Hybrid Strengthening of Cellulose Nanocrystals Based Solvent Co-Cross Linked Flexible organohydrogels with Fast Self-healing, Diverse Adhesive Nature, and Anti-freezing Behavior for Advanced Human Health Monitoring

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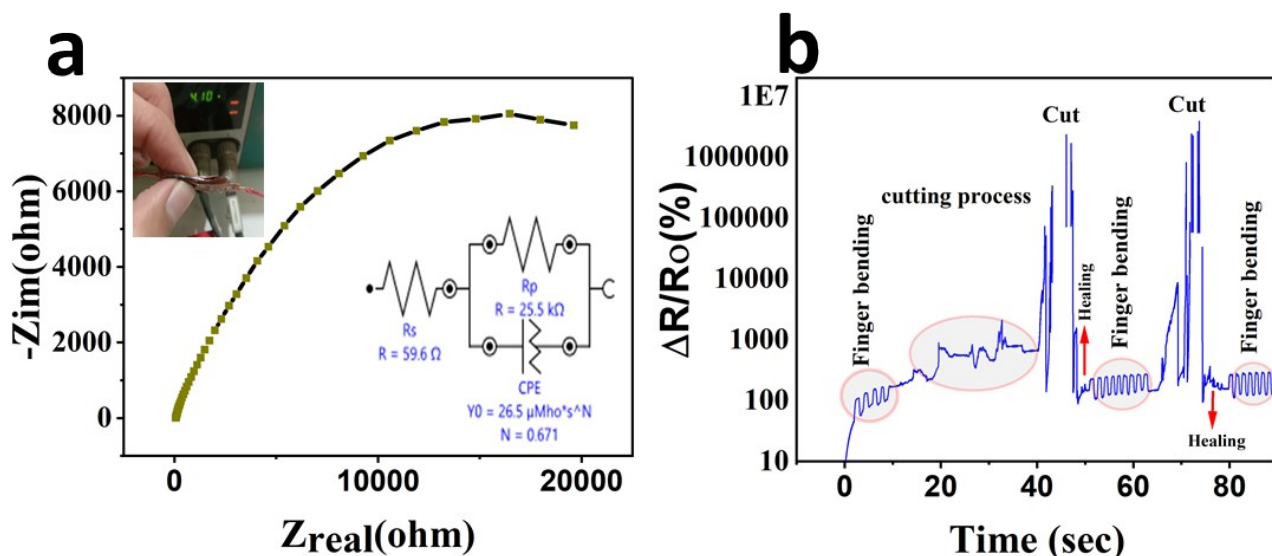
Figure S1 (a) Electrochemical impedance spectroscopy taken eight months later, (b) Self-healing analysis during the sensor response towards bending.

To calculate the electrical conductivity from EIS data we have utilized equation A.

$$\sigma = \frac{T}{RA}$$

A

σ = Conductivity (S/m)

T = Thickness of the gel (m)

R= Measured resistance (Ω)

A= Cross-sectional area (m²) (Width × Length of the gel in contact with electrodes)

Table S1: The generated report of EIS data taken eight months later

Element	Parameter	Value	Estimated Error (%)
Rs	R	59.65	1.995
Rp	R	25504	3.994
CPE	Y0	2.6471E-05	2.808
	N	0.67074	0.702
	χ^2	0.23351	

Table S2: The generated report of EIS data of freshly synthesized sample S5

Element	Parameter	Value	Estimated Error (%)
Rs	R	25.756	2.245
Rp	R	5108.8	3.492
CPE	Y0	8.5666E-05	3.374
	N	0.62106	0.872
	χ^2	0.23271	

Table S3: Statistical Analysis of stress data (tensile test) of S1, S2, S3, S4, and S5

SUMMARY

Groups	Count	Sum	Average	Variance
sample 1	1520	763977.7	502.6169	84218.27

sample 2	15008	16234421	1081.718	5.28E+08
sample 3	13343	24386656	1827.674	1.21E+09
Sample 4	10196	22270535	2184.242	1.39E+09
Sample 5	14380	43473620	3023.2	2.65E+09

ANOVA

Source of Variation	SS	Df	MS	F	P-value	F crit
Between Groups	3.18E+10	4	7.95E+09	5.666915	0.000148	2.372095
Within Groups	7.64E+13	54442	1.4E+09			
Total	7.64E+13	54446				

Table S4: Statistical Analysis of strain data (tensile test) of S1, S2, S3, S4, and S5

SUMMARY

Groups	Count	Sum	Average	Variance
Sample 1	1521	116247	76.42801	1328.558
Sample 2	15001	1132868	75.5195	661.2845
Sample 3	13329	1513523	113.5511	3869.208
Sample 4	10181	2300241	225.9347	14880.74
Sample 5	14357	3521883	245.3077	23930.88

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	294930534	4	73732633	7179.144	0.0000	2.372096
	558545067	54384	10270.39			

Within Groups		
Total	**853475601**	**54388**

Table S5: Statistical Analysis of finger bending initially and five months later (comparison of Figure 8b and 8f)

SUMMARY

Groups	Count	Sum	Average	Variance
Finger bending of fresh sample	1750	60819.67	34.7541	137.6284
Finger bending (Five months later)	1750	131782.2	75.30412	341.911

ANOVA

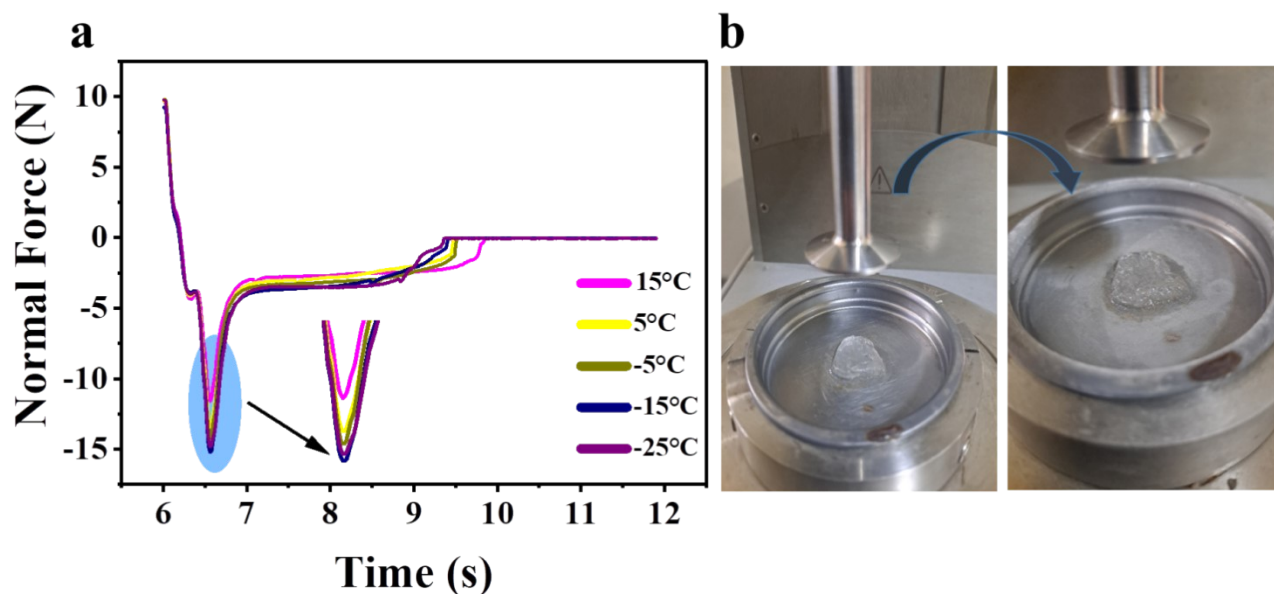| Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	1438766	1	1438766	6000.616	0.0000	3.844119
Within Groups	838714.5	3498	239.7697			
Total	2277480	3499				

Figure S2 a) Adhesion track test at different temperatures, (b) Photographs of organohydrogel during adhesion track test at 15°C and -25°C

Figure S3 (a) Photograph of freshly synthesized organohydrogel at subzero temperature, (b) Photograph of stored organohydrogels for eight months in sealed plastic bag.
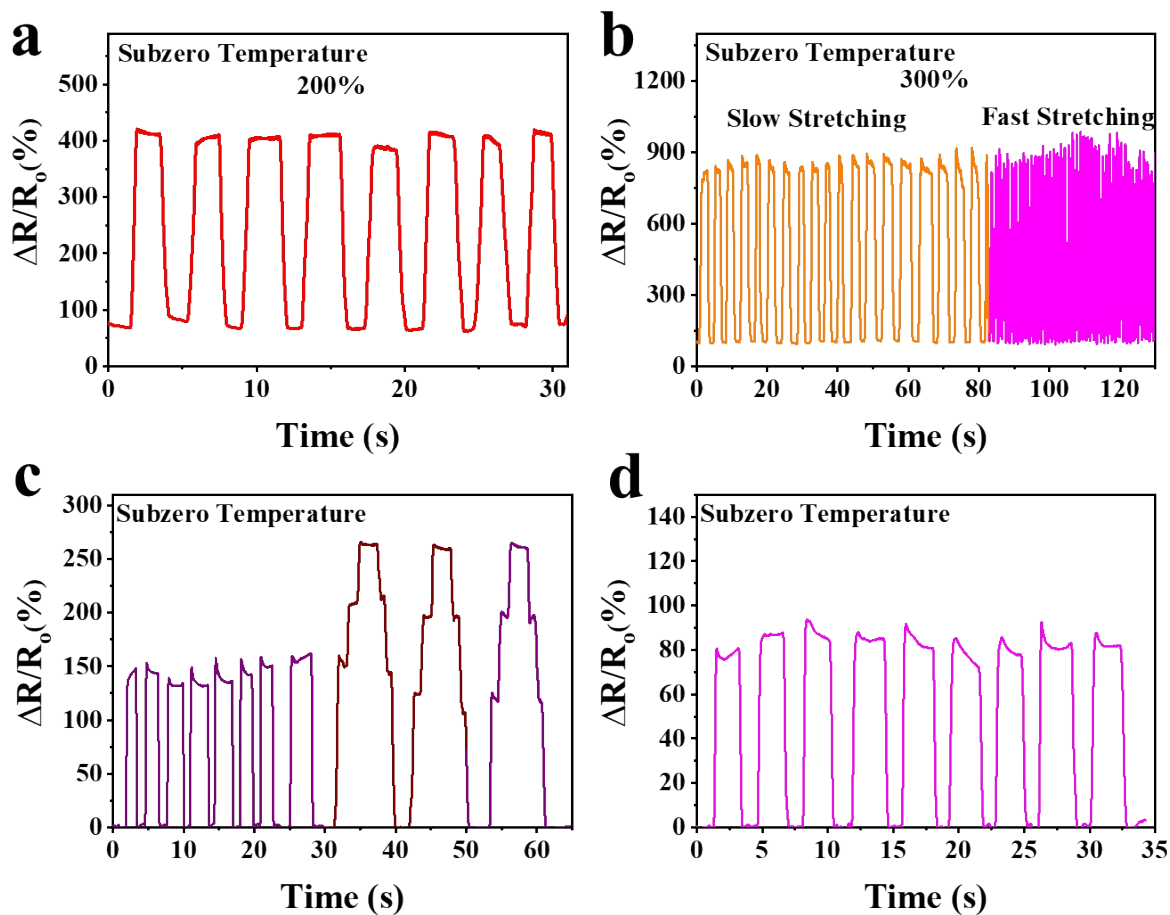
Figure S4 Strain sensing and human motion detection occurs at subzero temperature, (a) Strain sensing at 200%, (b) Slow and fast stretching at 300%, (c) Finger bending at one and different angles (d) Wrist bending at one angle.