Figures

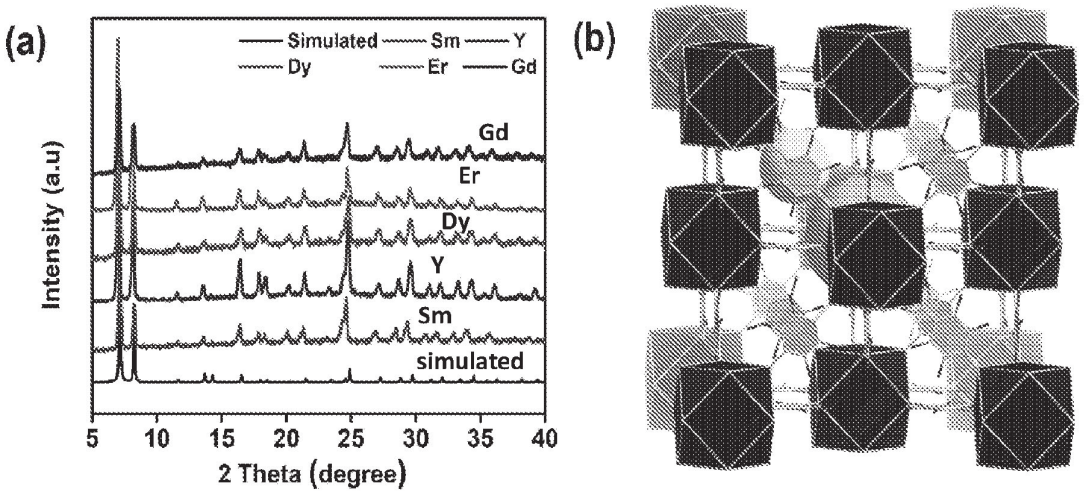

FIG. 1

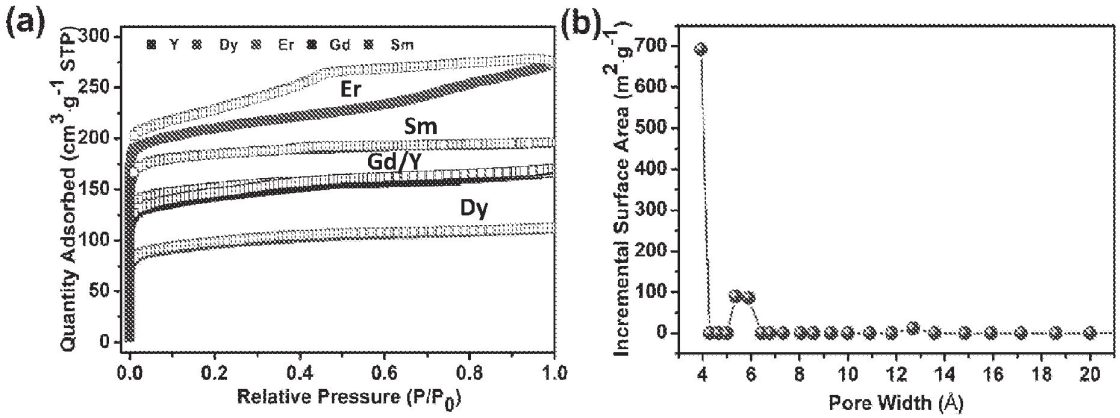

FIG. 2

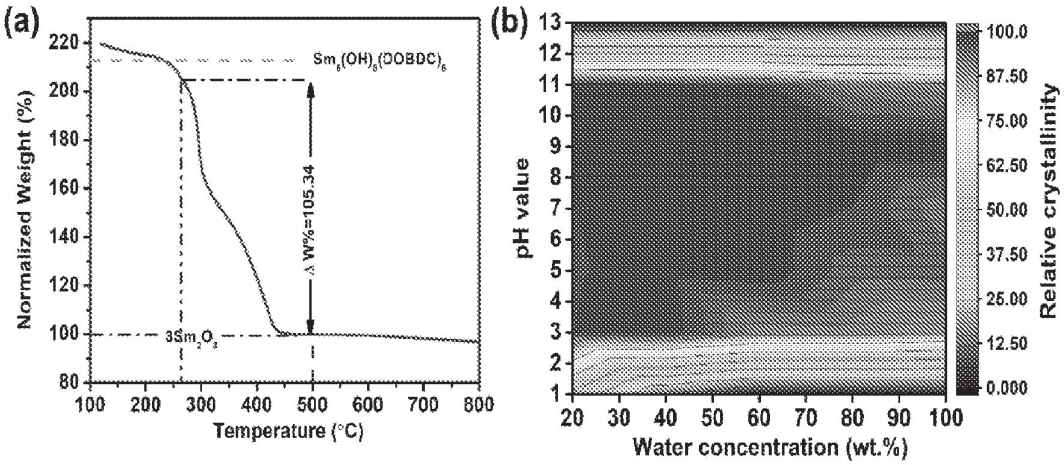
(a)
Normalized Weight (%)
Temperature (°C)
$Sm_6(OH)_6(DOBDC)_6$
$3Sm_2O_3$
Δ W%=105.34
(b)
pH value
Water concentration (wt.%)
Relative crystallinity

FIG. 3

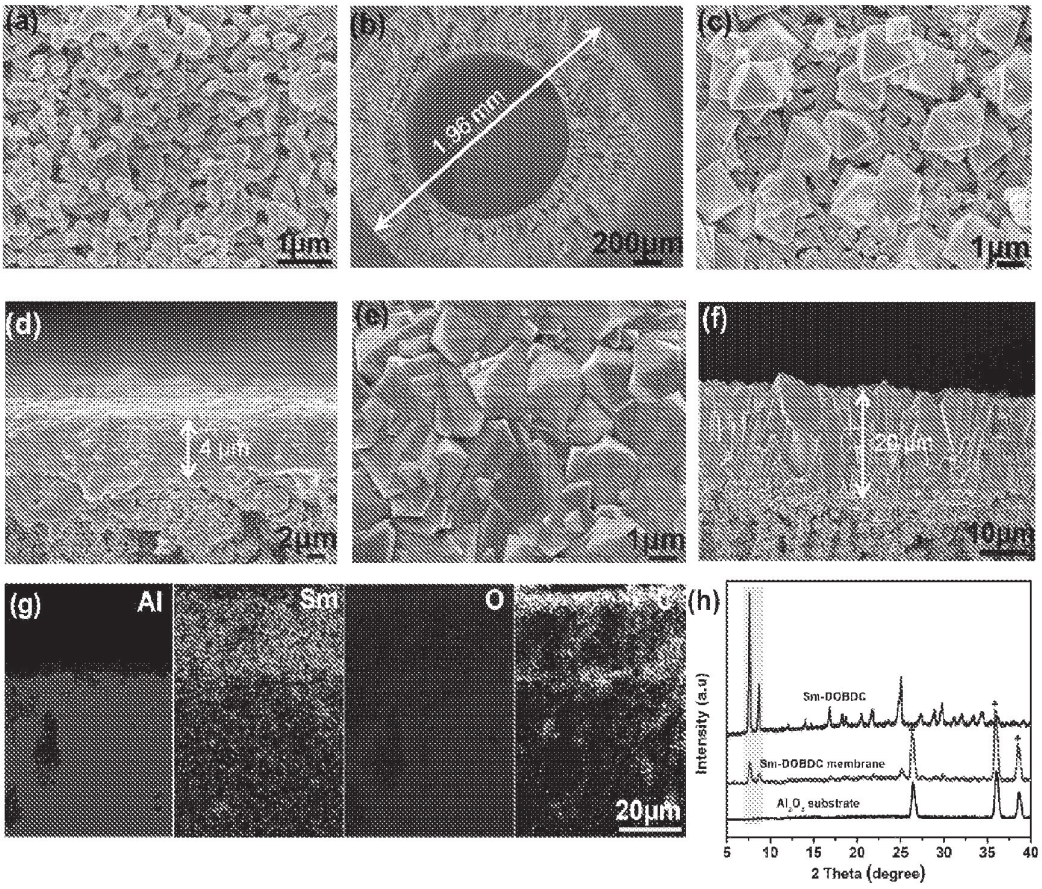
(a)
1μm
(b)
1.96 mm
200μm
(c)
1μm
(d)
4 μm
2μm
(e)
1μm
(f)
20 μm
10μm
(g)
Al
Sm
O
20μm
(h)
Sm-DOBDC
Sm-DOBDC membrane
Al_2O_3 substrate
Intensity (a.u)
2 Theta (degree)

FIG. 4

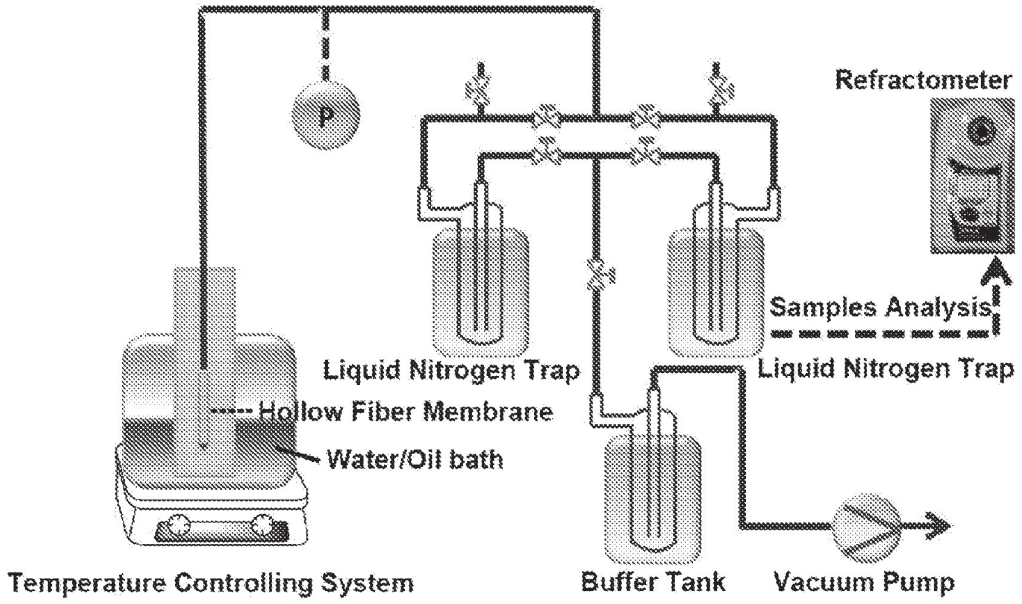
P
Refractometer
Samples Analysis
Liquid Nitrogen Trap
Liquid Nitrogen Trap
Hollow Fiber Membrane
Water/Oil bath
Temperature Controlling System
Buffer Tank
Vacuum Pump

FIG. 5

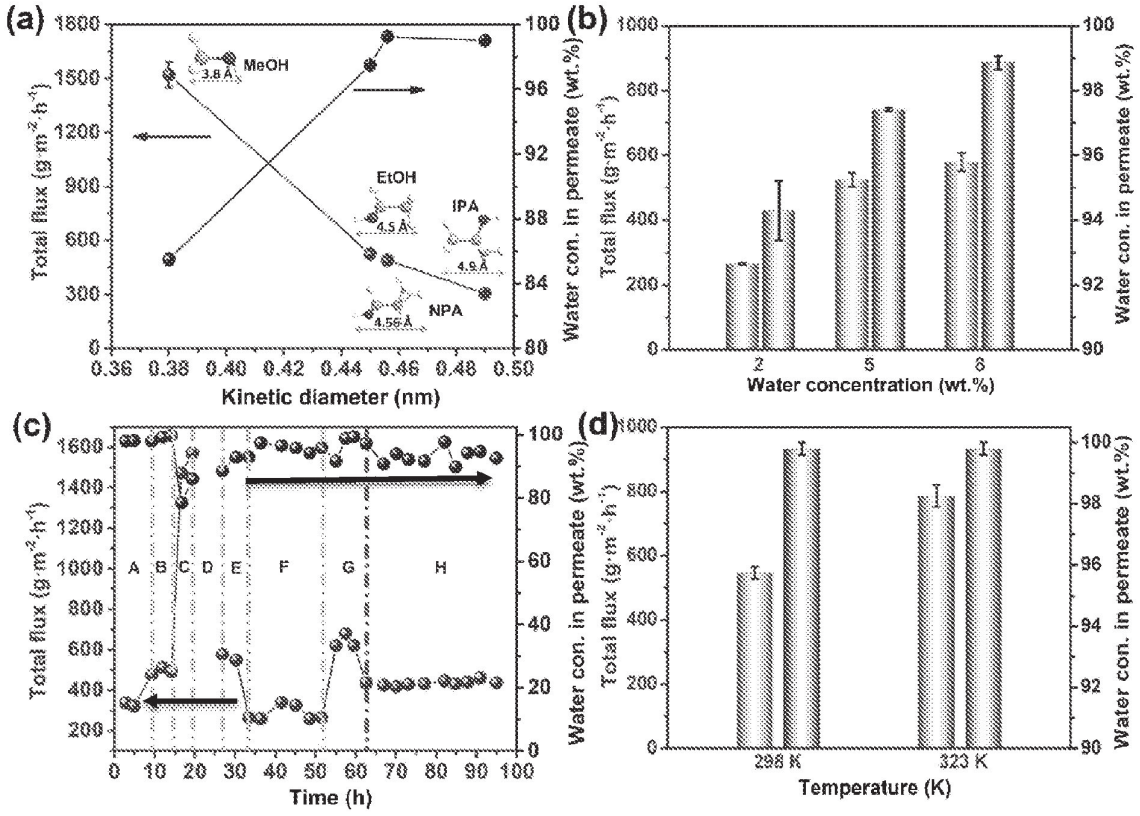
(a)
MeOH
3.8 Å
EtOH
4.5 Å
IPA
4.9 Å
NPA
4.56 Å
Total flux (g·m⁻²·h⁻¹)
Water con. in permeate (wt.%)
Kinetic diameter (nm)
(b)
Water concentration (wt.%)
(c)
A B C D E F G H
Time (h)
(d)
298 K
323 K
Temperature (K)

FIG. 6

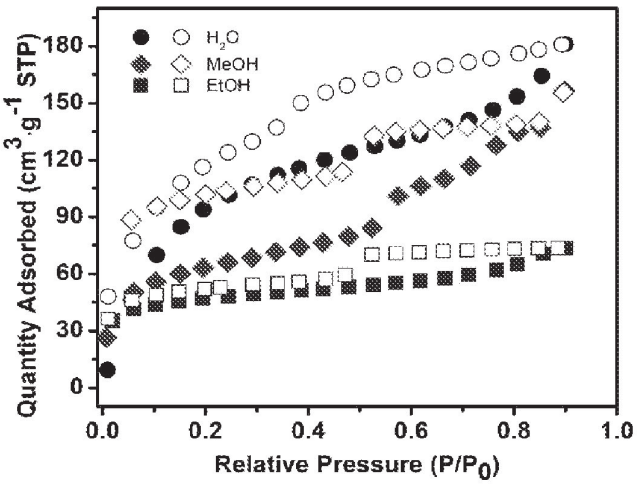
H2O
MeOH
EtOH
Quantity Adsorbed (cm3·g-1 STP)
0
30
60
90
120
150
180
0.0
0.2
0.4
0.6
0.8
1.0
Relative Pressure (P/P0)

FIG. 7

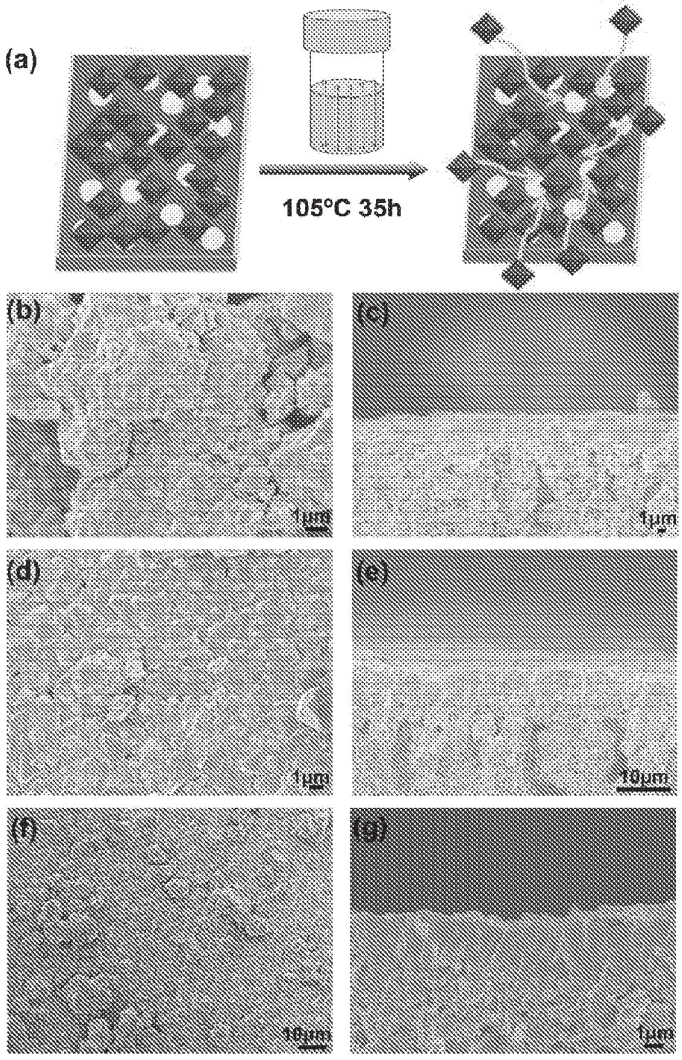
(a)
105°C 35h
(b)
1μm
(c)
1μm
(d)
1μm
(e)
10μm
(f)
10μm
(g)
1μm

FIG. 8

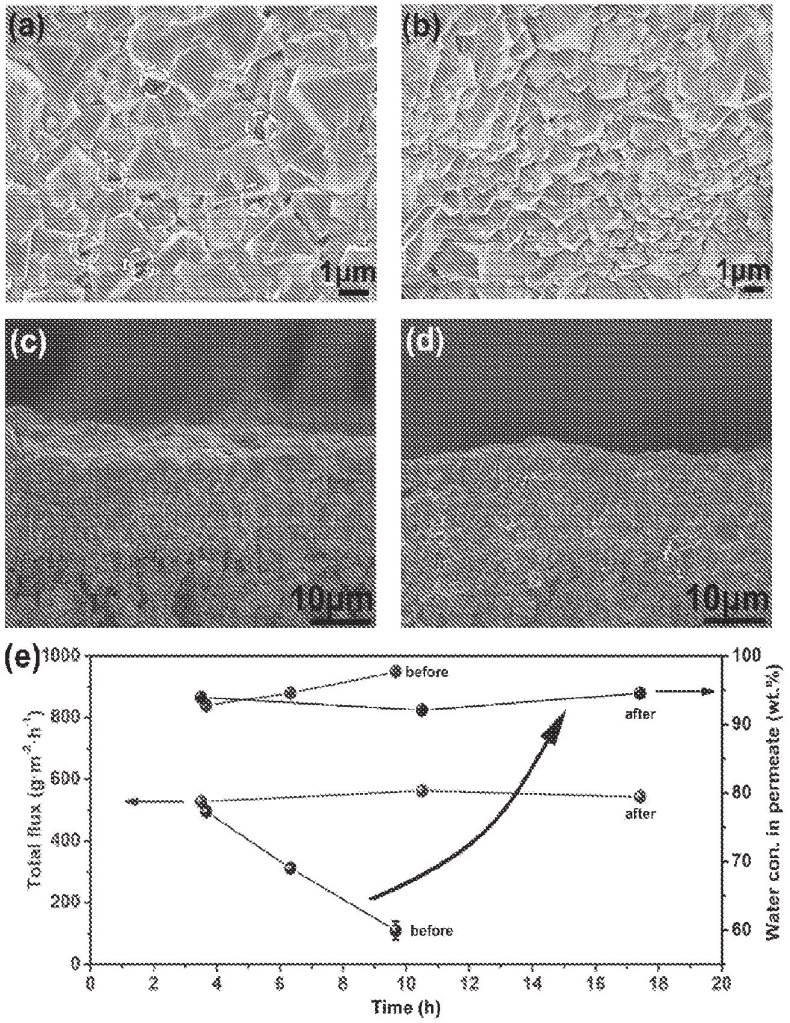
(a)
1μm
(b)
1μm
(c)
10μm
(d)
10μm
(e)
Total flux (g m-2 h-1)
Water con. in permeate (wt.%)
Time (h)
before
after
after
before
0
200
400
600
800
1000
60
70
80
90
100
0
2
4
6
8
10
12
14
16
18
20

FIG. 9

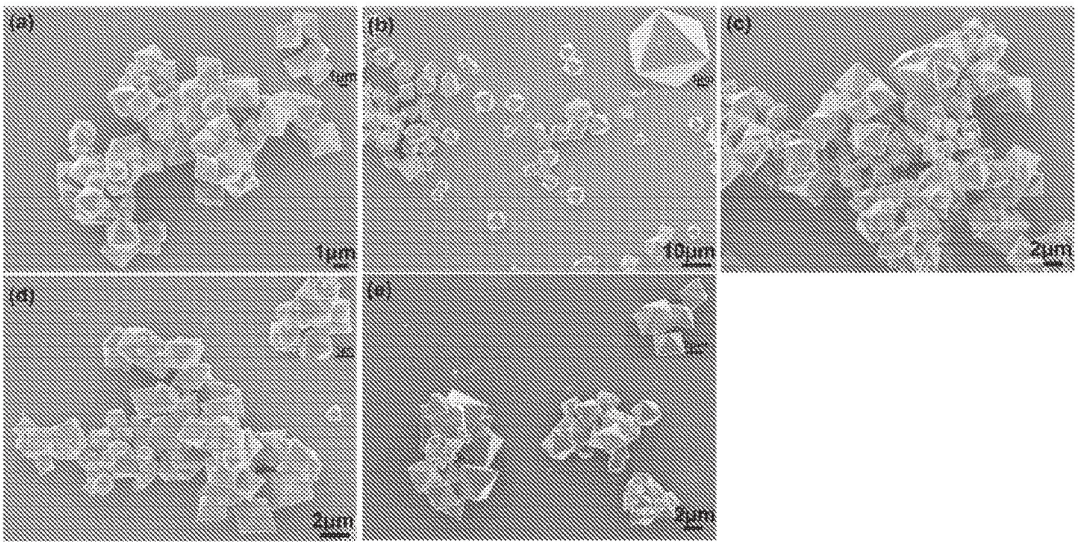
(a)
1μm
(b)
10μm
(c)
2μm
(d)
2μm
(e)
2μm

FIG. 10

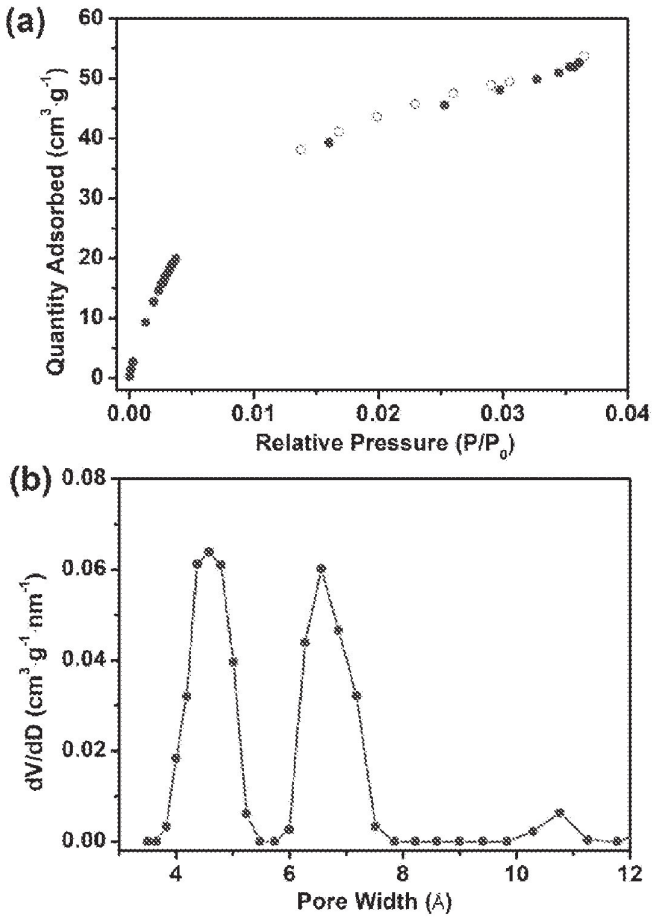
(a)
Quantity Adsorbed (cm3 g-1)
Relative Pressure (P/P0)
(b)
dV/dD (cm3 g-1 nm-1)
Pore Width (Å)

FIG. 11

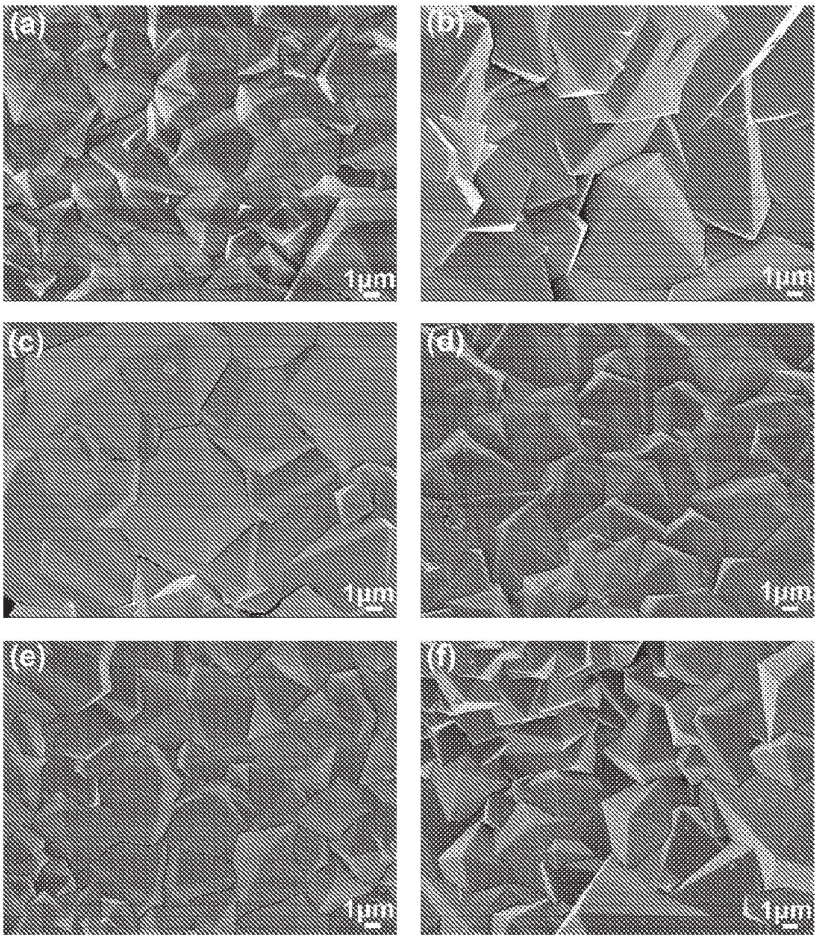

FIG. 12

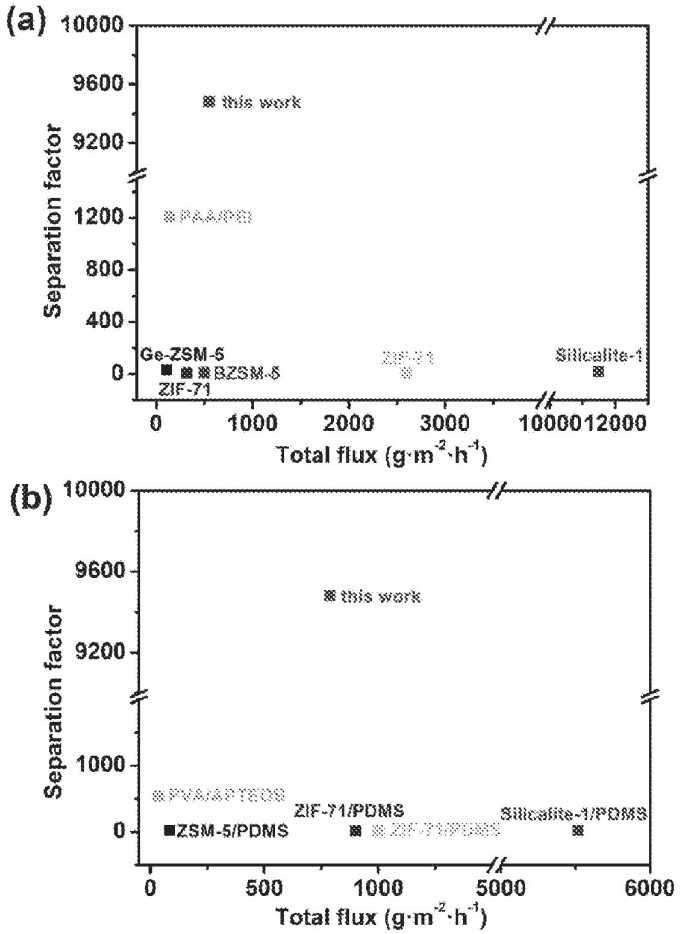
(a)
10000
9600
9200
1200
800
400
0
Separation factor
this work
PAA/PEI
Ge-ZSM-5
BZSM-5
ZIF-71
ZIF-71
Silicalite-1
0
1000
2000
3000
10000
12000
Total flux (g·m-2·h-1)
(b)
10000
9600
9200
1000
0
Separation factor
this work
PVA/APTEOS
ZIF-71/PDMS
Silicalite-1/PDMS
ZSM-5/PDMS
ZIF-71/PDMS
0
500
1000
5000
6000
Total flux (g·m-2·h-1)

FIG. 13

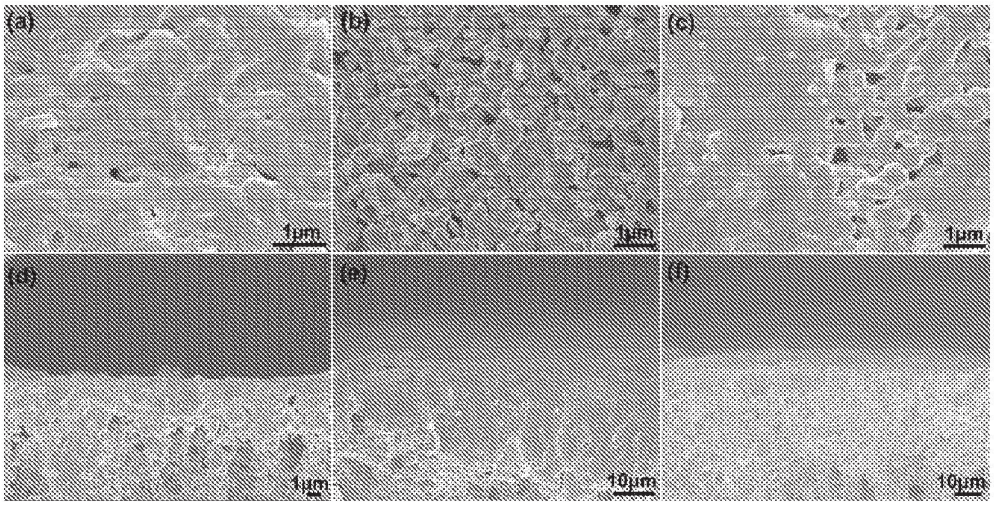
(a)
1μm
(b)
1μm
(c)
1μm
(d)
1μm
(e)
10μm
(f)
10μm

FIG. 14

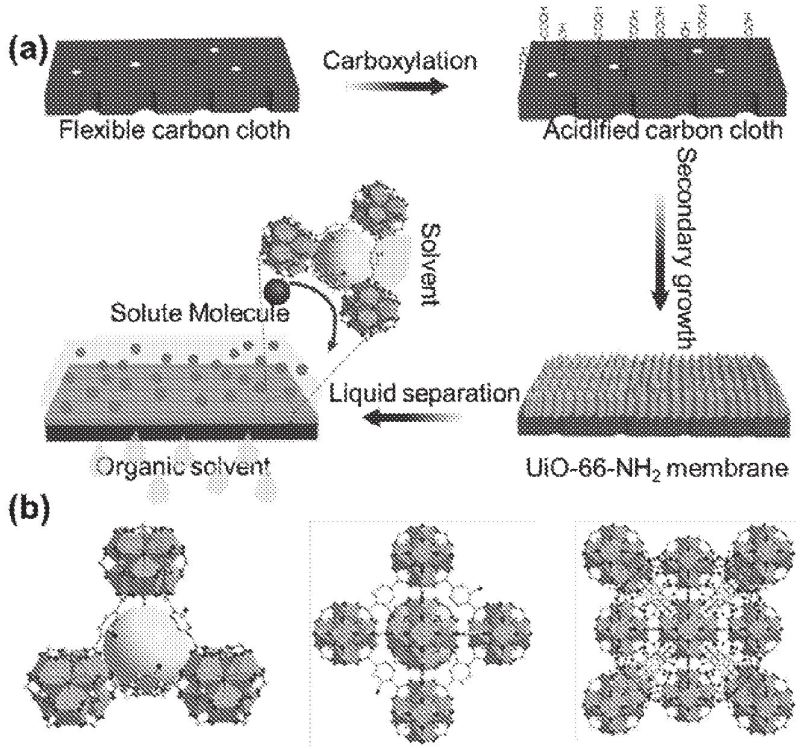
(a)
Carboxylation
Flexible carbon cloth
Acidified carbon cloth
Secondary growth
Solvent
Solute Molecule
Liquid separation
Organic solvent
UiO-66-NH2 membrane
(b)

Fig. 15

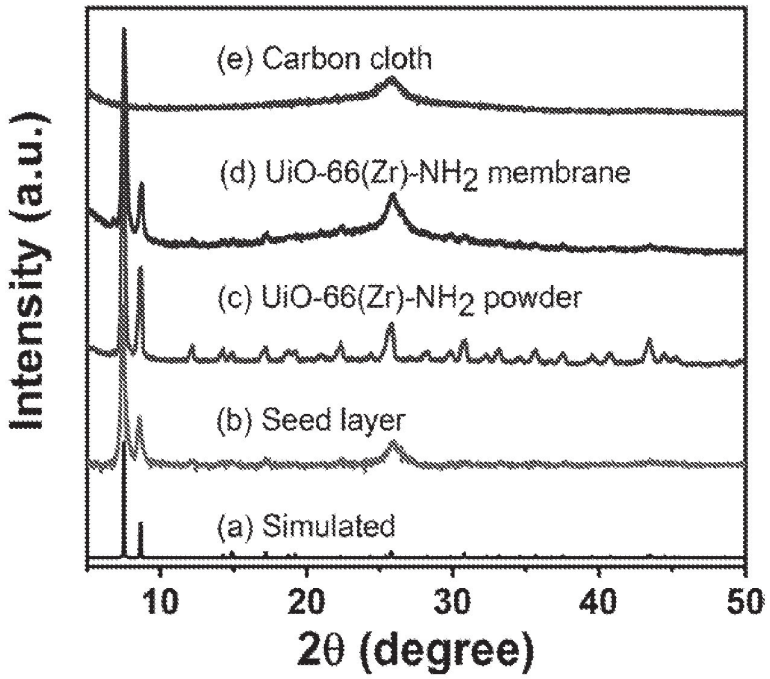
(e) Carbon cloth
(d) UiO-66(Zr)-NH2 membrane
(c) UiO-66(Zr)-NH2 powder
(b) Seed layer
(a) Simulated
Intensity (a.u.)
10
20
30
40
50
2θ (degree)

Fig. 16

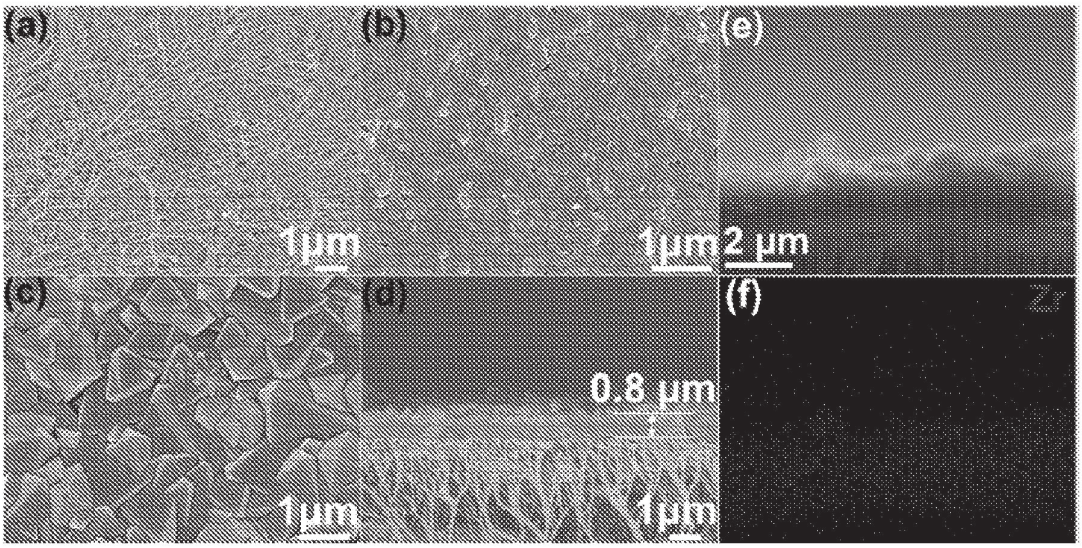
(a)
(b)
(e)
1μm
1μm
2 μm
(c)
(d)
(f)
Zr
0.8 μm
1μm
1μm

Fig. 17

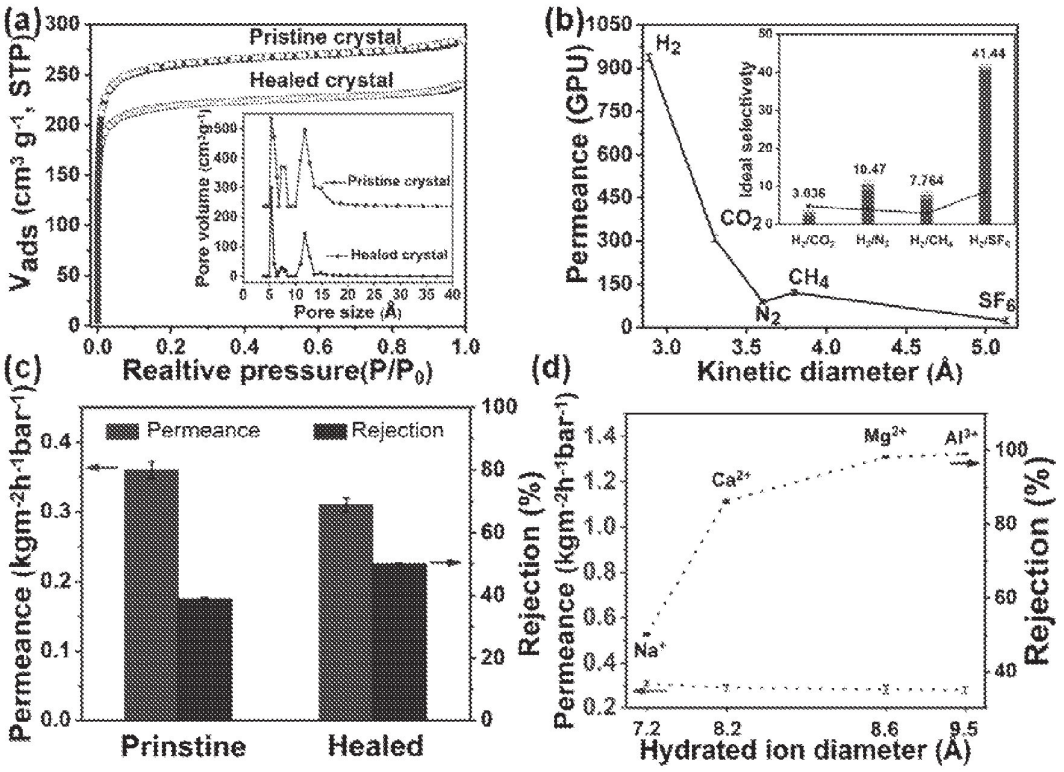
(a)
Pristine crystal
Healed crystal
Pore volume (cm³g⁻¹)
Pore size (Å)
Vads (cm³ g⁻¹, STP)
Realtive pressure(P/P0)
(b)
H2
CO2
CH4
N2
SF6
Permeance (GPU)
Ideal selectivity
3.036
10.47
7.764
41.44
H2/CO2
H2/N2
H2/CH4
H2/SF6
Kinetic diameter (Å)
(c)
Permeance
Rejection
Permeance (kgm-2h-1bar-1)
Rejection (%)
Prinstine
Healed
(d)
Na+
Ca2+
Mg2+
Al3+
Permeance (kgm-2h-1bar-1)
Rejection (%)
Hydrated ion diameter (Å)

Fig. 18

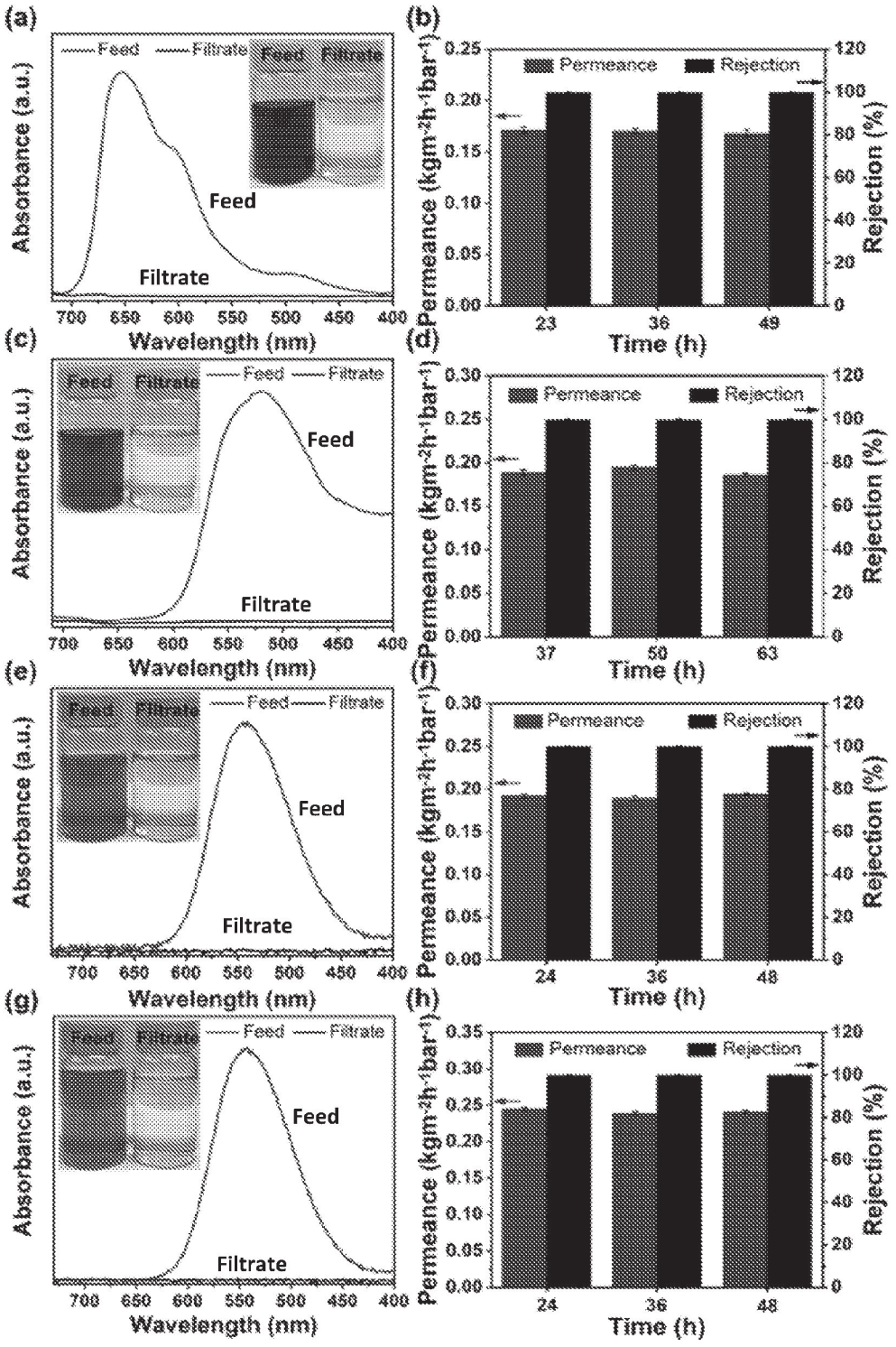
(a)
Feed
Filtrate
Absorbance (a.u.)
Wavelength (nm)
(b)
Permeance
Rejection
Permeance (kgm-2h-1bar-1)
Rejection (%)
Time (h)
(c)
(d)
(e)
(f)
(g)
(h)

Fig. 19

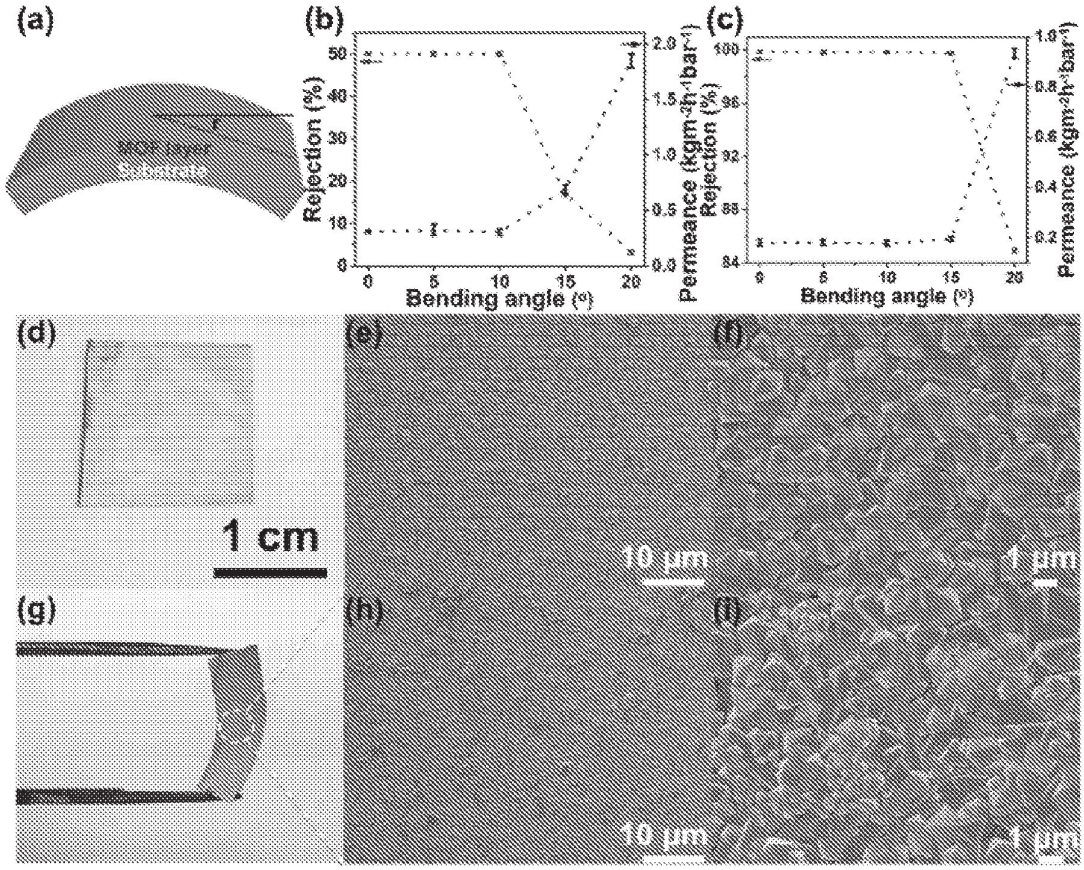
(a)
MOF layer
Substrate
(b)
Rejection (%)
Permeance (kgm⁻²h⁻¹bar⁻¹)
Bending angle (°)
(c)
Rejection (%)
Permeance (kgm⁻²h⁻¹bar⁻¹)
Bending angle (°)
(d)
1 cm
(e)
10 μm
(f)
1 μm
(g)
(h)
10 μm
(i)
1 μm

Fig. 20

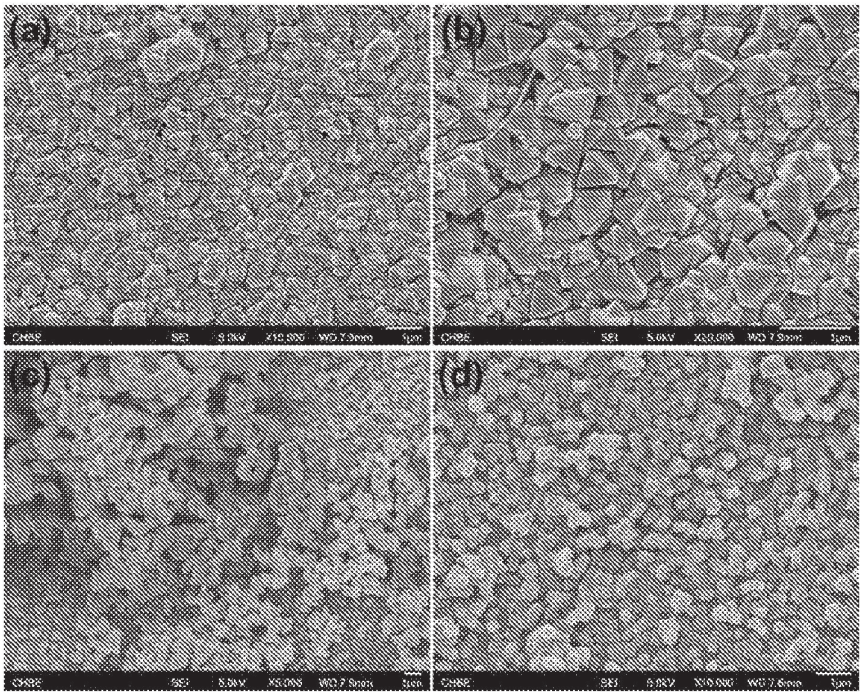
(a)
(b)
(c)
(d)

Fig. 21

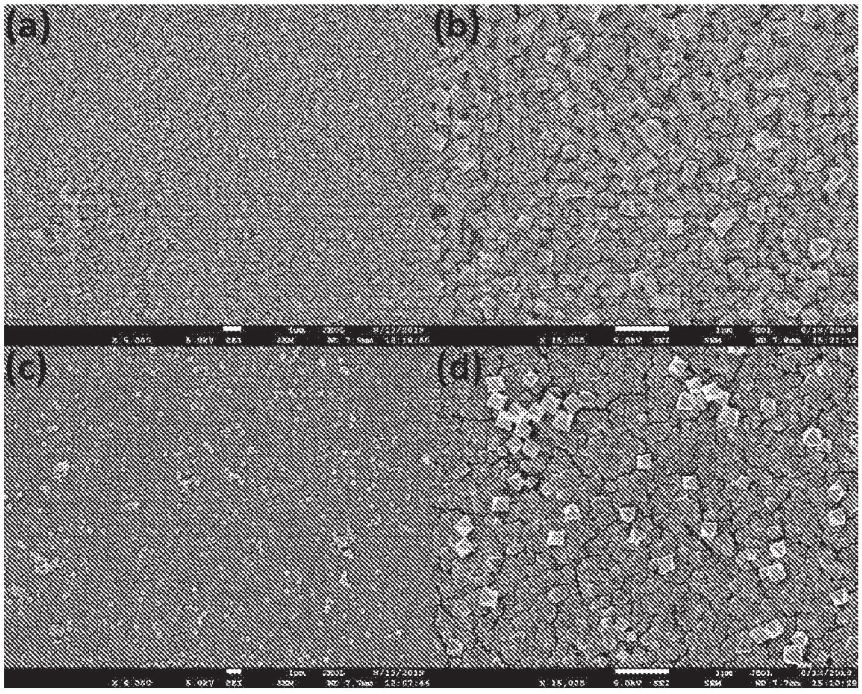

Fig. 22

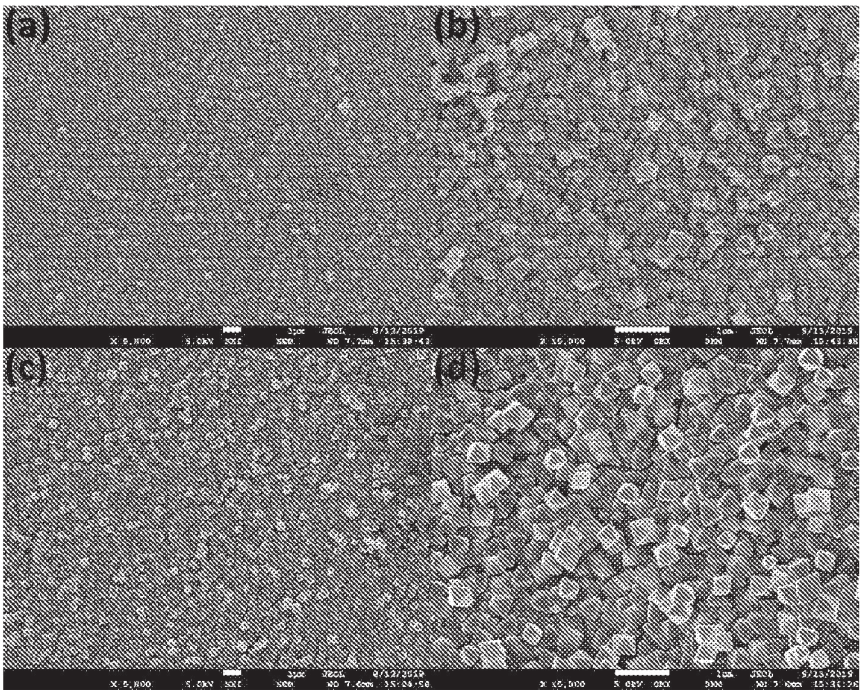

Fig. 23

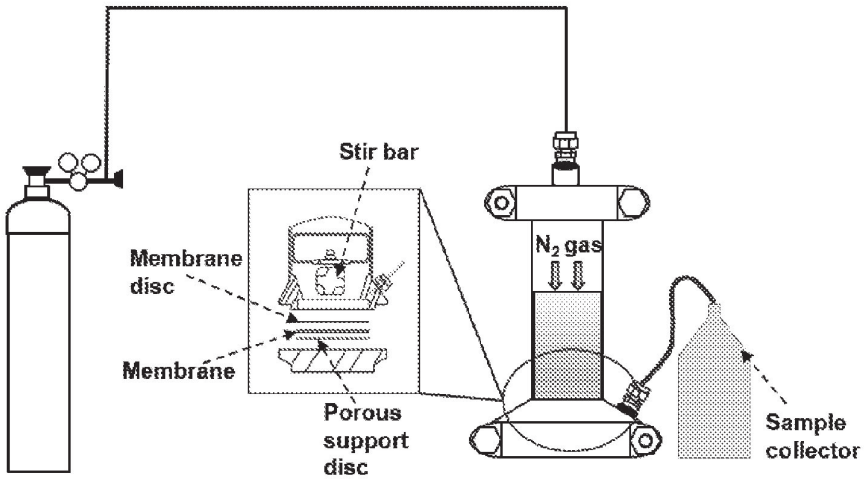
Stir bar
Membrane disc
Membrane
Porous support disc
N_2 gas
Sample collector

Fig. 24

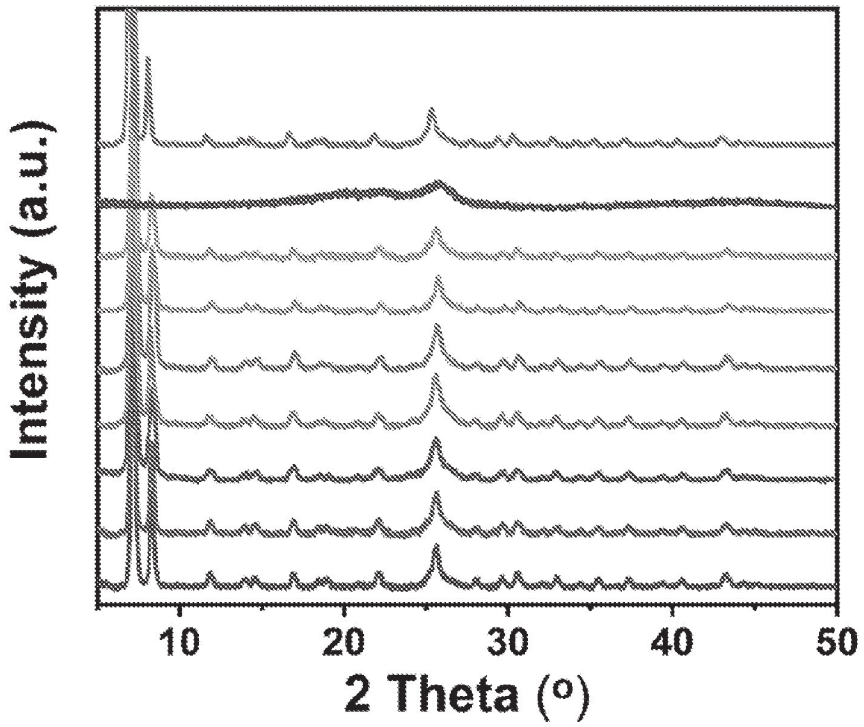
Intensity (a.u.)
10
20
30
40
50
2 Theta (°)

Fig. 25