Supporting information for

Full-Color Natural Rubber Latex with Photonic Nano

Structure Composite

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Experimental Section

Materials

Natural rubber latex was purchased from Ji Tian Chemical Co., Ltd, methyl methacrylate (MMA, 99%) was purchased from J&K Chemicals, potassium persulfate (KPS) was purchased from Sinopharm Chemical ReagentCo. Ltd.

Preparation of colloidal particles and 3D photonic crystal array.

The PMMA colloidal particles were synthesized using an emulsifier-free polymerization method.^{S1} 25mL MMA and 125 mL ultrapure water were mixed to a 250 mL four-necked flask. The mixture was stirred and heated to 80 °C under nitrogen. 0.3 g KPS was added to the solution, and continue to maintain 80 °C for 45 min. The resulting PMMA particles were centrifuged at 6500 rpm for 5 min to remove the unreacted monomer.

The glass slides were inserted vertically in the PMMA suspension (0.2 wt%) at 30 °C and relative humidity of 50%. After completely evaporating of water, the 3D photonic crystal arrays were prepared.

Preparation of photonic crystal composite with natural rubber latex.

The 3D photonic crystal array was placed on a homogenizer (US61M/KW-4A). 200 μ L of natural latex solution was added on its surface, spread at a speed of 200r/min for 5 seconds and 1500r/min for 5 seconds, and dried at room temperature to form a film. Then it was lifted off the glass slide.

Detection of VOCs by NRLPC.

Inject a certain amount of VOC solution into a self-made sealed chamber with a volume of 800 cm³. After the liquid is completely vaporized, continue to equilibrate for 15 minutes to make it evenly distributed in the sealed space, and record the spectrum detection results. The concentration of each VOC is finally marked in Figure 5 in the form of volume fraction.

Supplementary figures



Figure S1. Band diagrams calculated by plane-wave expansion of 3D NRLPCs with the structure colors of (a) blue (b)green (c)orange and (d) red, the right diagrams are the magnified images of red circle positions.



Figure S2. The structural color change of 3D NRLPC before and after continuous detection of toluene.

References

(S1) Lu, W.; Li, H. J.; Huo, B.; Meng, Z. H.; Xue, M.; Qiu, L. L.; Ma, S. P.; Yan, Z. Q.; Piao, C.
M.; Ma, X. Q. Full-Color Mechanical Sensor Based on Elastic Nanocomposite Hydrogels Encapsulated Three-Dimensional Colloidal Arrays. Sens. Actuators. B. 2016, 234. 527-533.