CLAIMS

What is claimed is:

1. A method for cross-linking a styrenic polymer, comprising:

providing a partly sulphonated styrenic polymer, and

cross-linking the partly sulphonated styrenic polymer in the presence of a polyphosphoric acid.

2. The method of claim 1, wherein the partly sulphonated styrenic polymer comprises a styrenic polymer that is selected from a group consisting of a homopolymer of a styrenic monomer, a copolymer of a styrenic monomer with one or more comonomers, and a combination thereof.

3. The method of claim 1, wherein the cross-linking is carried out at a temperature of 100˚C or greater.

4. The method of claim 1, wherein the cross-linking is carried out at a temperature in the range from 120˚C to 200 ˚C.

5. The method of claim 1, wherein the partly sulphonated styrenic polymer has a degree of sulfonation of 10% to 80%.

6. The method of claim 1, wherein the partly sulphonated styrenic polymer has a degree of sulfonation of 20% to 70%.

7. The method of any one of claims 1 to 6, wherein the cross-linking is carried out by forming the partly sulphonated styrenic polymer in a mold to obtain a molding, and immersing the molding into the polyphosphoric acid.

8. The method of claim 7, wherein the molding is selected from a group consisting of a film, an ion exchange resin and a hollow fiber.

9. The method of any one of claims 1 to 8, wherein the providing the partly sulphonated styrenic polymer comprises the steps of:

providing a styrenic polymer;

contacting acetic anhydride with concentrated sulfuric acid to form acetyl sulfate; and

reacting the acetyl sulfate with the styrenic polymer to obtain the partly sulphonated styrenic polymer.

10. The method of claim 1, wherein the partly sulphonated styrenic polymer comprises a styrenic polymer that is a homopolymer of a styrenic monomer.

11. The method of claim 1, wherein the partly sulphonated styrenic polymer comprises a styrenic polymer that is polystyrene.

12. The method of claim 1, wherein the partly sulphonated styrenic polymer has a degree of sulfonation of 51%.

13. The method of claim 1, wherein:

the partly sulphonated styrenic polymer comprises a styrenic poymer that is polystyrene, and

the partly sulphonated styrenic polymer has a degree of sulfonation of 51%.

14. An article comprising at least one component comprising a cross-linked polystyrene, the cross-linked polystyrene comprises a partly sulphonated styrenic polymer being crosslinked in the presence of a polyphosphoric acid.

15. A water treatment apparatus comprising at least one component comprising a cross-linked polystyrene, the cross-linked polystyrene comprises a partly sulphonated styrenic polymer being crosslinked in the presence of a polyphosphoric acid.

16. An ion exchange membrane comprising a cross-linked polystyrene, the cross-linked polystyrene comprises a partly sulphonated styrenic polymer being crosslinked in the presence of a polyphosphoric acid.

17. The ion exchange membrane of claim 16, wherein the membrane has an Ion Exchange Capacity (IEC) of from 1.9 to 2.5 meq/g.

18. A method for treating water, the method comprising

contacting the water with an ion exchange membrane comprising a cross-linked polystyrene, the cross-linked polystyrene comprises a partly sulphonated styrenic polymer being crosslinked in the presence of a polyphosphoric acid.

19. The method of claim 18, wherein the ion exchange membrane has an Ion Exchange Capacity (IEC) of from 1.9 to 2.5 meq/g.