Electronic Supplementary Information for:

Self-healing and Recyclable Photonic Elastomers Based on Water Soluble Supramolecular Polymer

Miaomiao Li,[#] Binghua Zhou,[#] Quanqian Lyu, Lizhen Jia, Haiying Tan, ZhanJun Xie, Bijin Xiong, Zhigang Xue,* Lianbin Zhang* and Jintao Zhu*

Key Laboratory of Materials Chemistry for Energy Conversion and Storage (HUST) of Ministry of Education, School of Chemistry and Chemical Engineering, Huazhong University of Science and Technology, Wuhan 430074, China

[*]Corresponding authors: E-mail: jtzhu@mail.hust.edu.cn (J. Z.); zhanglianbin@hust.edu.cn(L. Z.); zgxue@mail.hust.edu.cn (Z. X.)

[#]These authors contributed equally to this work.

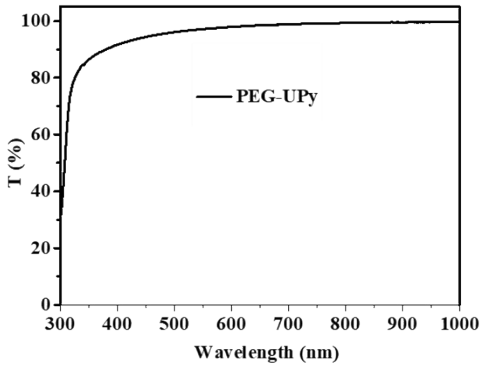

Fig. S1. Transmittance spectrum of the PEG-UPy film with a thickness of ~70 μm obtained by a spin-coating process. In the wavelength range between 300 and 1000 nm, the polymer PEG-UPy film shows high transmittance above 91%, demonstrating its high transparency in the visible region.

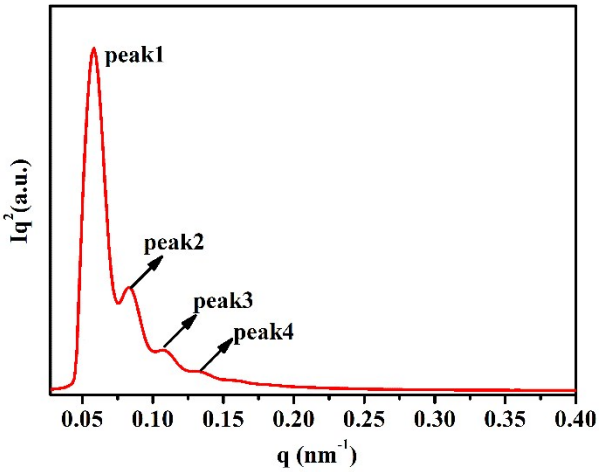

Fig. S2. The scattering intensity distribution curves of SAXS from the blue-colored elastomer. The appearance of four peaks arising from the uniformity of the spheres in the SAXS curves indicated the amorphous arrangement of SiO_2 NPs in such polymer matrix.[S1]

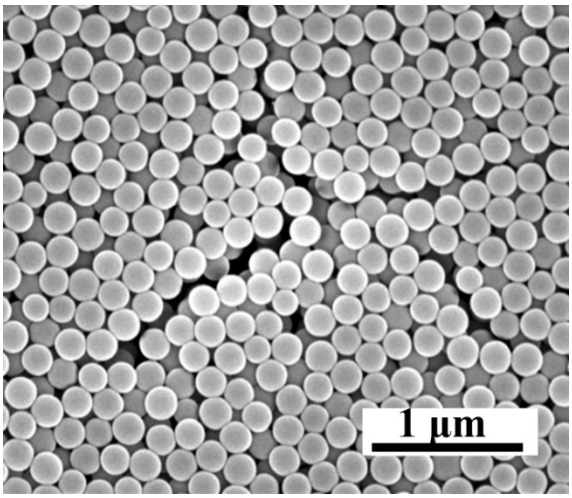

Fig. S3. SEM image of pure SiO_2 NPs film of a closely packing arrangement.

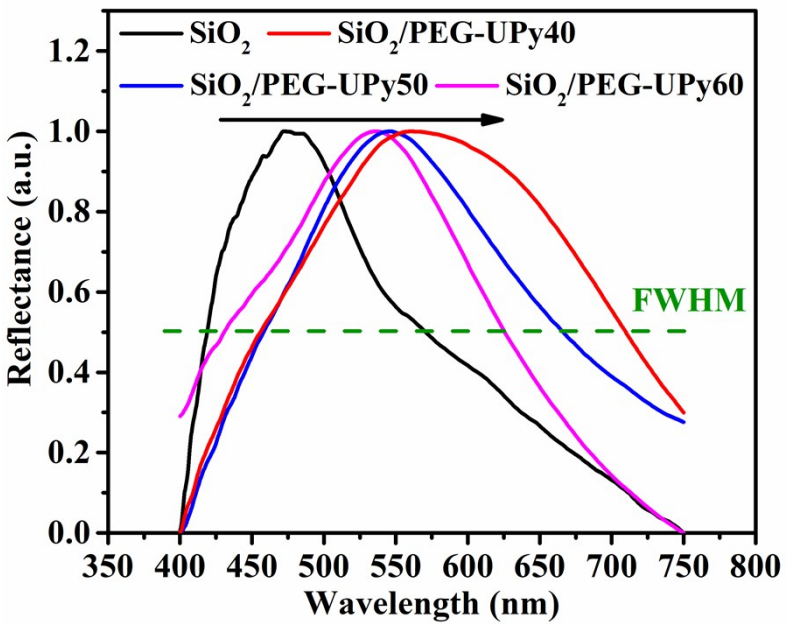

Fig. S4. Normalized reflection spectra of SiO_2 and SiO_2/PEG-UPy PEs. It can be found that its FWHM increased from 150 nm to 194 nm, 207 nm, and 254 nm along with the PEG-UPy content increasing from 0 to 40%, 50% and 60%. [S2]

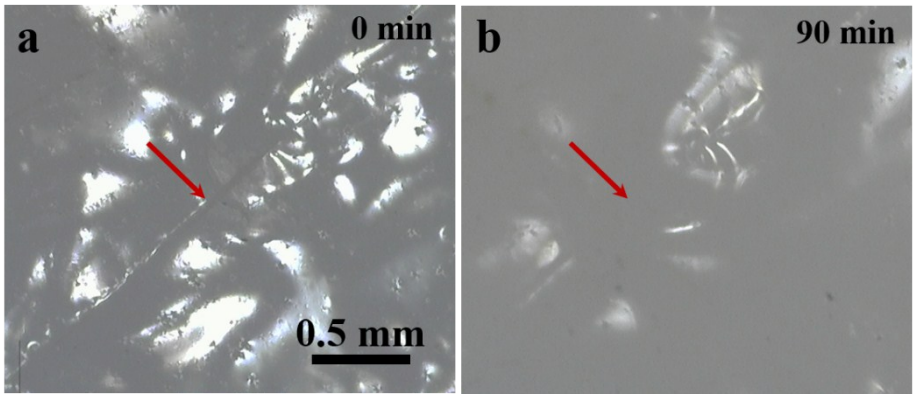

Fig. S5. Optical microscopy images of damaged (a) and healed (b) PEG-UPy film.

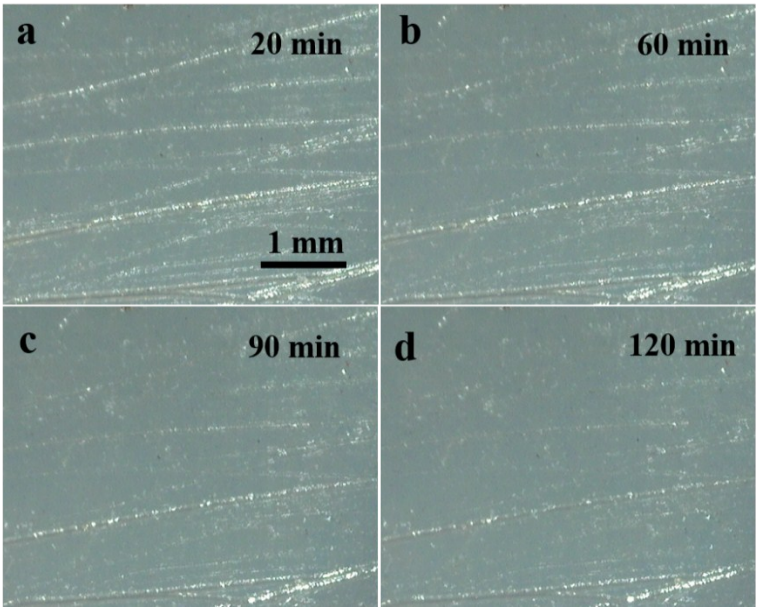

Fig. S6. Optical microscopy images of the as-abrased green-colored elastomer at self-healing time of 20 min (a), 60 min (b), 90 min (c) and 120 min (d).

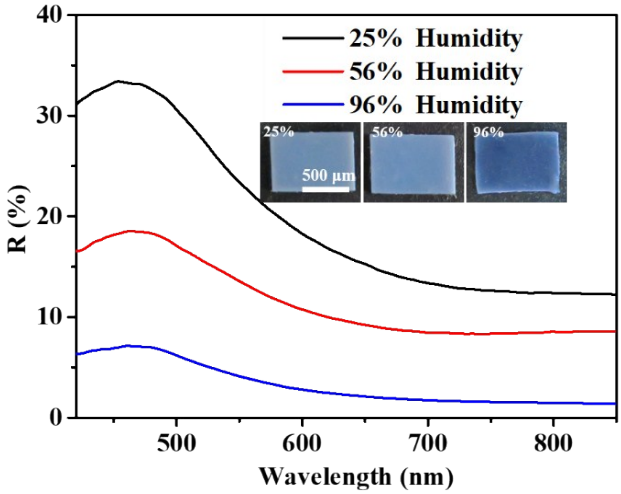

Fig. S7. Reflectance spectra of blue-colored SiO_2/PEG-UPy50 PE under different humidity RH. Insets showing the corresponding photographs of the PE under different RH.

As shown in the Figure S7, the peak position shows negligible change under different humidity conditions (e.g., 25%, 56%, and 96% RH), confirming the stable structural color. At high relative humidity (RH), the adsorbed water with a low refractive index from the external environment would decrease the effective refractive index of the PEs. We have investigated the effect of the RH on the effective refractive index of PEG-UPy polymer, and found that as the RH changes from 40%, 56% to 75%, the corresponding refractive index of the PEG-UPy polymer gradually decreases from 1.485, 1.457 to 1.413, which would result in a blue shift of the reflectance peak. On the other hand, the adsorbed water can swell the PEG-UPy polymer and increase the distance between the NPs, which would result in a red shift of the reflectance peak. Therefore, the SiO_2/PEG-UPy50 PE exhibit constant structural color when being exposed to high RH conditions. [S3, S4]

References

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