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Novel Robust Ion-specific Responsive Photonic Hydrogel Elastomers

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SUPPORTING TABLE

Table S1. A range of polyurethanes with different PEG types

	R_t	BDO	HEA	Appearance(aqueous solution/ cured gel)	Swelling ratio	Tensile strength (Max)	Elongation at break (Max)
PEG-400	2.2	0.005mol	0.014mol	Milky white / transparent	20%	4.82MPa	55%
PEG-1000	2.2	0.005mol	0.014mol	Milky white with blue light/transparent	135%	1.59MPa	83%
PEG-2000	2.2	0.005mol	0.014mol	Water clear/transparent	455%	0.43MPa	145%
PEG-4000	2.2	0.005mol	0.014mol	Water clear/ Membrane whitening	690%	6.62MPa	317%

Noticed: R_t is the mole ratio of NCO (IPDI) and OH (PEG)

A series of different molecular weight PEG was selected as the research object and prepared different polyurethanes. We can see the swelling ratio and chain elongation of the hydrogel increase as the increase of PEG mole weight, but the appearance of the hydrogel becomes white and opaque when the molecular weight reaches 4000, because of the Intermolecular crystallization. Through comprehensive investigation of various properties, PEG2000 was chosen as raw material to synthesize hydrogels.

SUPPORTING FIGURES

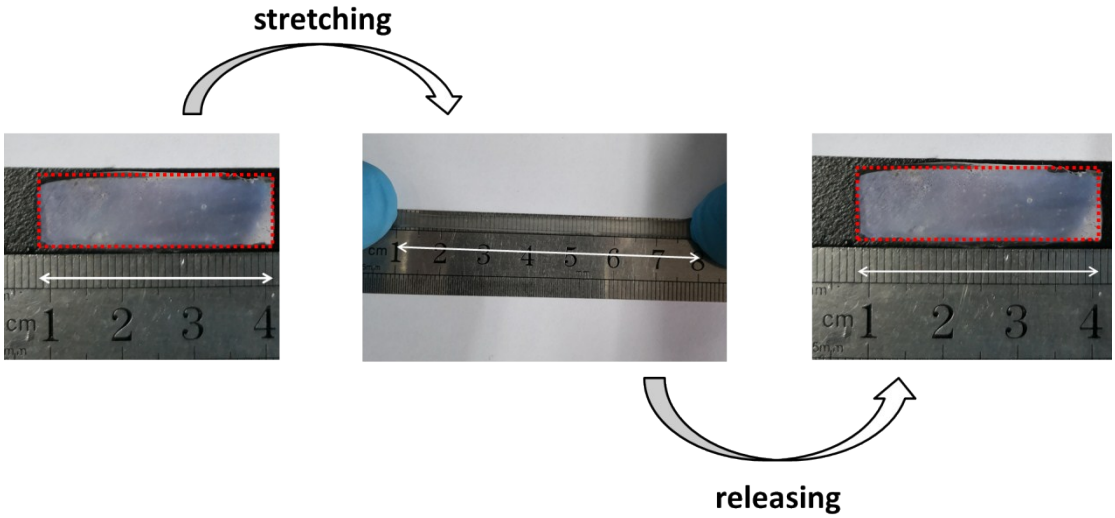

Fig.S1 Stretching and reversibility of Photonic Crystal Hydrogel. The initial length of photonic crystal is 4.3 cm, and the structure color is disappeared when the gels is pulled to 8 cm by external force, then released, the photonic crystal hydrogel can quickly restore its initial shape and structural color. It shows excellent anti-deformation ability and robust.

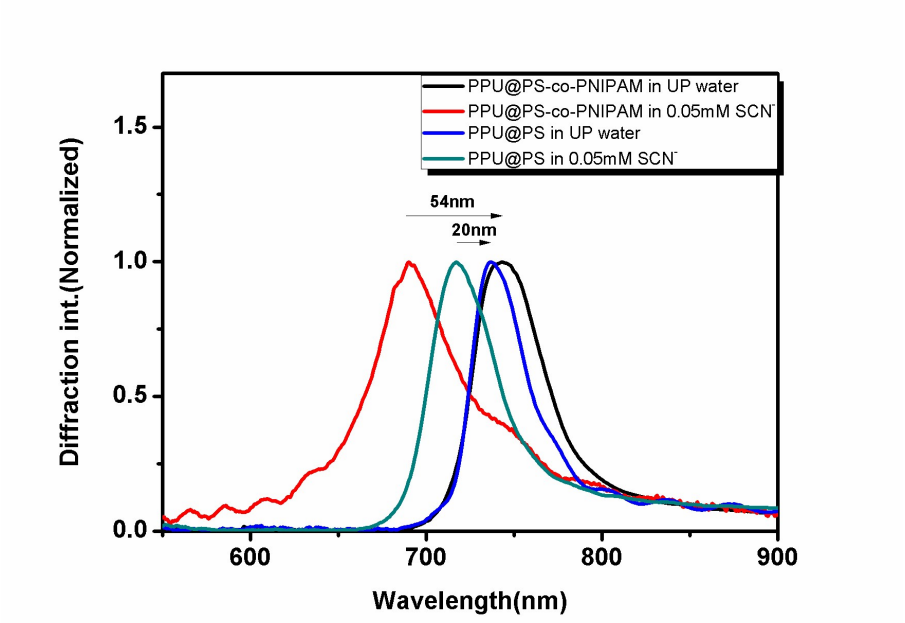

Fig.S2 Diffraction spectra of PPU@PS and PPU@PS-co-PNIPAM in pure water and 50μM SCN- solution, respectively. The shift of the diffraction peaks is 54nm when the photonic crystal is PS-co-PNIPAM, and the shift of the diffraction peak is 18nm when using the PS as photonic crystal.

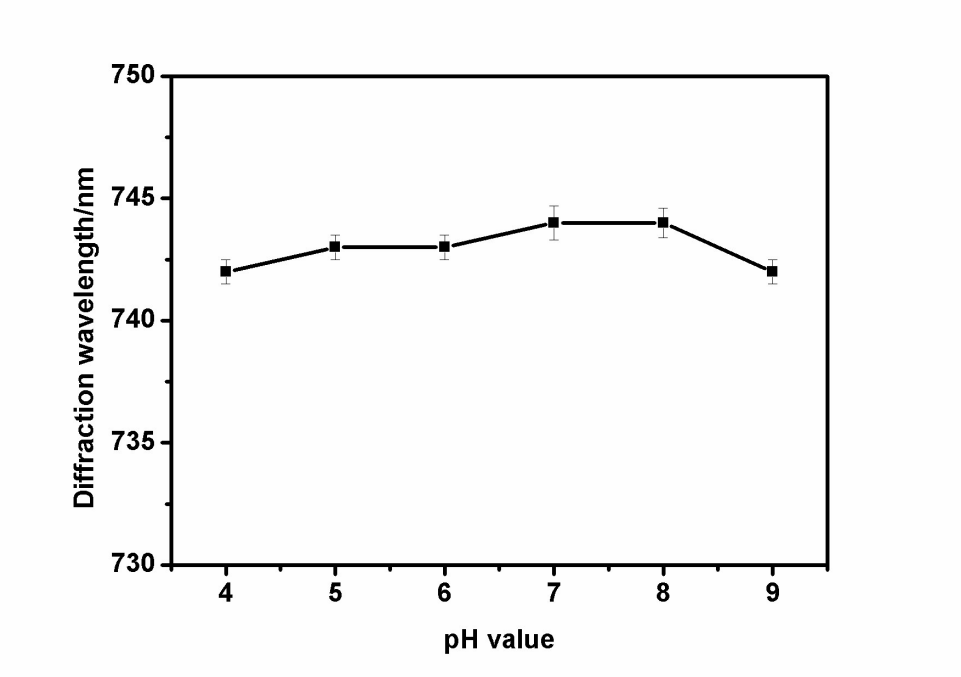

Fig.S3 Effect of pH to the diffraction wavelength of photonic crystal hydrogel

SCN^- ion concentration test method

Materials:

Iron nitrate ($FeNO_3$), nitric acid (HNO_3), Triton X-100, Sodium thiocyanate (NaSCN) were obtained from Sinopharm Chemical Reagent Co.,Ltd.

Preparation of SCN^- aqueous solution and $Fe(NO_3)_3$ aqueous solution

1.378 g of NaSCN was dissolved in ultrapure water, quantitatively transferred into a 1000 ml volumetric flask, and diluted to the mark with ultrapure water. This concentration of SCN^- is 1 mg/ml as a stock solution; 50g of $Fe(NO_3)_3$ was dissolved in 500ml of ultrapure water, added with 25ml of nitric acid, diluted with ultrapure water to 1000ml.

UV-visible spectrophotometer for determination of SCN^- ion concentration

According to Lambert-Beer law, the concentration of the color-developing complex is proportional to the absorbance. Transferring a certain amount of SCN^- stock solution to a 50ML volumetric flask, adding 5ml of $Fe(NO_3)_3$ solution and 0.8g Triton X-100 into the volumetric flask, then dilution to scale line (the pH value of mixture between 1 to 1.5), after settling 2min and test the absorbance at wavelength of around 460nm[1,2].

Fig.S4A and Fig.S4B show that the maximum absorption wavelength of complex is 453nm and the concentration of complex has a good linear relationship with absorbance (R=0.9986). By conversion, we can get the concentration of SCN^- is 3.67, 4.01, 5.21, 6.21μg/ml respectively and the minimum detection limit is 0.13μg/ml.

The linear regression equation as follows:

$$A = 0.114C - 0.048 \quad (7)$$

In which, the A and C are the absorbance and the concentration of SCN^- (μg/ml), respectively.

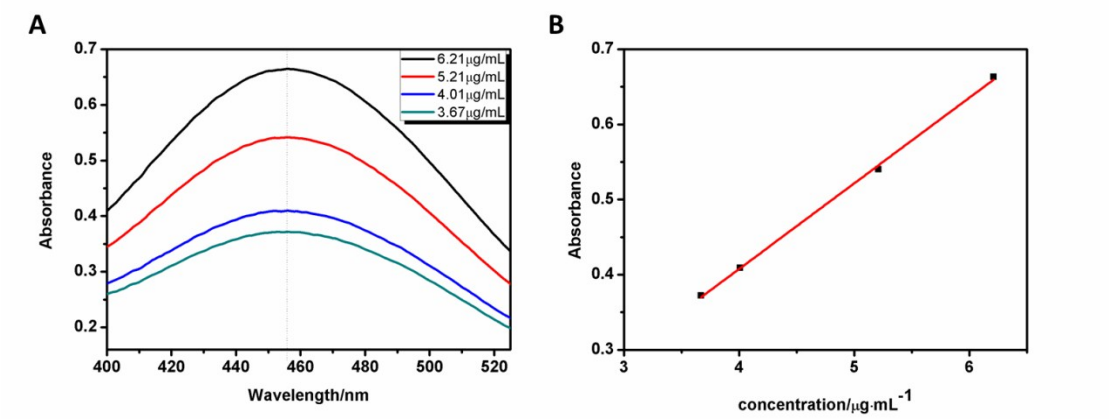

Fig.S4 (A) UV-visible spectrum of SCN^-. (B) Linear graph of $Fe(SCN)_3$ concentration and absorbance

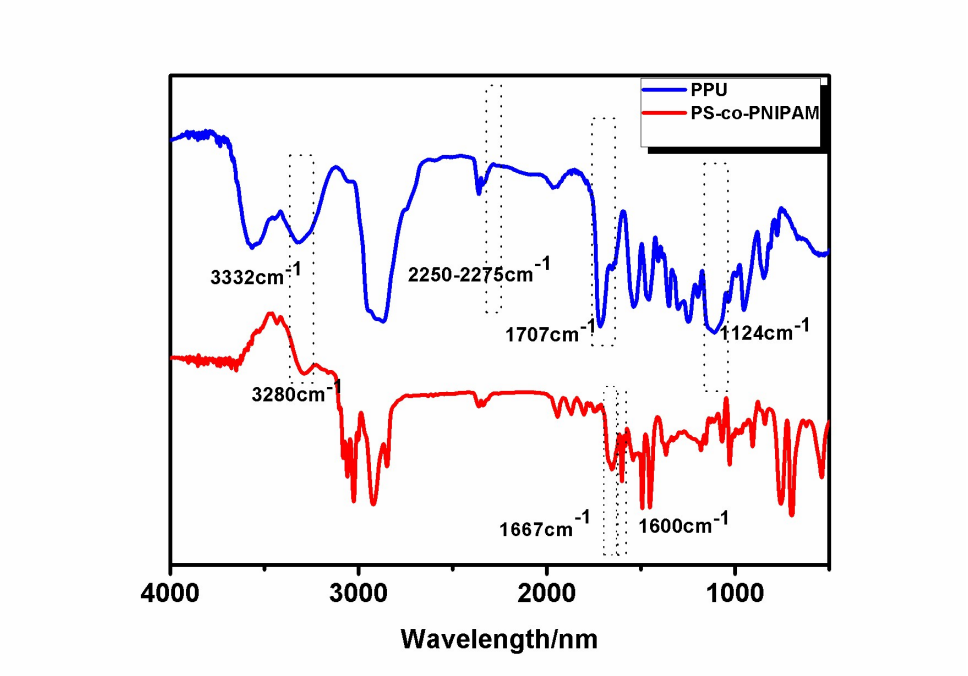

Fig.S5 The infrared spectroscopy of PPU and PS-co-PNIPAM

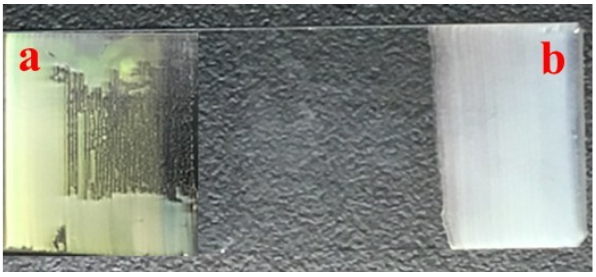

Fig.S6 Represented (a) PS microspheres and (b) PS-co-PNIPAM microspheres formed closed packed crystalline colloidal arrays on silica glass by vertical deposition technique, respectively

		Size (d.nm):	% Intensity:	St Dev (d.nm):
Z-Average (d.nm): 284.2	Peak 1:	301.0	100.0	72.68
PdI: 0.059	Peak 2:	0.000	0.0	0.000
Intercept: 0.886	Peak 3:	0.000	0.0	0.000

Result quality : Good

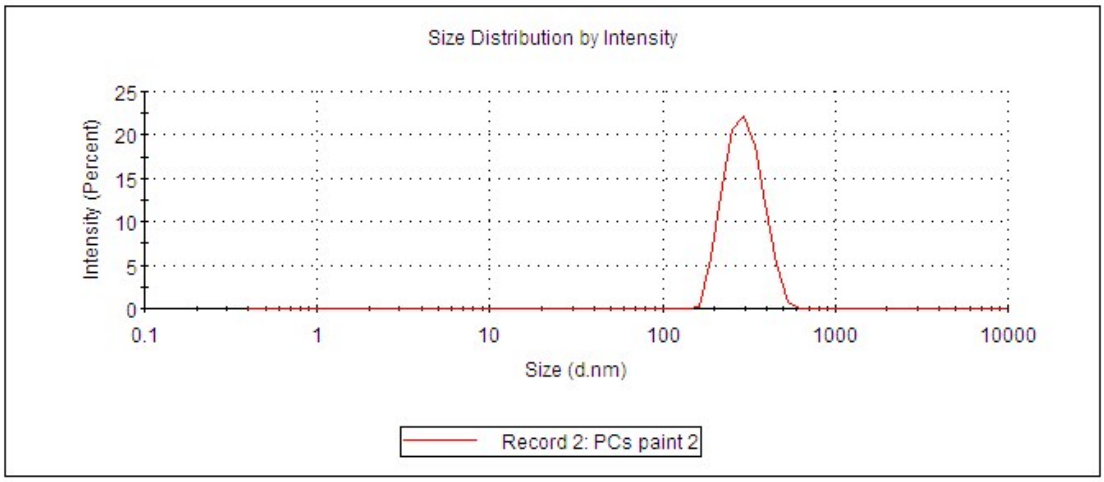

Fig.S7 Dynamic light scattering of prepared PS-co-PNIPAM, indicating the average sizes of 284.2nm and the PDI was 0.059 that smaller than 0.1, which showing a substantially narrow distribution of size and monodispersed.

References

1. F. Nyasulu and R. Barlag, *Journal of Chemical Education*, 2011, **88**, 313-314.
2. S. M. Sabir, H. Maqsood, I. Hayat, M. Q. Khan and A. Khaliq, *Journal of Medicinal Food*, 2005, **8**, 518-522.