

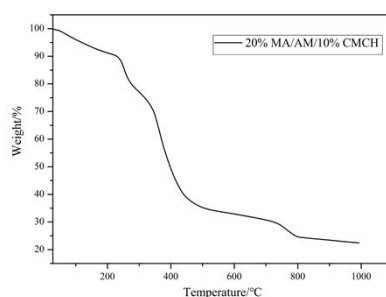
## A semi-interpenetrating network polyampholyte hydrogel simultaneously demonstrating remarkable toughness and antibacterial properties

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### Characterization of CMCH/AM/MA hydrogel:

Thermo gravimetric analytical images of the 10% CMCH/AM/20% MA hydrogel were depicted in Fig.S1.

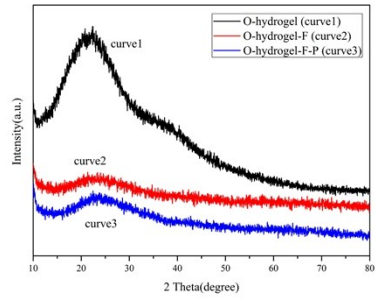
We used an SDT-Q600 (TA Instrument) under N<sub>2</sub> atmosphere at a heating rate of 10°C/min over a temperature range of 30-1000°C. The sample was sufficiently dried and crushed. As Fig 6 shows, the samples lost about 10% weight before 250 °C in the first stage, which is due to the evaporation of bonded water. The second stage occurred over 250-800°C. This stage is the beginning of degradation and formation of carbonaceous residue. Finally, the sample reached a steady state over 700-1000°C although it displays good thermal stability below 250°C.



**Fig. S1** Thermo gravimetric analysis of 10% CMCH/AM/20% MA hydrogel.

The X-ray diffraction spectrum of the dry 10% CMCH/AM/20% MA hydrogels containing O-hydrogel, O-hydrogel-F, O-hydrogel-F-P were characterized to study these hydrogels. As shown in figure s2,

These three hydrogel all had one peak at about 24°, and the O-hydrogel had high peak because of its rules, neat molecular sequences, the O-hydrogel-F, O-hydrogel-F-P had no significant difference of its Peak intensity, comparing with the O-hydrogel, we could clearly saw that the difference of Peak intensity is due to the iron ions. The ionic bonds of carboxylic-Fe<sup>3+</sup> had damaged the rules, neat molecular sequences of O-hydrogel due to the traction of ionic bonds.



**Fig.S2** XRD spectrum of the 10% CMCH/AM/20% MA hydrogel containing O-hydrogel, O-hydrogel-F, O-hydrogel-F-P.