

Supporting Information

Hydrogen Bonding Sewing Interface

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Section I. Mechanical Properties of Aramid Sensing Fibers

Table S1. Mechanical properties of aramid sensing fibers.

Test #	Fiber Diameter μm	Tensile Strength GPa	Elastic Modulus GPa
Test 1	17.4	2.08	50.76
Test 2	17.4	3.94	93.18
Test 3	17.4	2.71	81.04
Test 4	17.4	2.85	93.41
Test 5	17.4	3.64	70.14
Test 6	17.4	3.60	82.46
Test 7	17.4	2.63	80.14
Average ± standard deviation		3.06 ± 0.67	78.73 ± 14.73

Section II. Spring Constant Measurement of Aramid Sensing Cantilevers

Table S2. Spring constant measurement of individual aramid sensing cantilevers.

Sensor #	Fiber Diameter μm	Elastic Modulus GPa	Length mm	Spring constant N/m
Sensor 1	17.4	78.73	5.60	0.0043
Sensor 2	17.4	78.73	2.55	0.046
Sensor 3	17.4	78.73	1.69	0.157
Sensor 4	17.4	78.73 </td <td>3.56</td> <td>0.017</td>	3.56	0.017
Sensor 5	17.4	78.73	2.67	0.040
Sensor 6	17.4	78.73	2.56	0.045
Sensor 7	17.4	78.73	2.97	0.029
Sensor 8	17.4	78.73	2.56	0.045

Section III. Debonding of Individual Carbon Fiber out of FTO Glass without Water Pretreatment

Table S3. Specific ISR between individual carbon fiber and FTO glass without water pretreatment.

Test #	Sensor #	Spring constant (N/m)	Contact length (mm)	Deflection (μm)	Debonding force (μN)	Specific ISR ($\mu\text{N}/\text{mm}$)
1	1	0.0043	0.29	220	0.95	3.27
2	1	0.0043	0.29	143	0.62	2.14
3	1	0.0043	0.29	190	0.83	2.86
4	1	0.0043	0.29	154	0.68	2.34
Average \pm standard deviation						2.65 \pm 0.51

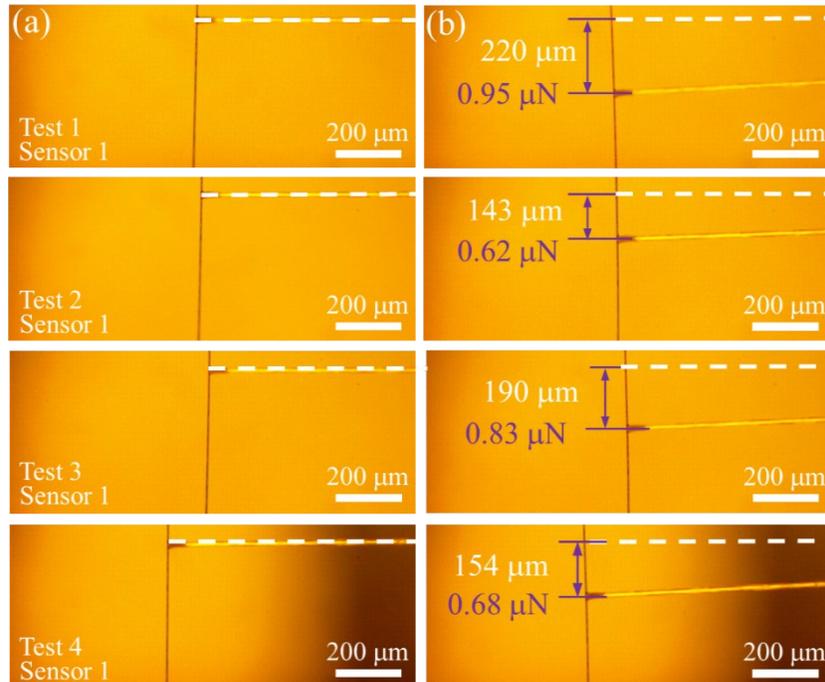


Figure S1. Debonding of individual carbon fiber out of FTO glass without water pretreatment. Column (a) Optical image of bridged carbon fiber and aramid sensing fiber before test. Column (b) Last moment before debonding the carbon fiber out of the FTO glass.

Section IV. Debonding of Individual Water-treated Carbon Fiber out of FTO Glass after Water Evaporation

Table S4. Specific ISR between individual water-treated carbon fiber and FTO glass after water evaporation.

Test #	Sensor #	Spring constant (N/m)	Contact length (mm)	Deflection (μm)	Debonding force (μN)	Specific ISR ($\mu\text{N}/\text{mm}$)
1	2	0.046	0.28	899	41.35	147.14
2	2	0.046	0.28	869	39.97	142.14
3	2	0.046	0.28	736	33.86	120.36
4	3	0.157	0.28	395	62.02	221.79
Average \pm standard deviation						157.86 \pm 44.18

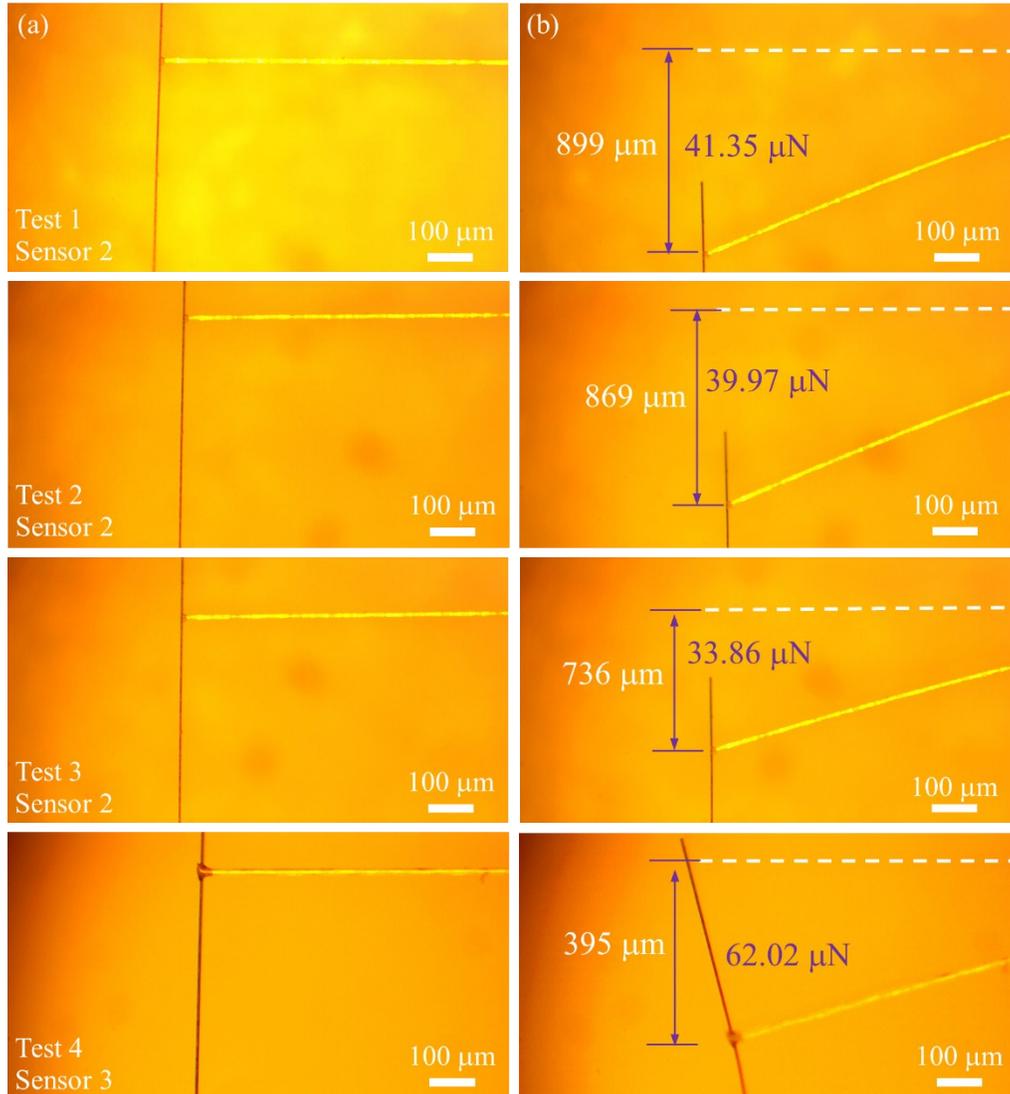


Figure S2. Debonding of individual water-treated carbon fiber out of FTO glass after water evaporation. Column (a) Optical image of bridged **water-treated** carbon fiber and aramid sensing fiber before test. Column (b) Last moment before debonding the carbon fiber out of the FTO glass after water treatment.

Section V. Debonding of Individual Hexane-treated Carbon Fiber out of FTO after Hexane Evaporation

Table S5. Specific ISR between individual hexane-treated carbon fiber and FTO glass after hexane evaporation.

Test #	Sensor #	Spring constant (N/m)	Contact length (mm)	Deflection (μm)	Debonding force (μN)	Specific ISR ($\mu\text{N}/\text{mm}$)
1	4	0.017	0.28	66	1.12	4.00
2	4	0.017	0.28	65	1.10	3.93
3	5	0.040	0.28	21	0.83	2.96
4	5	0.040	0.28	23	0.93	3.32
Average \pm standard deviation						3.55 \pm 0.50

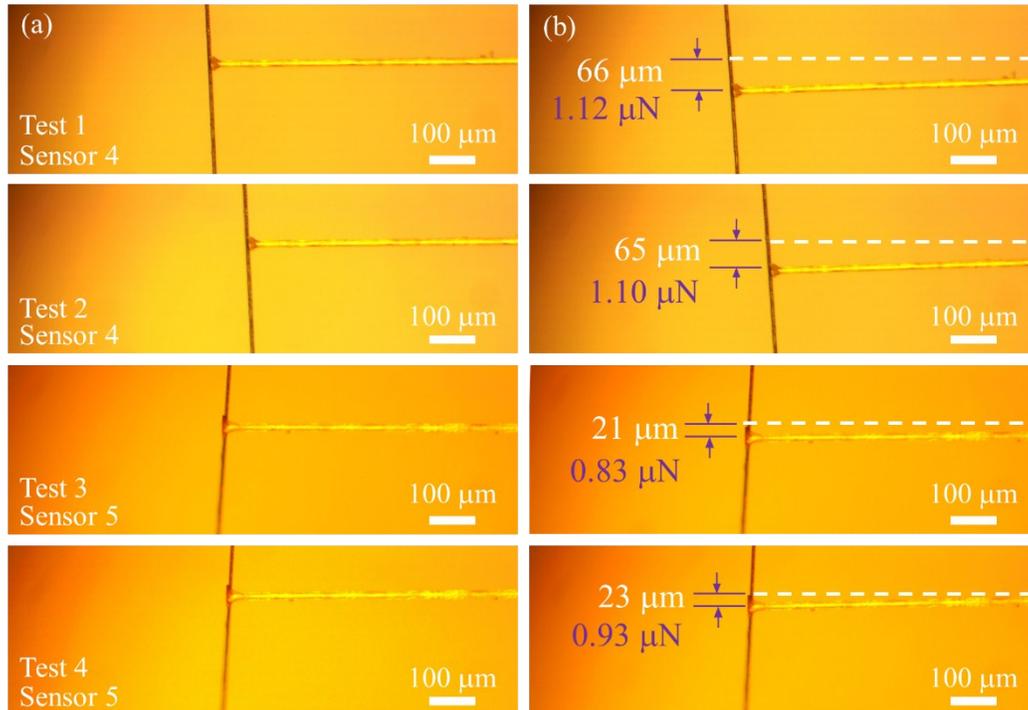


Figure S3. Debonding of an individual hexane-treated carbon fiber out of FTO glass after hexane evaporation. Column (a) Optical image of bridged hexane-treated carbon fiber and aramid sensing fiber before test. Column (b) Last moment before debonding the carbon fiber out of the FTO glass after hexane evaporation.

Section VI. Debonding of Individual Carbon Fiber out of Au Coated Glass without Pretreatment

Table S6. Specific ISR between individual carbon fiber and Au coated glass without pretreatment.

Test #	Sensor #	Spring constant (N/m)	Contact length (mm)	Deflection (μm)	Debonding force (μN)	Specific ISR ($\mu\text{N}/\text{mm}$)
1	1	0.0043	0.29	62	0.27	0.93
2	1	0.0043	0.29	132	0.57	1.97
3	1	0.0043	0.29	113	0.49	1.69
4	1	0.0043	0.29	73	0.32	1.10
Average \pm standard deviation						1.42 \pm 0.49

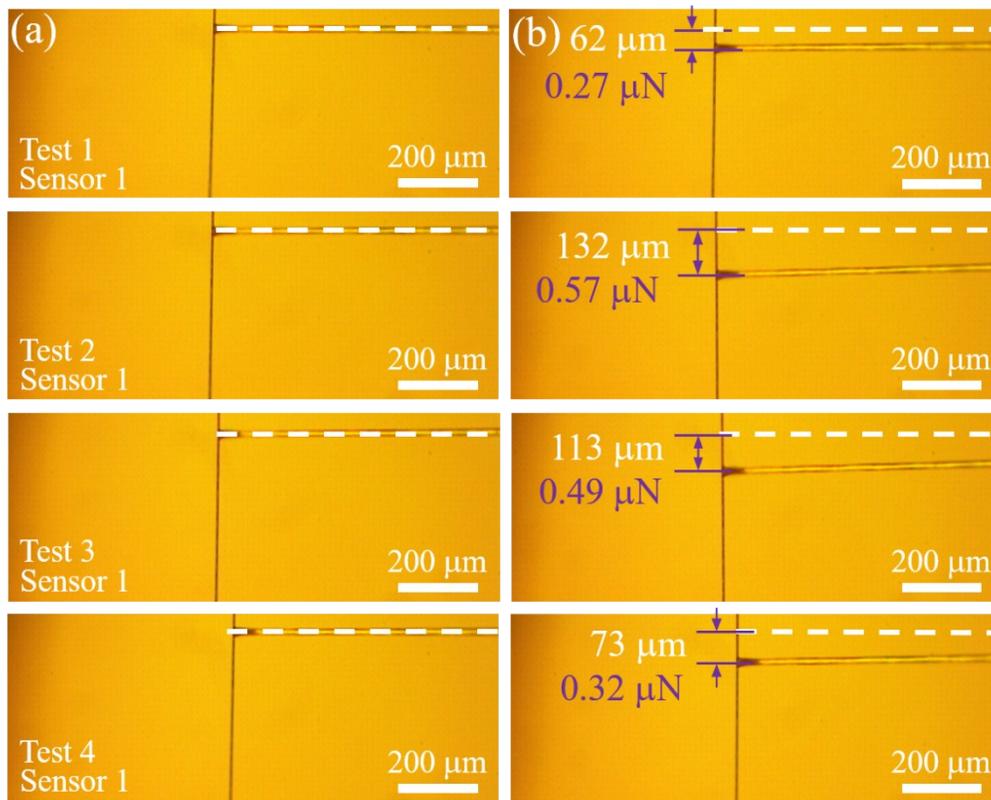


Figure S4. Debonding of individual carbon fiber out of Au coated glass without pretreatment. Column (a) Optical image of bridged carbon fiber and aramid sensing fiber before test. Column (b) Last moment before debonding the carbon fiber out of the Au without water pretreatment.

Section VII. Debonding of Individual Water-treated Carbon Fiber out of Au Coated Glass after Water Evaporation

Table S7. Specific ISR between individual water-treated carbon fiber and Au coated glass after water evaporation.

Test #	Sensor #	Spring constant (N/m)	Contact length (mm)	Deflection (μm)	Debonding force (μN)	Specific ISR ($\mu\text{N}/\text{mm}$)
1	3	0.157	0.28	158	24.80	88.57
2	3	0.157	0.28	174	27.40	97.86
3	6	0.045	0.26	605	27.25	104.81
4	6	0.045	0.26	587	26.42	101.62
Average \pm standard deviation						98.21 \pm 7.03

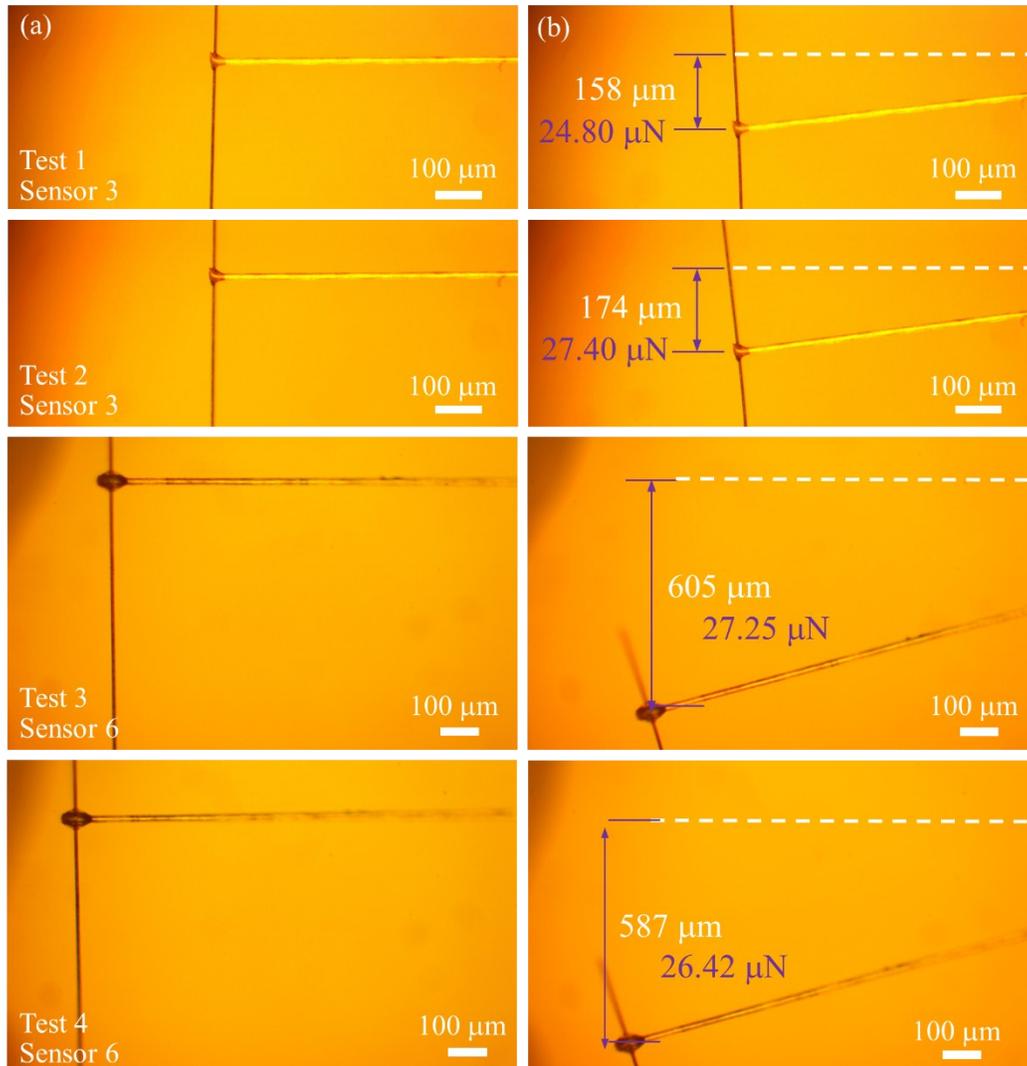


Figure S5. Debonding of individual water-treated carbon fiber out of Au coated glass after water evaporation. Column (a) Optical image of bridged water-treated carbon fiber and aramid sensing fiber before test. Column (b) Last moment before debonding the carbon fiber out of the Au after water treatment.

Section VIII. Contact Angle Measurement

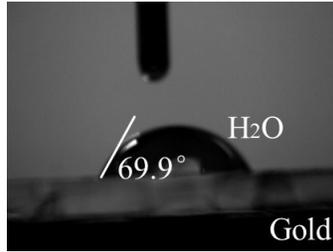


Figure S6. Measurement of contact angle between H₂O and Au coated glass.

Section IX. Debonding of Individual Hexane-treated Carbon Fiber out of Au Coated glass after Hexane Evaporation

Table S8. Specific ISR between an individual hexane-treated carbon fiber and Au coated glass after hexane evaporation.

Test #	Sensor #	Spring constant (N/m)	Contact length (mm)	Deflection (μm)	Debonding force (μN)	Specific ISR (μN/mm)
1	7	0.029	0.26	22	0.64	2.46
2	8	0.045	0.26	27	1.12	4.67
3	1	0.0043	0.31	305	1.45	4.67
4	1	0.0043	0.33	231	0.99	3.01
Average ± standard deviation						3.70±1.14

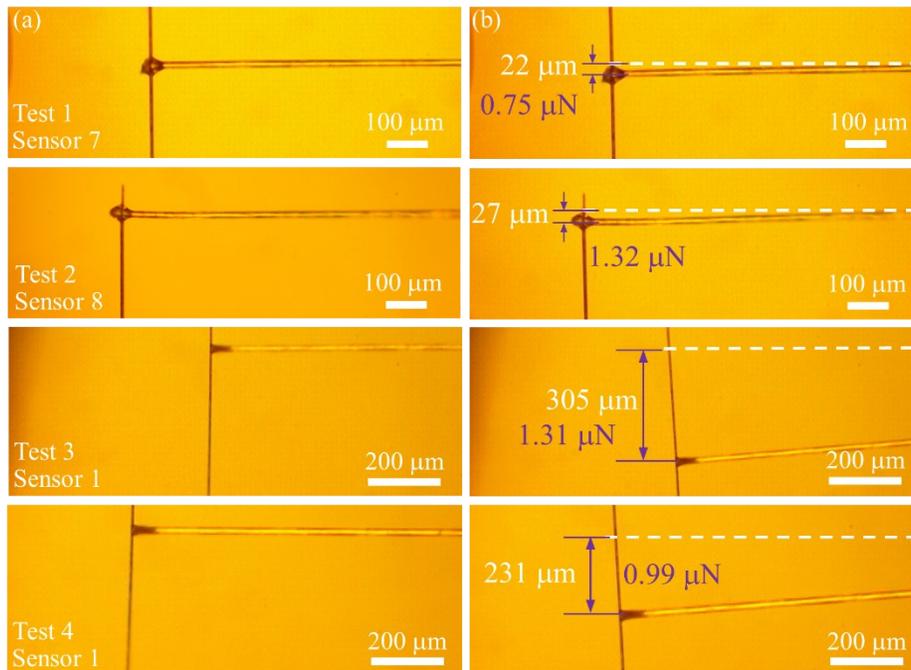


Figure S7. Debonding of individual hexane-treated carbon fiber out of Au coated glass after hexane evaporation. Column (a) Optical image of bridged hexane-treated carbon fiber and aramid sensing fiber before test. Column (b) Last moment before debonding the carbon fiber out of the Au after hexane evaporation.