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Claims

1. A method of fabricating a tough hydrogel, comprising:
 - (a) polymerising a plurality of charged monomers in the presence of a
5 plurality of multivalent ions under predetermined conditions in order to form an ion impregnated hydrogel;
 - (b) exposing the ion impregnated hydrogel to heat;
 - (c) cooling the ion impregnated hydrogel of step (b); and
 - (d) optionally repeating step (b) and/or step (c) at least one further time in
10 order to form the tough hydrogel;wherein a valency of the multivalent ion is at least 2.
2. The method according to claim 1, wherein the plurality of charged monomers is a charged vinyl monomer.
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3. The method according to claims 1 or 2, wherein the plurality of charged monomers is a salt form of a plurality of monomer, the monomer is selected from acrylic acid, acrylamide, sulfopropyl acrylate, 2-hydroxyethyl methacrylate or a combination thereof.
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4. The method according to any one of claims 1 to 3, wherein the plurality of charged monomer is provided at a concentration of about 5 wt% to about 50 wt%.
- 25 5. The method according to any one of claims 1 to 4, wherein the step of polymerising (step (a)) further comprises a cross linking agent.
6. The method according to claim 5, wherein the cross linking agent is N,N'-methylenebisacrylamide.
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7. The method according to any one of claims 1 to 6, wherein the plurality of multivalent ions is a plurality of multivalent cations.

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8. The method according to any one of claims 1 to 7, wherein the plurality of multivalent ions is selected from Al^{3+} and Fe^{3+} .

9. The method according to any one of 1 to 8, wherein the plurality of
5 multivalent ions is provided at a concentration of about 10 mM to about 2 M.

10. The method according to any one of claims 1 to 9, wherein the step of exposing (step (b)) crosslinks the ion impregnated hydrogel (from step (a)) via ionic interactions.

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11. The method according to any one of claims 1 to 10, wherein the ion impregnated hydrogel (from step (a)) is exposed to heat at a temperature of about 40 °C to about 100 °C.

15 12. The method according to any one of claims 1 to 11, wherein the ion impregnated hydrogel (from step (a)) is heated by exposing the ion impregnated hydrogel to microwave radiation for at least 15 sec.

13. The method according to any one of claims 1 to 12, when step (b) and/or
20 step (c) is repeated 2 to 10 times.

14. The method according to any one of claim 1 to 13, wherein the cooling step is performed for at least about 10 sec.

25 15. The method according to any one of claims 1 to 14, wherein the toughness of the hydrogel is increased by at least about 100%.

16. A hydrogel as fabricated by the method according to any one of claims 1 to 15.

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17. A hydrogel, comprising:

(a) a plurality of charged polymers, the plurality of charged polymers is

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covalently crosslinked and comprises a plurality of charged moiety; and
(b) a plurality of multivalent ions in order to form ionic crosslinks between
the plurality of polymers;
wherein a valency of the plurality of multivalent ions is at least 2.

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18. The hydrogel according to claims 16 or 17, wherein the plurality of
charged polymers is a salt form of a plurality of polymers, the polymers selected
from polyacrylic acid, polyacrylamide, polysulfopropyl acrylate, poly(2-
hydroxyethyl) methacrylate or a combination thereof.

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19. The hydrogel according to any one of claims 16 to 18, the hydrogel having
a at least 80% recovery of mechanical strength after a resting period of about
30 min.