Polypyrrole/PU hybrid hydrogels: electrically conductive and fast self-healing for the potential application in body-monitor sensor

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Table S1. Compare of self-healing hydrogels (Materials, Mechanical properties, Self-healing conditions and efficiency, Functionalization, and Water content)

Materials	Mechanical properties	Self-healing conditions, self-healing efficiency	Functionality	Water content
PUASPy-0.2[1]	Breaking elongation and ultimate tensile strength are 554 % and 1.1 MPa	10 min, 50 ℃, 58 % efficiency	Conductive	72 %
PU10[2]	Breaking elongation and ultimate tensile strength are 2000 % and 0.382 MPa	10 min, room temperature, 86.6 % efficiency	None	62 %
PVA-TA300(S)[3]	Breaking elongation and ultimate tensile strength are 630 % and 5.6 MPa	1 h, room temperature, 39.8 % efficiency	Adhesiveness	40 %
CNC-PEG[4]	Breaking elongation and ultimate tensile strength are 690 % and 0.3 MPa	24 h, 90 ℃, 78 % efficiency	None	96 %
PANI/PSS−20UPy[5]	Breaking elongation and ultimate tensile strength are 650 % and 0.1 MPa	30 s, room temperature, 100 % efficiency	Conductive	78 %
A6ACA[6]	Breaking elongation and ultimate tensile strength are 580 % and 0.055 MPa	2s, pH<3, not mentioned	Adhesiveness	94 %
pAA-6βCD/pAA-Fc[7]	Continuous step strain measurements: G' of the pAA-6 b CD/pAA-Fc sol recovered to 90% of its initial state in 20 s	24 h, 24 ℃, 84 % efficiency	Sol−gel phase transition	Not mentioned
Dex-L-PEG[8]	Storage modulus = ~ 5000 Pa from strain amplitude sweep (γ = 1.0%) of rheological test	7 h, pH =7.4 ,37 ℃, 98.7% healing efficiency	None	Not mentioned
GCS–PEG[9]	Storage modulus = ~ 1000 Pa from amplitude oscillatory forces (γ = 1.0%) of rheological test	within 15 min, centrally punched hole disappeared	Injectable	Not mentioned

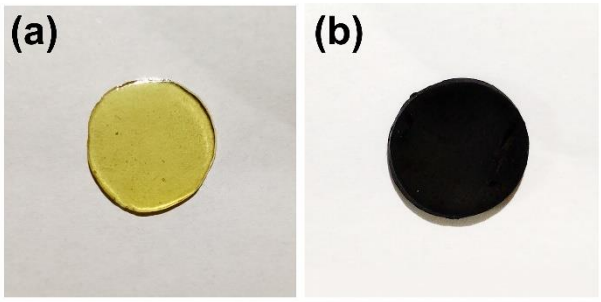

Figure S1. Photographs of PUAS(a) and PUASPy-0.2(b) hydrogels

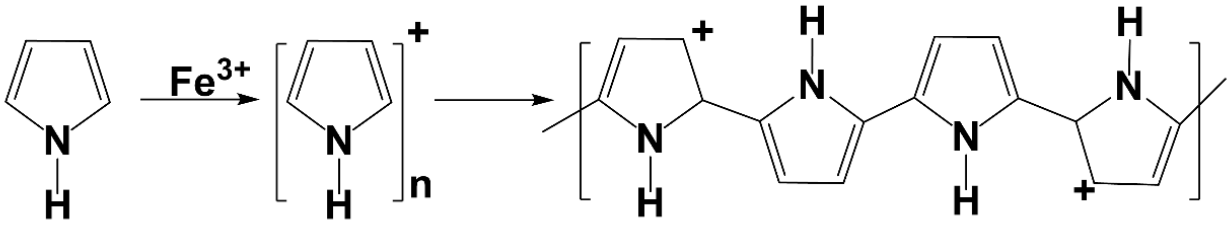

Figure S2. The mechanism of pyrrole polymerization

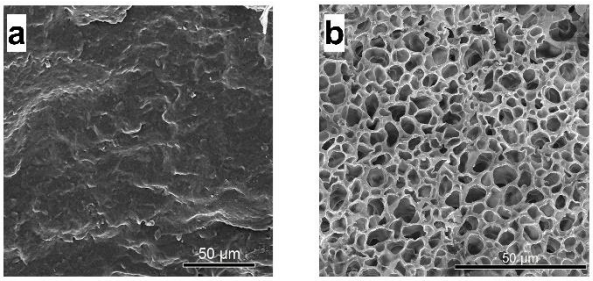

Figure S3. SEM micrographs of the PU0(a)/PU1(b) hydrogels (freeze-dried).

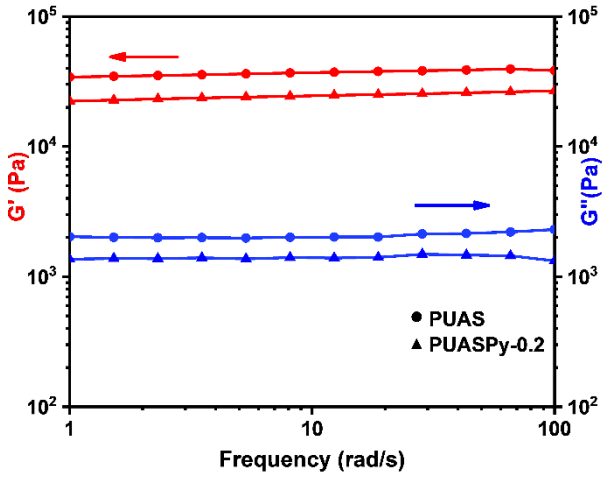

Figure S4. Storage modulus(G') and loss modulus(G'') of PUAS and PUASPy-0.2 hydrogels

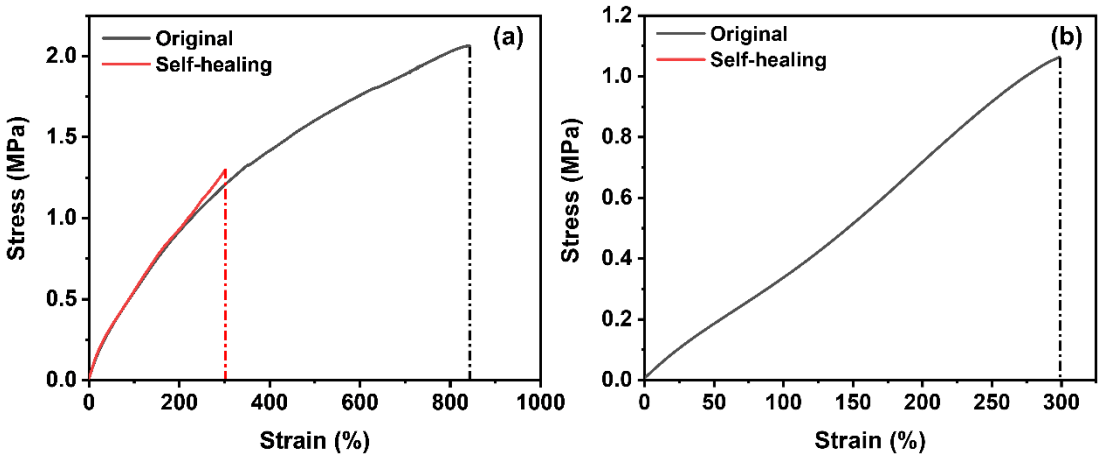

Figure S5. Tensile stress-strain curves of PUAS (a), PU0-0.2 (b) hydrogels at original and self-healing states

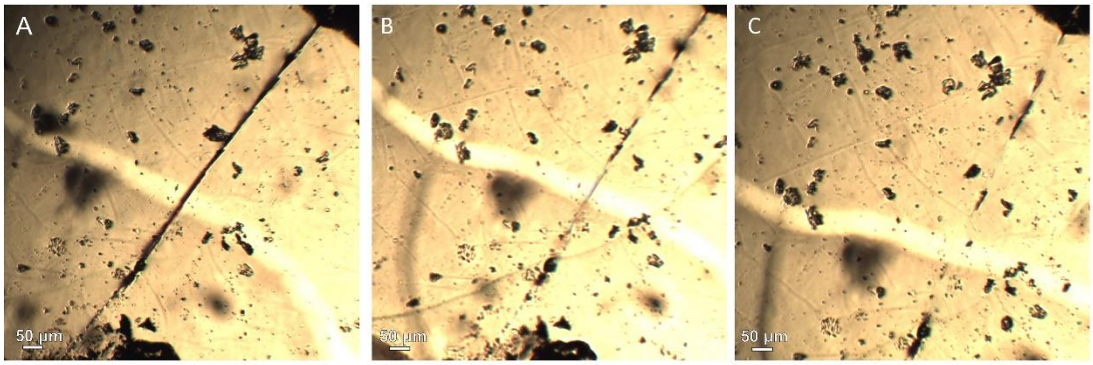

Figure S6. Optical microscopy images that recorded changes of the incision on the PUAS gel over time at 50 ℃: A, 0 min; B, 5 min; C, 10 min

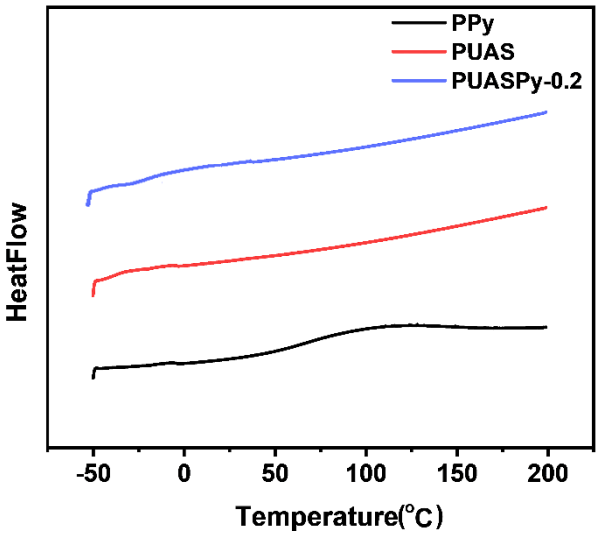

Figure S7. DSC of PPy, PUAS and PUASPy-0.2

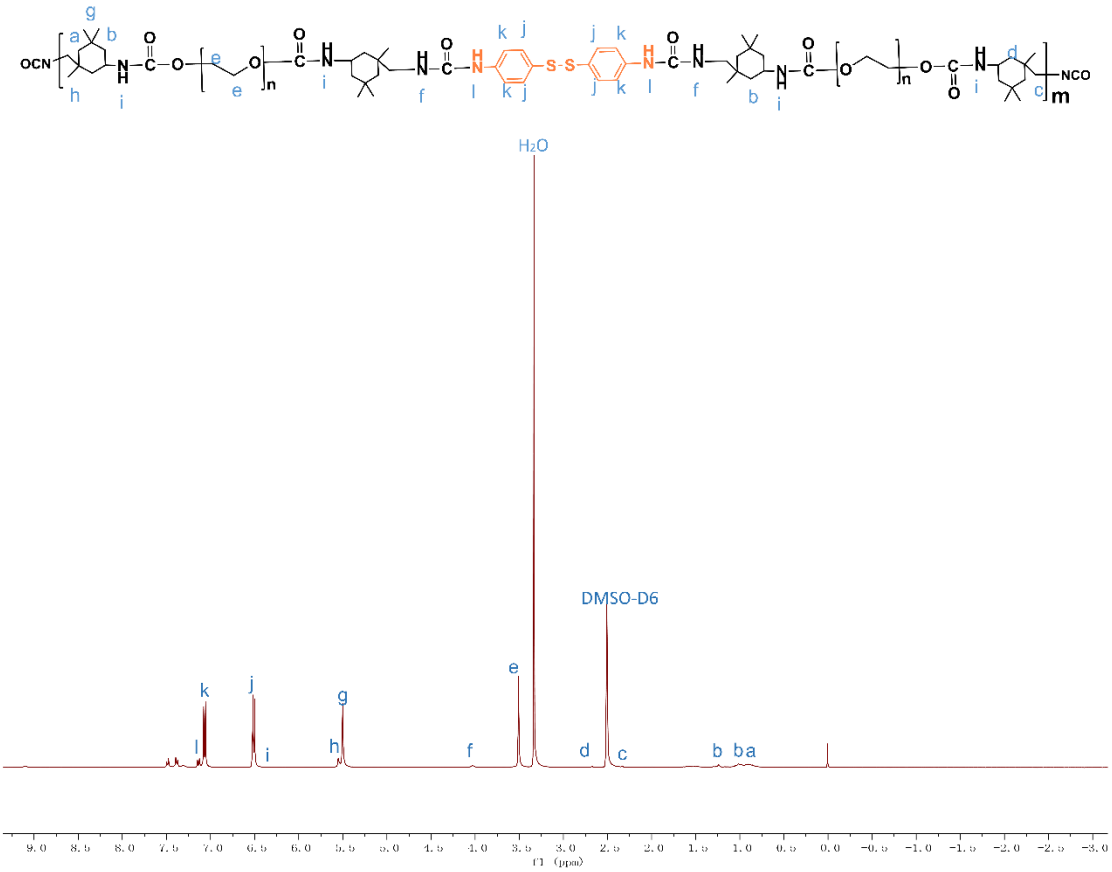

Figure S8. ^{1}H NMR spectrum (DMSO-D6) of PU prepolymer. δ (ppm) = 2.50-2.52 (DMSO-D6); 0.89, 0.97, 1.24, 2.34, 2.70(H_a, H_b, H_c, H_d –CH_2 of IPDI); 3.51 (H_e, -CH_2-CH_2- of PEG); 4.04, 6.30, 7.14 (H_f, H_i, H_l, -NH-); 5.51-5.56 (H_g, H_h -CH_3 of IPDI), 6.51 (H_j, -CH- of APDS), 7.07 (H_k, -CH- of APDS)

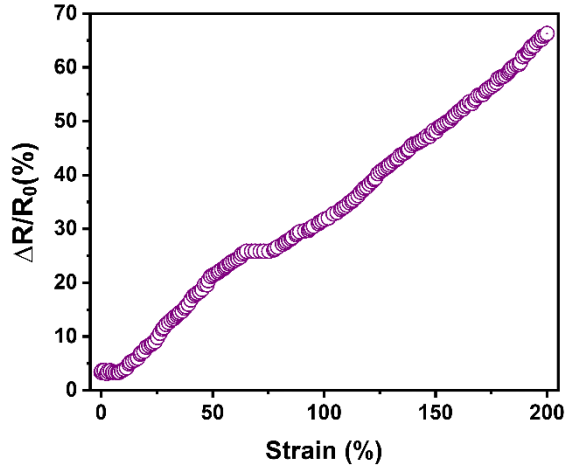

Figure S9. Resistance-strain curve of PUASPy-0.2 hydrogel

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