Electronic Supplementary Material

Achieving near-infrared-light-mediated switchable friction regulation on MXene-based double network hydrogels

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Supplementary methods

Chemicals and materials:

Ti_3AlC_2 (MAX, 98%, 11 Technology Co., Ltd., China); lithium fluoride (LiF, 99%, Aladdin, China); concentrated HCl (Dexiang Chemistry Co., Ltd., China); 2-Acrylamido-2-methylpropanesulfonic acid (AMPS, 98%, Alfa Aesar); chitosan (CS, acyl ≥ 95%, viscosity 100–200 mPa.s, aladdin); N-isopropylacrylamide (NIPAM, > 98%, TCI); N,N′-methylenebisacrylamide (MBAA, > 99.5%, Sigma-Aldrich); 2-Oxoglutaric Acid (99%, TCI); deionized water was obtained from a Milli-Q water system.

Supplementary figures

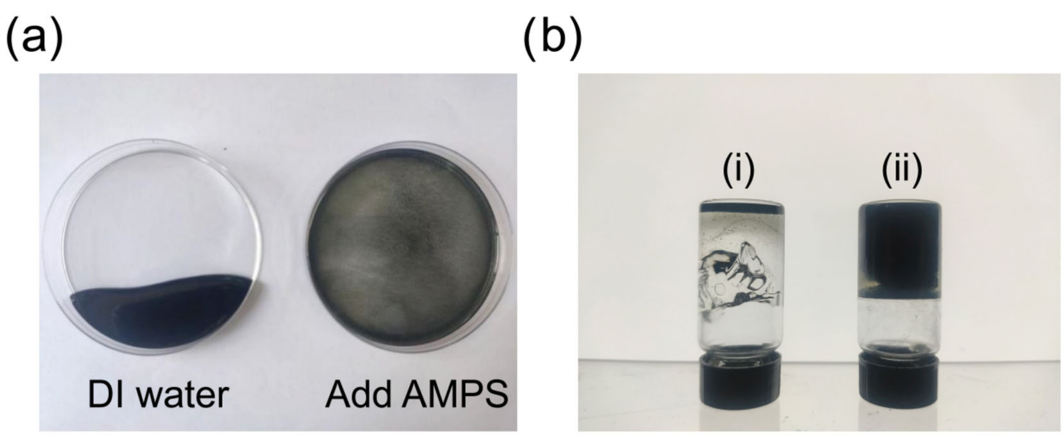

Fig. S1 (a) Optical picture of the change in dispersion of $Ti_3C_2T_x$ in deionized (DI) water and after the addition of 2-acrylamido-2-methyl-1-propanesulfonic acid (AMPS); and (b) gelatinization phenomenon occurred after the addition of MXene to the AMPS solution: (i) MXene concentration of 0.2 mg/mL, (ii) MXene concentration of 0.6 mg/mL.

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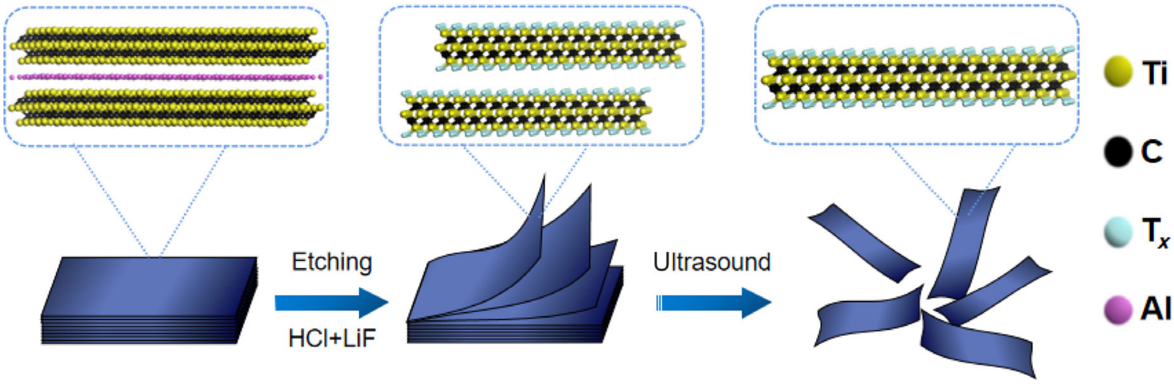

Fig. S2 Preparation process of MXene nanosheets.

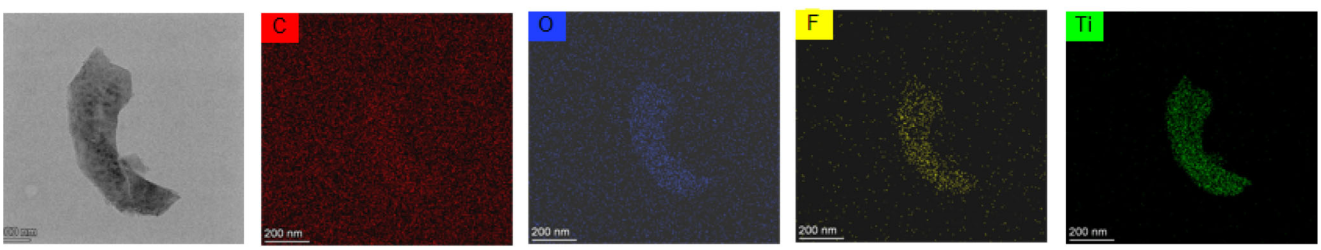

Fig. S3 Transmission electron microscopy (TEM) image of MXene nanosheets after probe sonication.

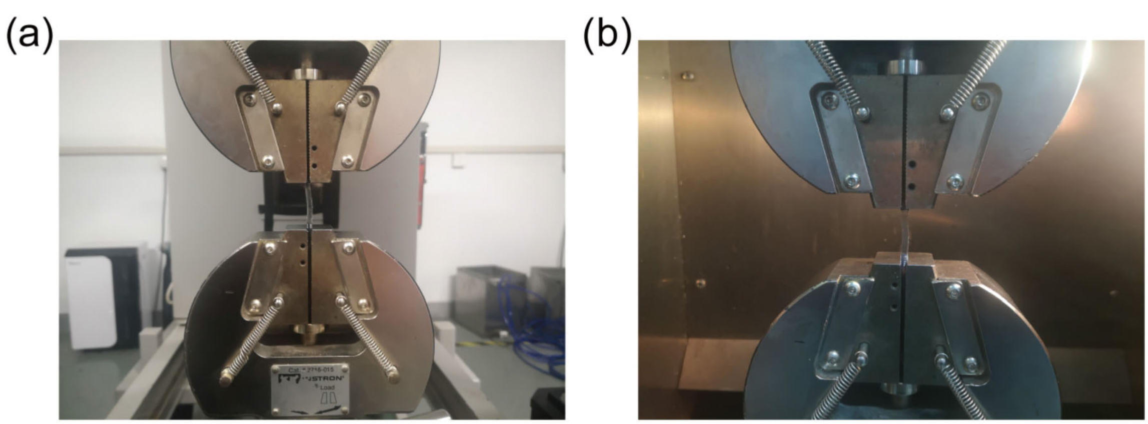

Fig. S4 Optical picture of the tensile test. (a) Room temperature tensile test, tensile speed 50 mm/min; (b) 50 °C tensile test, tensile speed 50 mm/min.

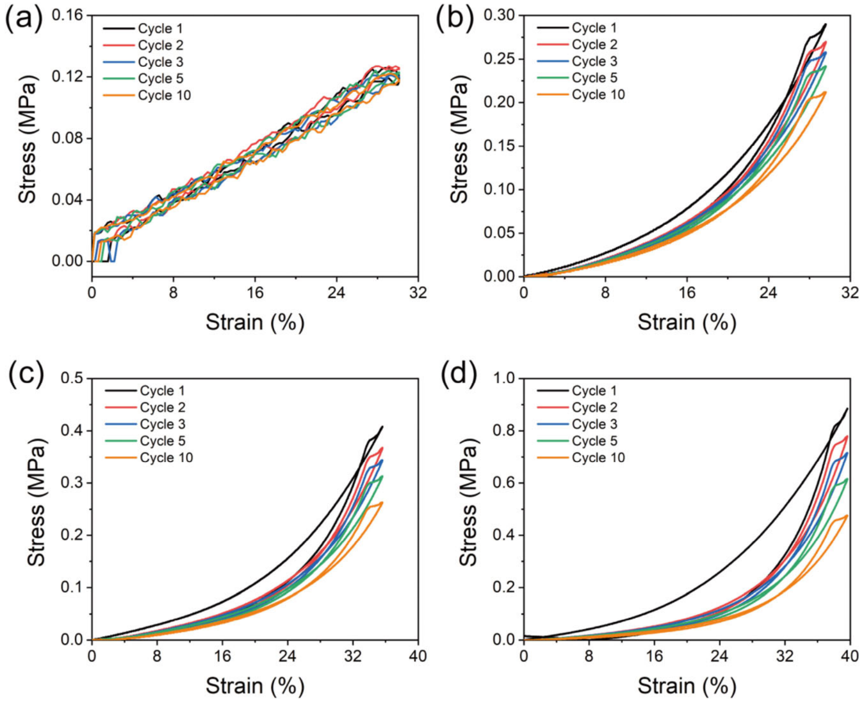

Fig. S5 Stress–strain curves for M–DN hydrogels loaded–unloaded in tension and loaded–unloaded in compression. (a) Tensile loading–unloading test of M–DN hydrogels at 30% strain and 25 °C; (b) 30% strain, M–DN hydrogel compression loading–unloading test at 25 °C; (c) M–DN hydrogel compression loading–unloading test at 36% strain and 25 °C; and (d) 40% strain, M–DN hydrogel compression loading–unloading test at 25 °C.

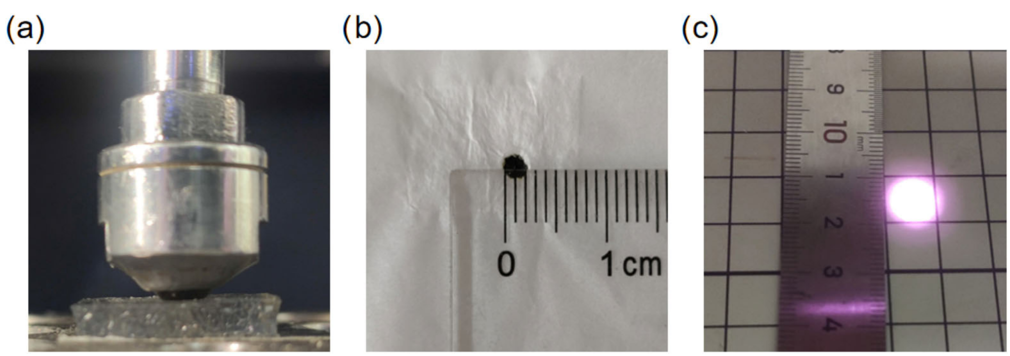

Fig. S6 (a) Downwards pressure of the glass sphere on the hydrogel at 1 N; (b) size of contact area between glass sphere and hydrogel at 1 N pressure; and (c) picture of near infrared light diameter size.

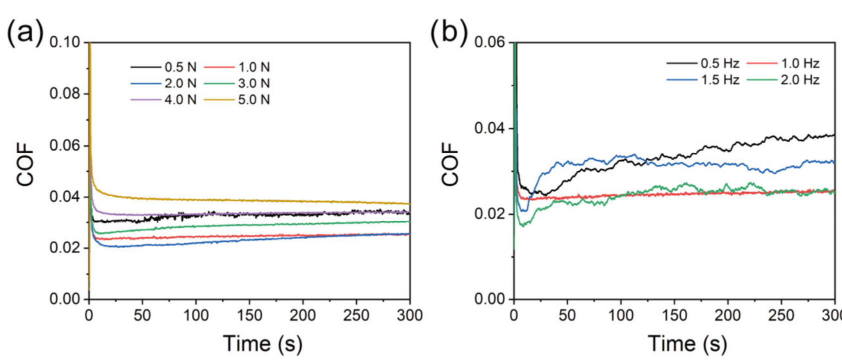

Fig. S7 M–DN hydrogel friction condition test. (a) Variation in the friction coefficient under different pressure conditions and (b) friction coefficient changes under different frequency conditions.