Electronic Supplementary Material (ESI) for RSC Advances.

SUPPORTING INFORMATION

Byssal Threads Inspired Ionic Cross-Linked Narce-Like Grahpene Oxide Paper with Superior Mechanical Strength

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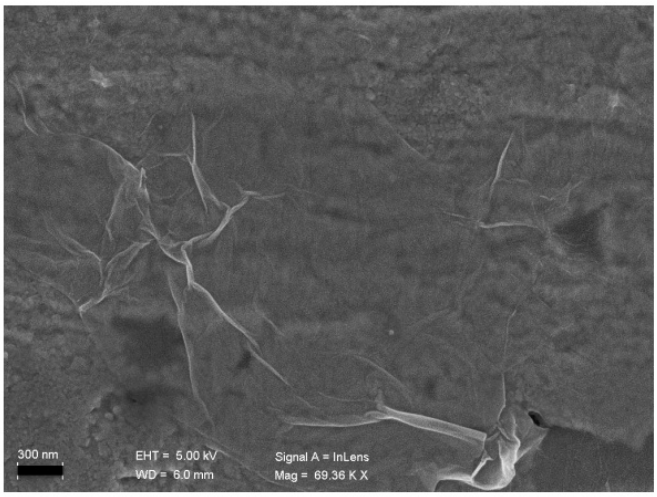

Fig. S1 SEM image of GO nanosheets used in our experiment. The scale bar is 300 nm.

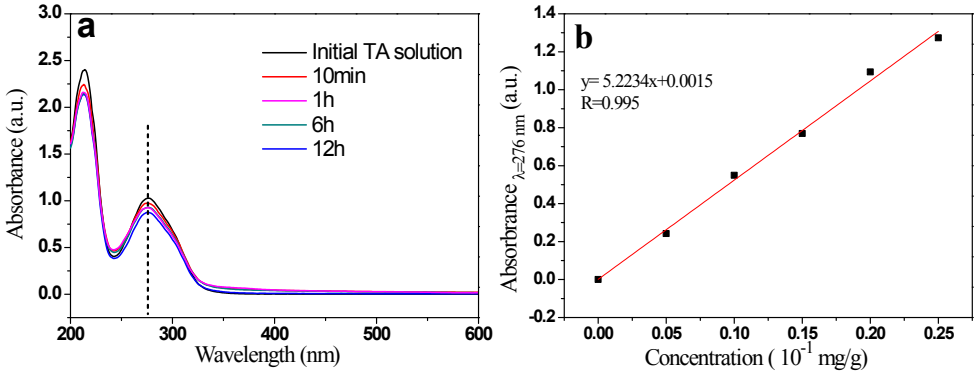

Fig. S2 a) UV-Vis spectra of filtered GO-TA mixture solution of different absorption time. Initial concentrations of GO and TA were 0.4 mg/mL and 0.2 mg/mL, respectively. Each solution was diluted by water with 9 times of volume before UV-Vis measurement. b) The standard curve of tannic acid (TA).

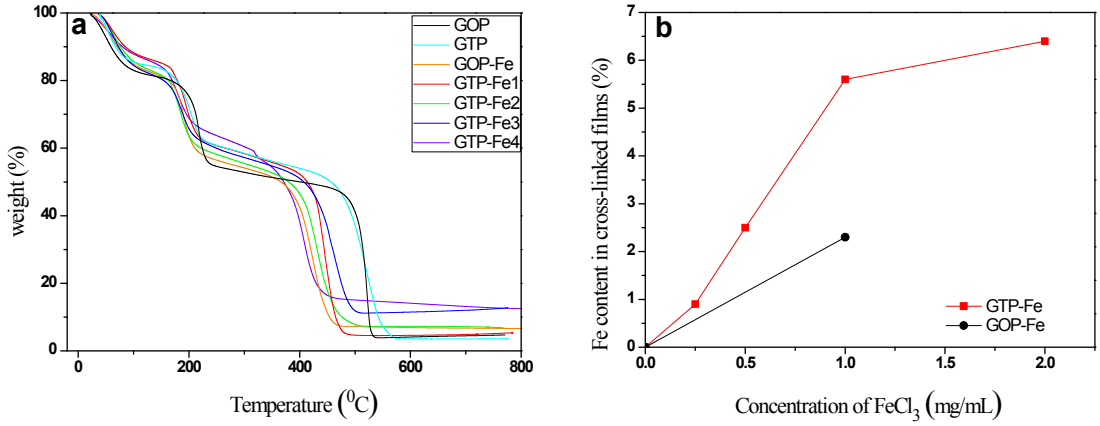

Fig. S3 a) TGA curves of the respective papers. b) The relationship between the Fe content in cross-linked films and the concentration of $FeCl_3$ solution.

The Fe content in the paper was calculated from the remaining mass at 750 °C. Fe_2O_3 was formed at 750 °C and the Fe content was determined as follow:

$$P_{Fe} = (P_{750} - P_{control-750}) \times (2M(Fe) \div M(Fe_2O_3)) = (P_{750} - P_{control-750}) \times 0.6994$$

P_{Fe} is the Fe content of the tested sample;

P_{750} is the remaining weight percentage of the tested sample and $P_{control-750}$ is the remaining weight percentage of the respective control sample (GOP or GTP).

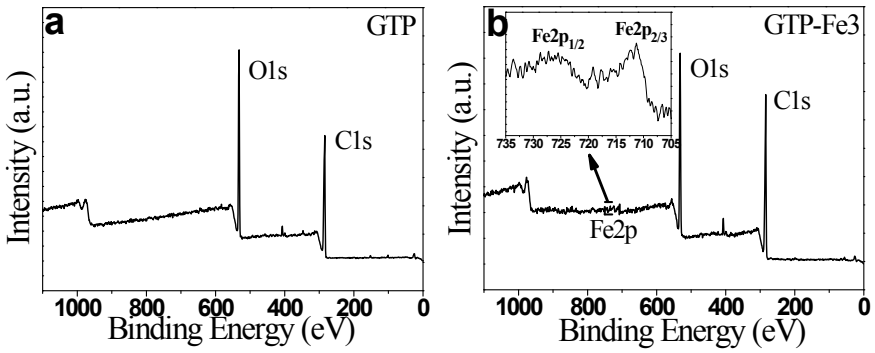

Fig. S4 (a) XPS wide scans of GTP; (b) XPS wide scans of GTP-Fe3, and the inset of Fe 2p spectra.

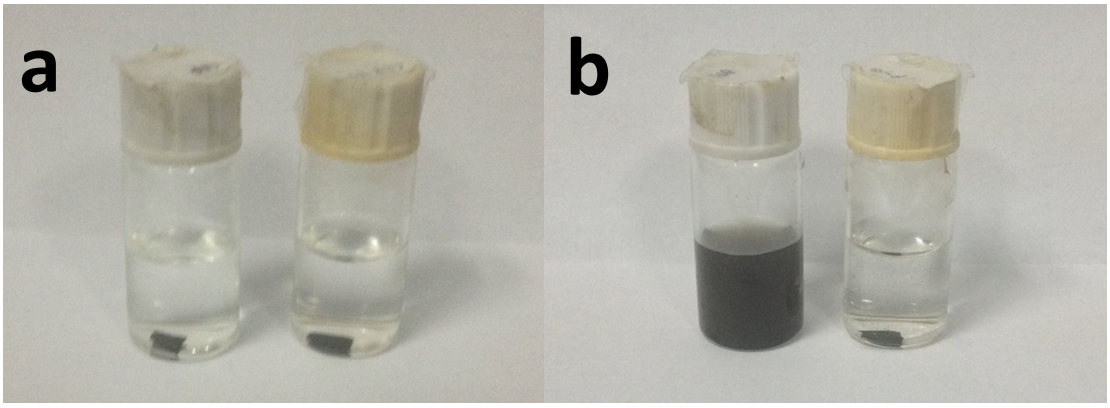

Fig. S5 The digital images of pristine GOP (left) and GTP-Fe1 (right) before (a) and after (b) ultrasonicating for 10 minutes, demonstrating the high stability of our obtained cross-linked GO film in water.

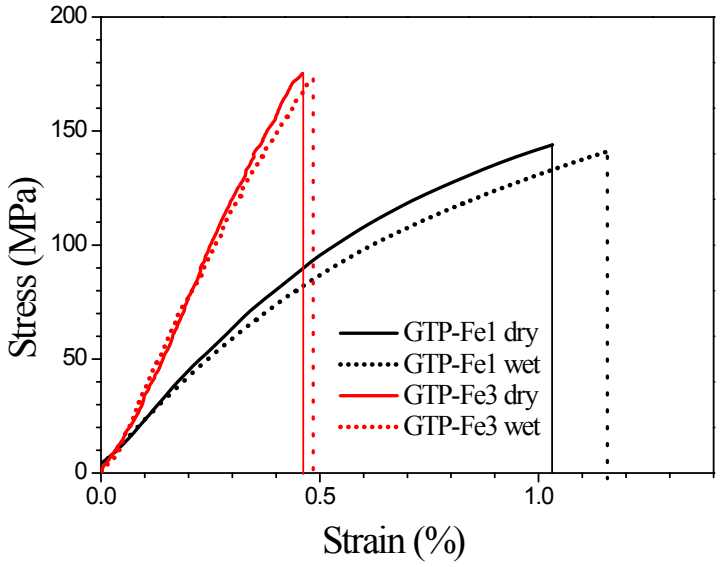

Fig. S6 Stress–strain curves of the dry paper samples (solid curves) and wet paper samples (dotted curves). The wet samples were prepared by immersing the dry samples in water for 24 hours.

Table S1 The comparison of mechanical proprieties of our Fe^{3+}-TA cross-linked GOP with other GO based papers.

Cross-linking Strategies	Stress [MPa]	Young's modules [GPa]	Ultimate strain [%]	Reference
GO-PAA	91.9	33.3	0.32	23
GO-PMMA	148.3	7.5	3.17	25
GO-PVA	71	27.6	0.27	25
GO-DOPA-PEI	178.96	84.84	0.24	29
GO-Borate	185	127	0.24	26
GO-Mg^{2+}	87.9	24.6	0.4	27
GO-Ca^{2+}	125.8	28.1	0.5	27
GO-Fe^{3+}	92.47	19.6	1.02	Our work
GO-TA-Fe^{3+}	138.83-169.27	23.1-49.7	0.97-0.41	Our work

Table S2 Complete results of the tensile tests.

Sample	Thickness (μm)	Width (mm)	Stress (MPa)	Strain (%)	Young's Modulus* (GPa)
GOP-a1	17.2	6.71	80.78	1.44	10.2
GOP-a2	17.2	5.64	73.27	1.60	6.5
GOP-a3	17.2	5.64	83.95	1.52	7.8
GOP-b1	5.1	6.51	73.41	1.74	9.0
GOP-b2	5.1	7.35	77.20	1.82	6.3
GTP-a1	16.1	4.85	61.00	1.28	9.0
GTP-a2	16.1	4.85	63.18	1.44	7.1
GTP-a3	16.1	4.83	71.45	1.68	8.4
GTP-b1	4.5	5.16	77.72	1.04	10.6
GTP-b2	4.5	4.98	68.08	1.12	9.4
GOP-Fe-1	9.2	7.21	72.65	0.76	23.1
GOP-Fe-2	9.2	6.82	92.71	1.10	16.8
GOP-Fe-3	9.2	6.15	112.07	1.22	19.0
GTP-Fe1-1	9.0	6.56	137.89	1.02	25.3
GTP-Fe1-2	9.0	6.89	148.33	1.08	23.1

GTP-Fe1-3	9.0	6.89	129.21	0.82	20.9
GTP-Fe2-1	7.6	7.12	135.40	0.70	29.3
GTP-Fe2-2	7.6	8.20	146.07	0.61	30.4
GTP-Fe2-3	7.6	6.68	165.76	0.74	28.8
GTP-Fe3-1	4.1	8.03	166.92	0.39	52.0
GTP-Fe3-2	4.1	7.46	160.73	0.37	49.1
GTP-Fe3-3	4.1	7.46	174.14	0.44	47.9

* Young's modulus is determined by fitting the stress-strain curve in the linear regime with a straight line.