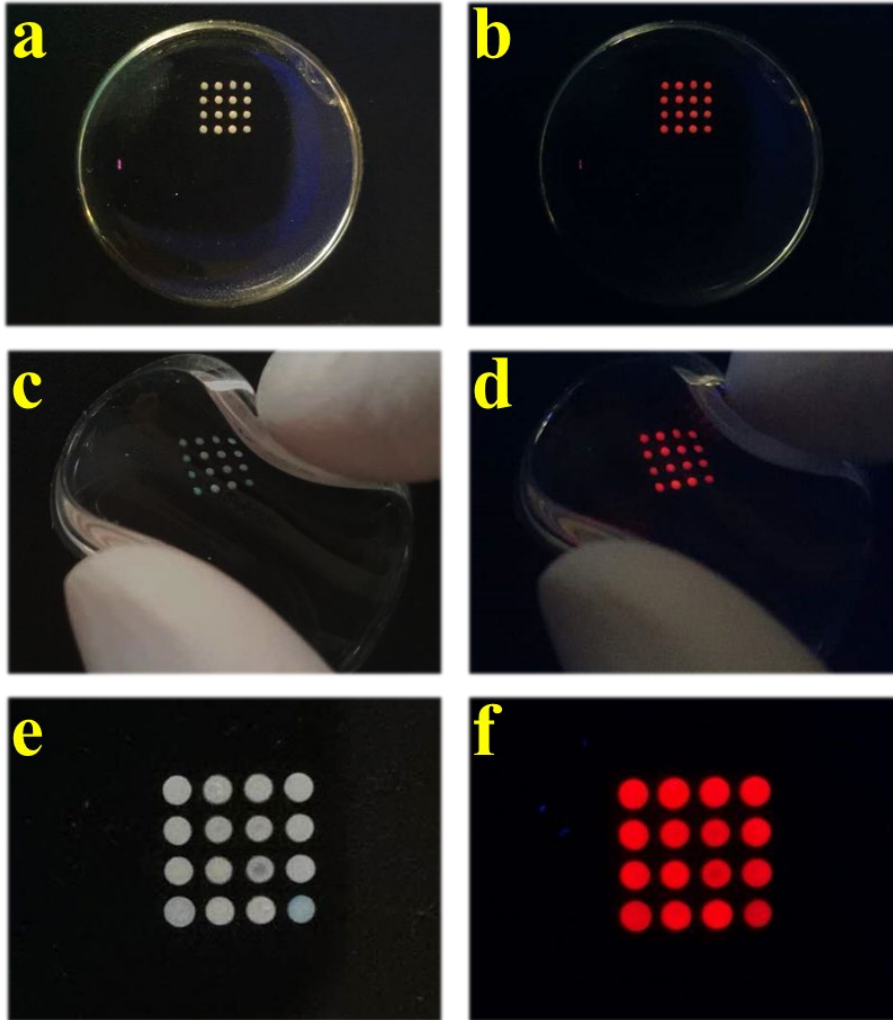


Fig. S8. The MXene integrated colloidal crystal arrays on other substrates. **(a-d)** Optical images and fluorescence images of PDMS substrate before and after its deformation. **(a, c)** Bright field image; **(b, d)** fluorescence field image. **(e-f)** Optical image and fluorescence image of PhC arrays on quartz substrate. **(e)** Bright field image; **(f)** fluorescence field image.

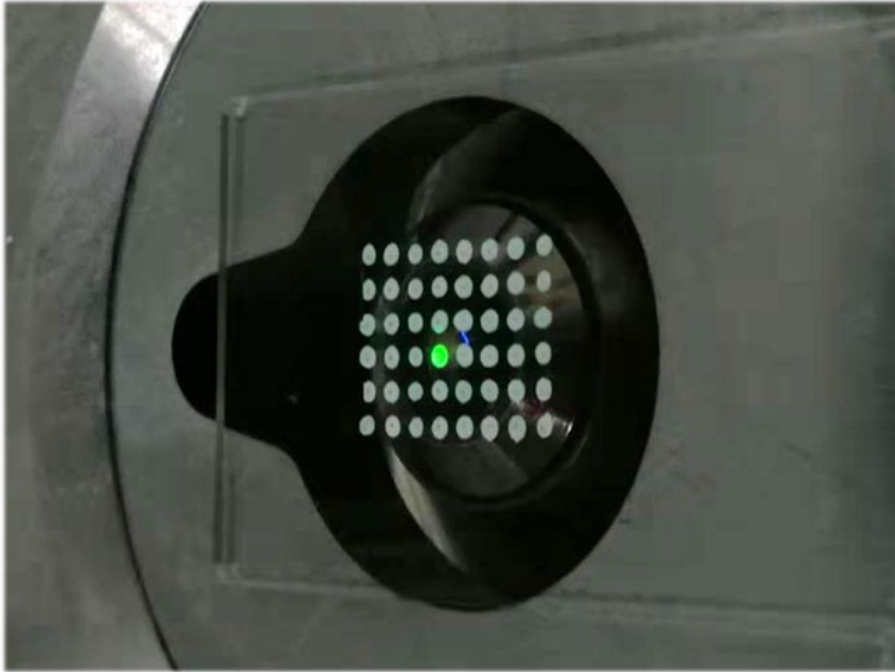


Fig. S9. The fluorescence microscope was used to measure the intensity of QD-labeled probes on each MXene integrated PhC dot.

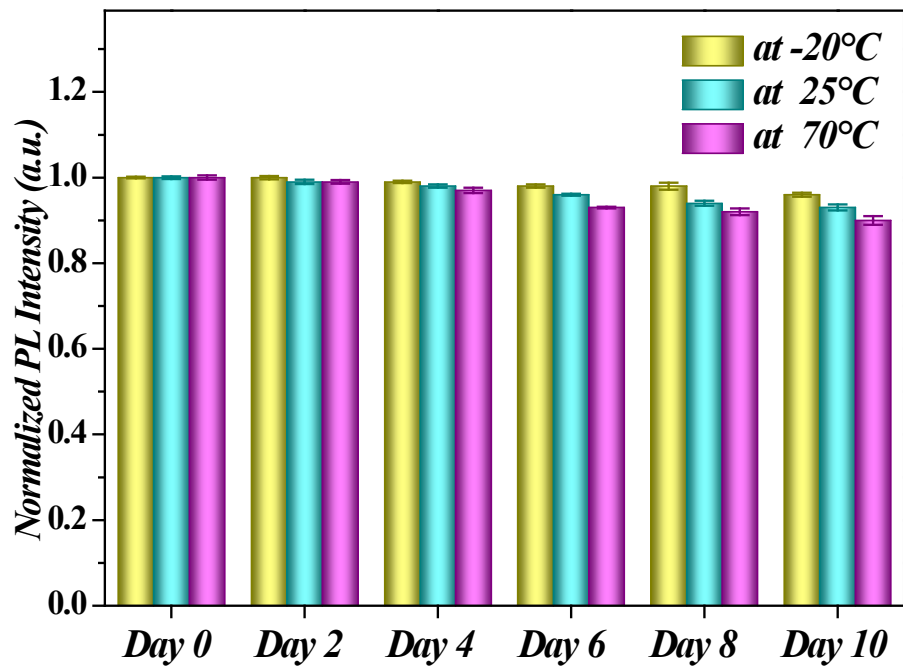


Fig. S10. The stability experiment of coding information at different temperature.

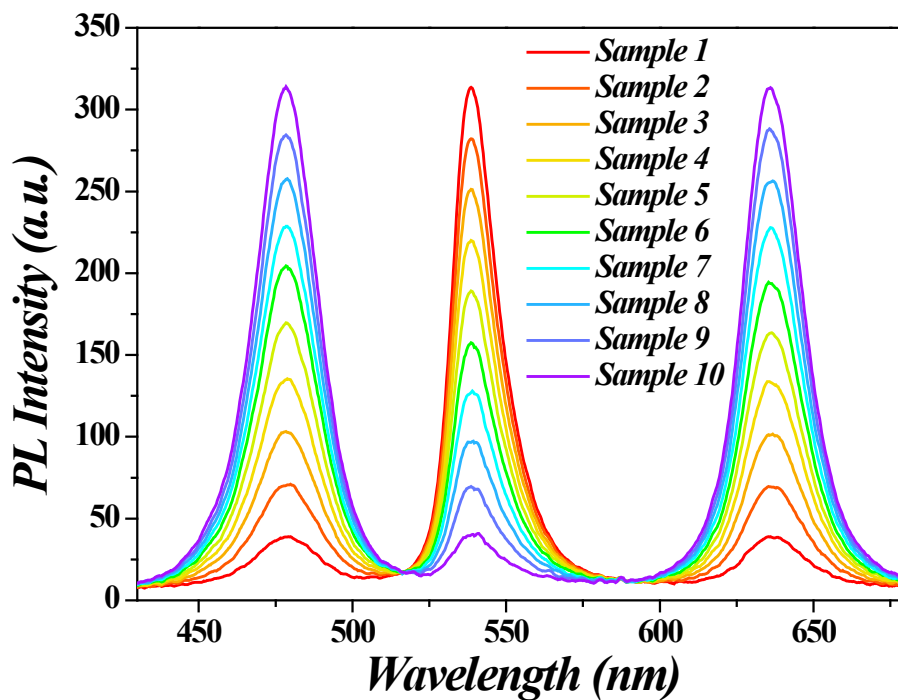


Fig. S11. Spectrogram of different samples. **Sample 1:** 100 nM target 1, 1000 nM target 2 and 100 nM target 3; **Sample 2:** 200 nM target 1, 900 nM target 2 and 200 nM target 3; **Sample 3:** 300 nM target 1, 800 nM target 2 and 300 nM target 3; **Sample 4:** 400 nM target 1, 700 nM target 2 and 400 nM target 3; **Sample 5:** 500 nM target 1, 600 nM target 2 and 500 nM target 3; **Sample 6:** 600 nM target 1, 500 nM target 2 and 600 nM target 3; **Sample 7:** 700 nM target 1, 400 nM target 2 and 700 nM target 3; **Sample 8:** 800 nM target 1, 300 nM target 2 and 800 nM target 3; **Sample 9:** 900 nM target 1, 200 nM target 2 and 900 nM target 3; **Sample 10:** 1000 nM target 1, 100 nM target 2 and 1000 nM target 3.

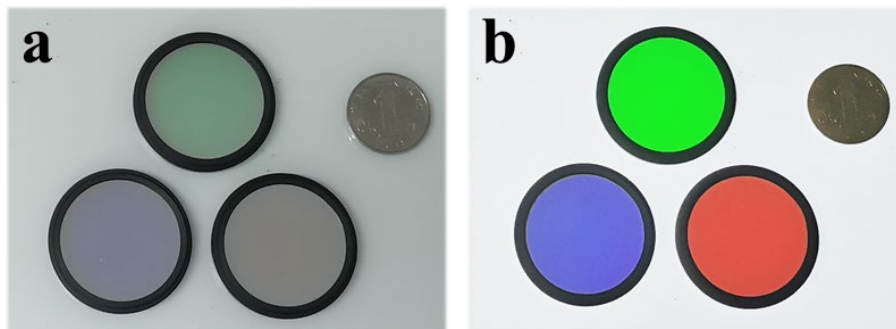


Fig. S12. (a) Three filters utilized in this work, whose diameter were 4 cm (a little bigger than a coin). (b) Only corresponding light can cross the filter.

Table S1. The information encryption strategy using MXene integrated PhC arrays based on fluorescence color and intensity. The number represents the intensity of fluorescence, and the color corresponds to the type of QD-labeled probe.

Code unit	Spectrum signal	Code unit	Spectrum signal	Code unit	Spectrum signal
A	(0,0,1)	J	(0,1,2)	S	(2,1,1)
B	(0,1,0)	K	(0,2,1)	T	(0,2,2)
C	(1,0,0)	L	(1,0,2)	U	(2,0,2)
D	(0,0,2)	M	(1,2,0)	V	(2,2,0)
E	(0,2,0)	N	(2,0,1)	W	(1,2,2)
F	(2,0,0)	O	(2,1,0)	X	(2,1,2)
G	(0,1,1)	P	(1,1,1)	Y	(2,2,1)
H	(1,0,1)	Q	(1,1,2)	Z	(2,2,2)
I	(1,1,0)	R	(1,2,1)	space	(0,0,0)

Table S2. The information encryption strategy refers to Morse code. The dimmed dots represent “dit” and the bright dots represent “dah”.

Code unit	Spectrum signal	Code unit	Spectrum signal	Code unit	Spectrum signal
A	● ● ○ ○	J	● ● ● ●	S	● ● ● ○
B	● ● ● ●	K	● ● ● ○	T	● ○ ○ ○
C	● ● ● ●	L	● ● ● ●	U	● ● ● ○
D	● ● ● ○	M	● ● ○ ○	V	● ● ● ●
E	● ○ ○ ○	N	● ● ○ ○	W	● ● ● ○
F	● ● ● ●	O	● ● ● ○	X	● ● ● ●
G	● ● ● ○	P	● ● ● ●	Y	● ● ● ●
H	● ● ● ●	Q	● ● ● ●	Z	● ● ● ●
I	● ● ○ ○	R	● ● ● ○	space	○ ○ ○ ○

Table S3. Sequences for the targets and semiconductor quantum dot modified probes

Oligonucleotides	sequence (5'-3')
Target 1	TAA GGT GCA TCT AGT GCA GAT
Probe 1	AGGAAACAGAAAAT ATC TGC ACT AGA TGC ACC TTA—QD⁴⁶⁵
Target 2	ACC TGG CAT ACA ATG TAG ATT
Probe 2	AGGAAACAGAAAAT AAT CTA CAT TGT ATG CCA GGT—QD⁵³⁰
Target 3	TCA AGT CAC TAG TGG TTC CGT
Probe 3	AGGAAACAGAAAAT ACG GAA CCA CTA GTG ACT TGA—QD⁶²⁵

Movie S1 Three decoded patterns on PhC arrays under different filters.