Supporting information

Fast, high chromatic, electrically responsive photonic crystal inks for displays

Dong Wang[a, b, c], Xiaohui Sun[a, b], Wei Wu[a, b], Mang Li[a,b], Xueying Zhao[a, b], Huiqi Ren[c], Bo Wang[a, b], Jingfang Li[d], Xuyang Zhang[a, b, *], Guohua Wu[a, b, e, *], Xiangwei Wang[a, b, *]

[a] College of Materials Science and Chemical Engineering, Harbin Engineering University, Harbin 150001, China

[b] Qingdao Innovation and Development Center of Harbin Engineering University, Qingdao 266000, China

[c] Defense Engineering Institute, Academy of Military Sciences, People's Liberation Army of China, Luoyang 471023, China

[d] School of Science, Chongqing University of Posts and Telecommunications, Chongqing 400065, China

[e] The Key Laboratory of Functional Molecular Solids, Ministry of Education, China

*Correspondence to: X. Zhang (xuyangz@hrbeu.edu.cn), G. Wu (ghwu@hrbeu.edu.cn) and X. Wang (wangxiangwei@hrbeu.edu.cn)

Table S1 Comparison of the various ERPCs in literature works and this work: the chemical composition, the working electric field, and the corresponding required time to shift 35nm from the initial state.

Particles[a]	d_p(nm)	f_p(%)	Solvent	E(10^4 V/m)	U(V)	Thickness(μm)	Time(s)
PMMA-co-PS[S1]	137	/	H_2O	2.50	2.5	100	80
SiO_2[S2]	120	10	PCb	1.25	2.5	200	60
PS[S3]	138	/	H_2O	/	AC	100	9
Fe_3O_4@C[S4]	130	18	PCb	2.70	2.7	100	60
SiO_2[S5]	200	20	PCb	2.50	2.5	100	20
SiO_2[S6]	171	18	aniline	1.00	1.0	100	10
SiO_2	189	25	PCb	1.25	2.5	200	5

Note[a]: These f_p values referred to the weight percentages of colloidal particles, and the data in the table corresponds to an electric field of 1.00-2.70*10^4 V/m. Some particles in the literature can achieve faster response times under high electric field.

Table S2 The recipes of the SiO_2 based liquid photonic crystals.

Sample[b]	SiO_2 (%)	SiO_2 (μL)	PC (μL)	Black (%)
A	15.0	30.0	170.0	0
B	20.0	40.0	160.0	0
C	25.0	50.0	150.0	0
D	30.0	60.0	140.0	0
E	25.0	50.0	150.0	0.025
F	25.0	50.0	150.0	0.050
G	25.0	50.0	150.0	0.100

Note[b]: The density of SiO_2 microspheres is 2.0 g/cm^3, the density of ethanol is 0. 79 g/cm^3, Black (%) refers to the mass percentage of black substance in SiO_2

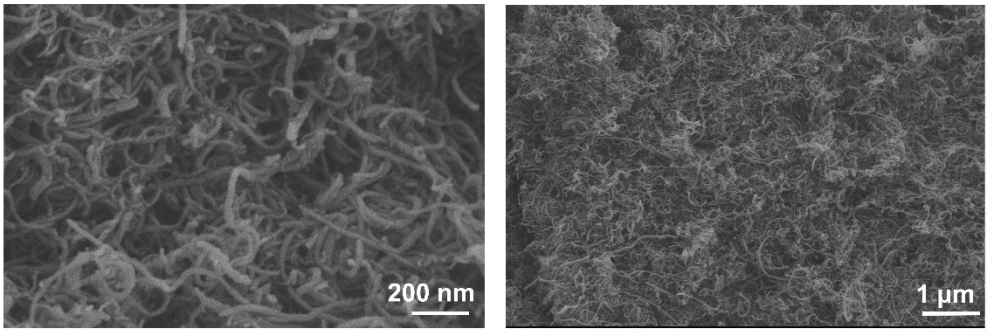

Fig. S1. SEM images of ACNTs.

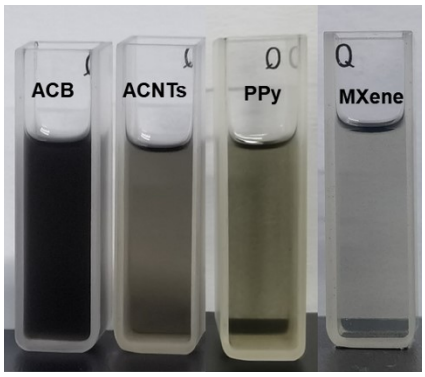

Fig. S2. Optical images of suspensions of four black substances (ACB, ACNTs, PPy and MXene) with mass fraction of 0.01% in ethanol.

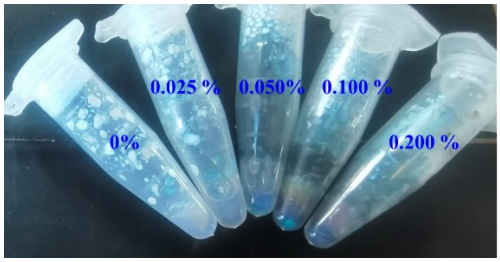

Fig. S3. Optical images of SiO_2 based liquid photonic crystals (LPCs) with different contents of ACNTs.

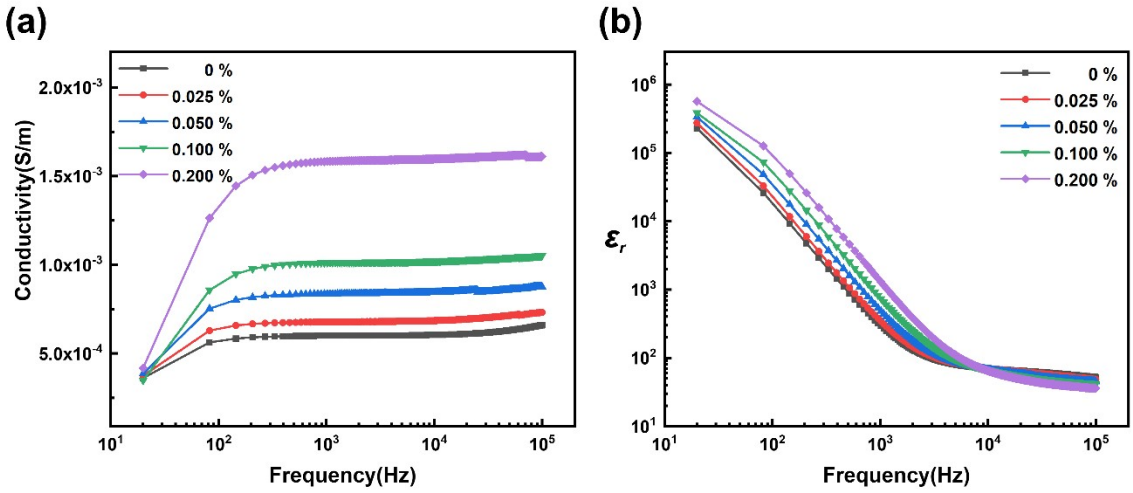

Fig. S4. (a) Conductive spectra of SiO_2 based LPCs with different ACNTs additions; (b) relative dielectric constant spectra of SiO_2 based LPCs with different ACNTs additions.

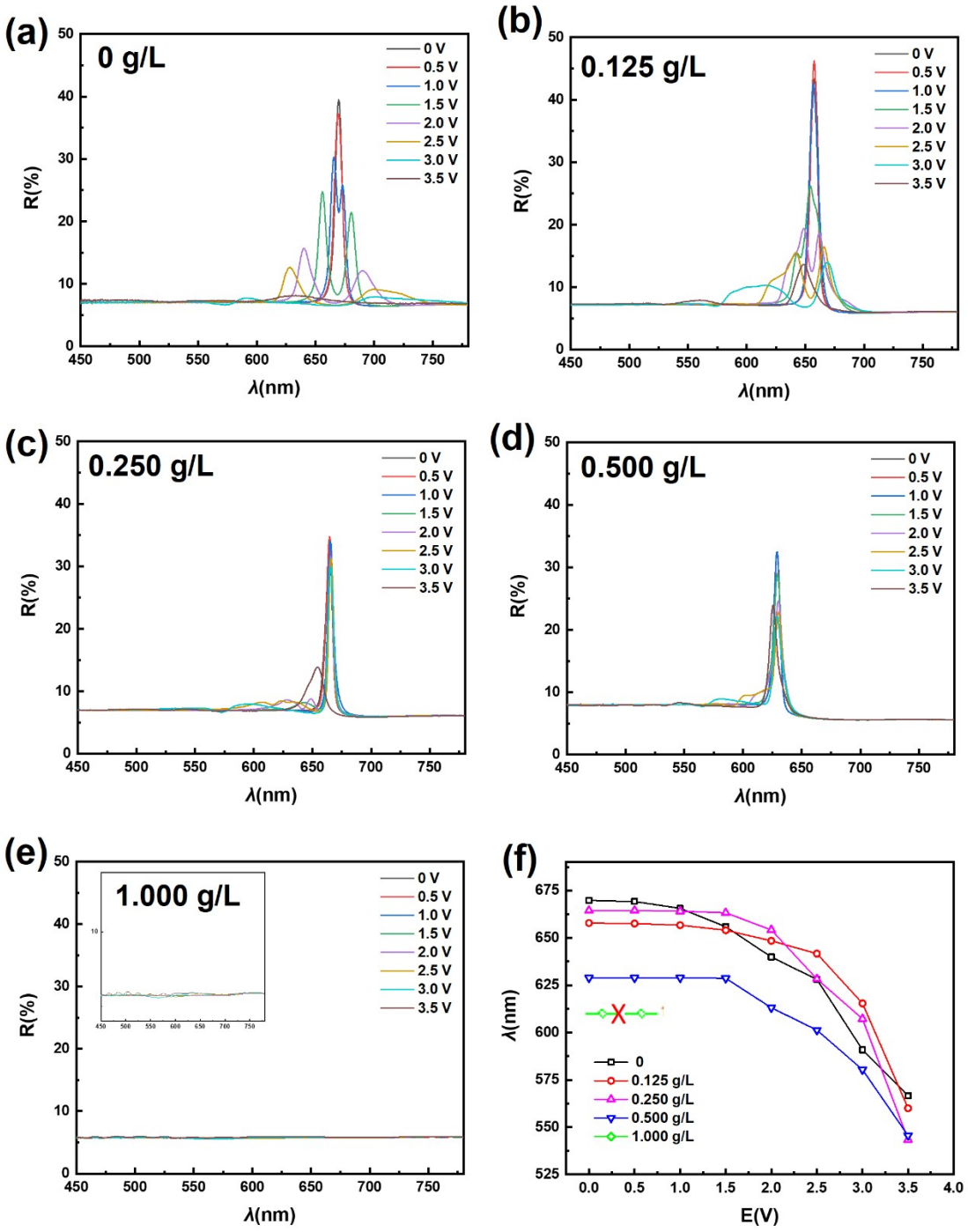

Fig. S5. Reflection spectra of SiO_2 based ERPCs with different SDBS concentration as the electric field increases from 0 to 3.5 V：(a) 0 g/L, (b) 0.125 g/L, (c) 0.250 g/L, (d) 0.500 g/L, (e) 1.000 g/L; (f) the reflection wavelength of SiO_2 based ERPCs with SDBS as the electric field increases from 0 to 3.5 V.

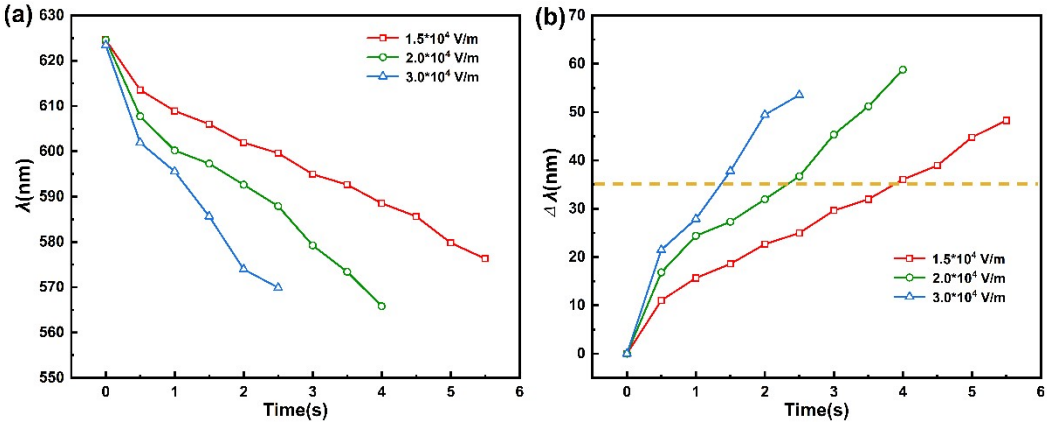

Fig. S6. The reflection wavelength changes of SiO_2 based ERPCs with SDBS: when electric voltages of 3.0 V, 4.0 V and 6.0 V are applied (yellow dashed line as reference wavelength for comparison).

References

S1. M. G. Han, C. J. Heo, C. G. Shin, H. S. Shim, J. W. Kim, Y. W. Jin and S. Y. Lee, J. Mater. Chem. C, 2013, **1**, 5791-5798.

S2. Y. X. Luo, J. F. Zhang, A. H. Sun, C. Y. Chu, S. Zhou, J. J. Guo and G. J. Xu, Adv. Mater. Res. *2014*, **924**, 158-165.

S3. M. G. Han, C. J. Heo, H. Shim, C. G. Shin, S. J. Lim, J. W. Kim, Y. W. Jin and S. Lee, *Adv. Opt. Mater.*, 2014, **2**, 535-541.

S4. H. Y. Lee, S. H. Kim, H. N. Lee, K. H. Park, Y. S. Kim and G. R. Yi, *Rsc Adv.*, 2016, **6**, 100167-100173.

S5. Y. Ren, Y. Guo, Y. Cheng, Y. Chu, Y. Fang, Y. Liu, J. Hou and Z. Liu, *Optical Materials*, 2022, **129**, 112508.

S6. G. Bao, W. Yu, Q. Fu and J. Ge, J. Mater. Chem. C, 2023, 11(10) 3513-3520.