CLAIMS

1. A method of forming a porous material, comprising:

a) impregnating a porous polymer with a pore-forming agent in order to form an impregnated polymer; and

b) at least partially carbonising the impregnated polymer at a temperature of 150 °C to 500 °C in order to form the porous material;

wherein the porous material is characterised by a crystallinity of 10% to 70% relative to the porous polymer.

2. The method according to claim 1, wherein the pore-forming agent is selected from a metal salt.

3. The method according to claim 1 or 2, wherein the pore-forming agent is selected from calcium nitrate, calcium nitrite, calcium chloride, magnesium nitrate, magnesium nitrite, magnesium chloride, sodium nitrate, sodium nitrite, sodium carbonate, potassium carbonate, aluminium nitrate, aluminium nitrite, zinc nitrate, ferric nitrate, ferrous nitrate, cupric nitrate, calcium acetate, tetrabutylammonium bromide, sodium pyridine acetate or a combination thereof; and/or

wherein the pore-forming agent is provided in an aqueous medium at a concentration of 0.1 M to 10 M.

4. The method according to any one of claims 1 to 3, wherein a weight ratio of porous polymer to pore-forming agent is 0.1 to 0.4.

5. The method according to any one of claims 1 to 4, wherein the porous polymer is a porous polymer sheet or a hollow fiber, wherein the porous polymer is selected from polyacrylonitrile (PAN), polyethersulfone (PES), polyvinylidene fluoride (PVDF), polysulfone, sodium alginate, chitosan, polydimethylsiloxane, polyvinyl alcohol, poly(ether-ether-ketone), poly(methyl methacrylate) (PMMA), polytetrafluoroethylene (PTFE) or a combination or co-polymer thereof.

6. The method according to any one of claims 1 to 5, wherein the impregnation step is performed for at least 1 h.

7. The method according to any one of claims 1 to 6, wherein the method further comprises a step of drying the impregnated polymer after the impregnation step.

8. The method according to any one of claims 1 to 7, wherein the impregnated polymer is carbonised at a temperature of 200 °C, performed with a ramp rate of 1 °C min^{-1} to 10 °C min^{-1}, for 30 min to 360 min, and/or in the presence of oxygen.

9. The method according to any one of claims 1 to 8, wherein the method further comprises a step of washing the porous material.

10. The method according to any one of claims 1 to 9, wherein the porous material is characterised by a degree of carbonisation relative to the porous polymer of at least 20% and/or an increase in pore size relative to the porous polymer of 5 times to 100 times.

11. A porous material, comprising an at least partially carbonised porous polymer, wherein the porous material has a pore size of 100 nm to 800 nm; and
wherein the at least partially carbonised porous polymer is characterised by a crystallinity of 10% to 70% relative to the uncarbonised porous polymer.

12. The porous material according to claim 11, wherein a degree of carbonisation of the at least partially carbonised porous polymer is characterised by an 30% to 90% decrease in X-ray diffraction (XRD) peak intensity relative to the uncarbonised porous polymer.

13. The porous material according to claim 11 or 12, wherein the porous material has a pore size of 100 nm to 300 nm.

14. The porous material according to any one of claims 11 to 13, wherein the porous material is characterised by a molecular weight cut-off (MWCO) of 500 kDa to 4000 kDa.

15. The porous material according to any one of claims 11 to 14, wherein the porous material is characterised by at least one of the following:
i) a water permeance of 800 L m^{-2} h^{-1} bar^{-1} to 1100 L m^{-2} h^{-1} bar^{-1};

ii) a DMF permeance of 1200 L m^{-2} h^{-1} bar^{-1} to 1600 L m^{-2} h^{-1} bar^{-1};

iii) a n-hexane permeance of 2400 L m^{-2} h^{-1} bar^{-1} to 2800 L m^{-2} h^{-1} bar^{-1};

iv) a NMP permeance of 100 L m^{-2} h^{-1} bar^{-1} to 160 L m^{-2} h^{-1} bar^{-1};

v) a DMSO permeance of 80 L m^{-2} h^{-1} bar^{-1} to 160 L m^{-2} h^{-1} bar^{-1}.

16. The porous material according to any one of claims 11 to 15, wherein the porous material is characterised by a volume swelling of 0.1% to 10% and/or a solvent uptake of 0.1 to 10%.

17. The porous material according to any one of claims 11 to 16, wherein the porous material is stable against organic solvents for at least 60 days, wherein the organic solvent is selected from DMF, NMP, DMSO, or a combination thereof.

18. The porous material according to any one of claims 11 to 17, wherein the porous material is characterised by a tensile strength of 10 MPa to 20 MPa, and/or a decrease in tensile strength relative to the uncarbonised porous polymer of 10% to 50%.

19. The porous material according to any one of claims 11 to 18, wherein the porous material is characterised by a Young’s modulus of 500 MPa to 900 MPa; and/or an increase in Young’s modulus relative to the uncarbonised porous polymer of 50% to 200%.

20. The porous material according to any one of claims 11 to 19, wherein the porous material is formed as a flat sheet or a hollow fiber.