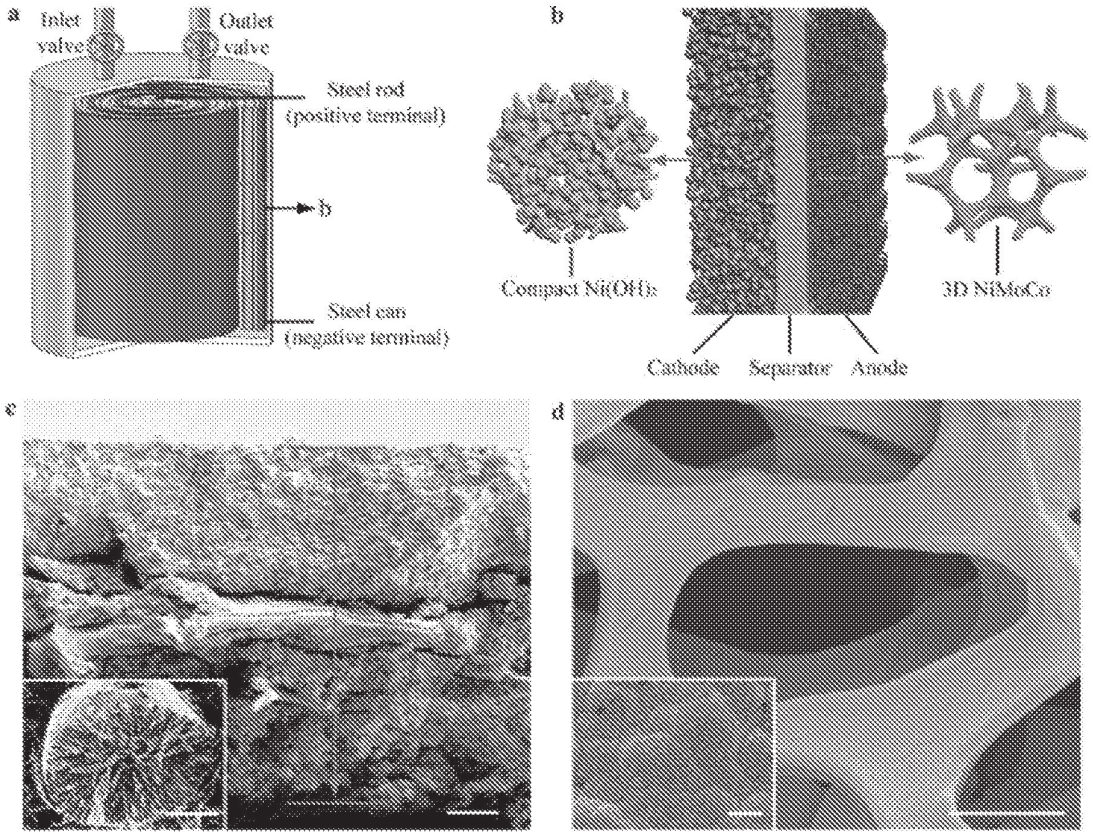
a
Inlet valve
Outlet valve
Steel rod (positive terminal)
b
Steel can (negative terminal)
b
Compact Ni(OH)2
3D NiMoCo
Cathode
Separator
Anode
c
d

Fig. 1

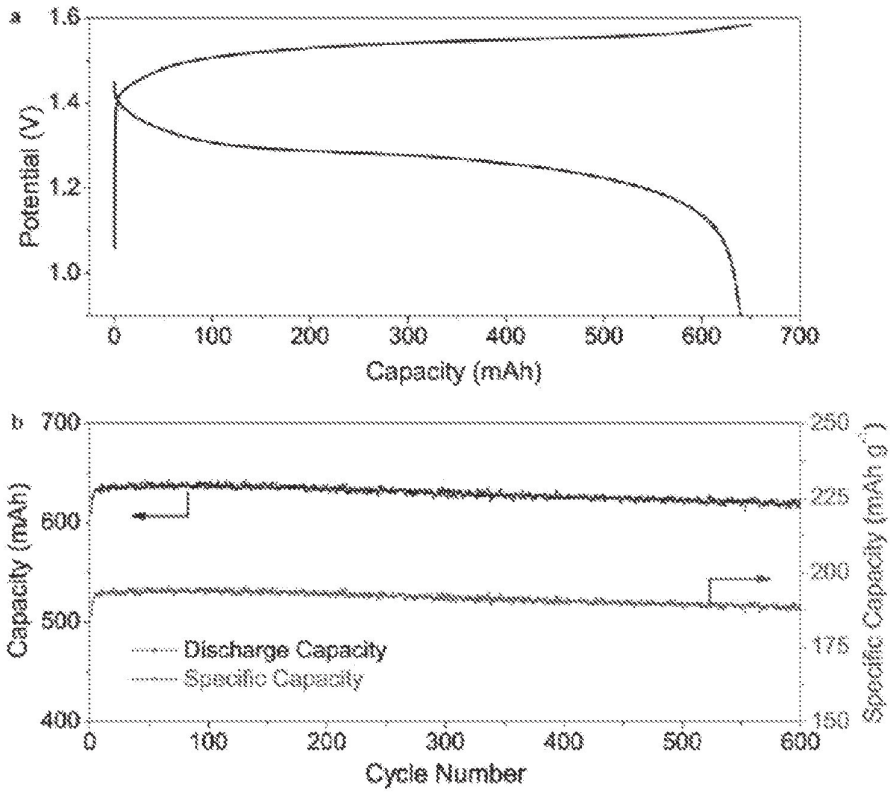
a
1.6
1.4
1.2
1.0
Potential (V)
0
100
200
300
400
500
600
700
Capacity (mAh)
b
700
600
500
400
Capacity (mAh)
250
225
200
175
150
Specific Capacity (mAh g-1)
Discharge Capacity
Specific Capacity
0
100
200
300
400
500
600
Cycle Number

Fig. 2

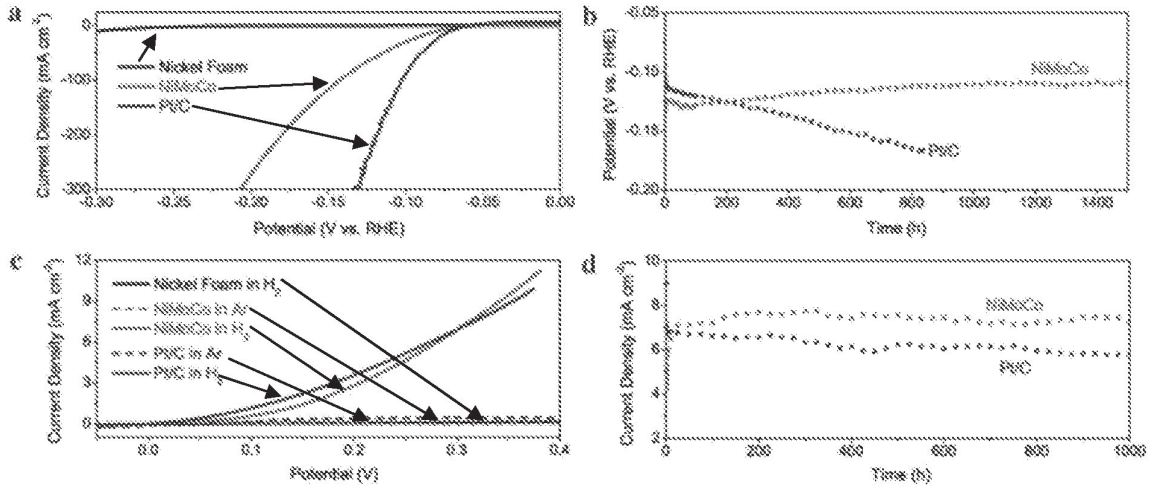
a
Current Density (mA cm⁻²)
Nickel Foam
NiMoCo
Pt/C
Potential (V vs. RHE)
b
Potential (V vs. RHE)
NiMoCo
Pt/C
Time (h)
c
Current Density (mA cm⁻²)
Nickel Foam in H2
NiMoCo in Ar
NiMoCo in H2
Pt/C in Ar
Pt/C in H2
Potential (V)
d
Current Density (mA cm⁻²)
NiMoCo
Pt/C
Time (h)

Fig. 3

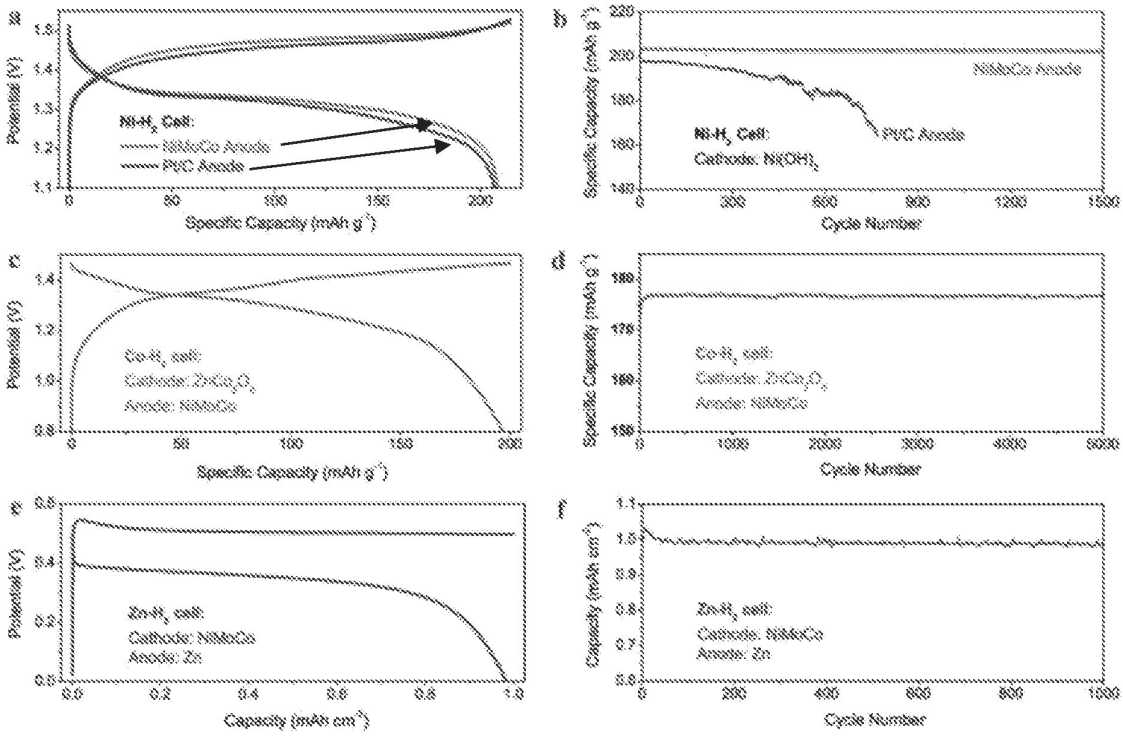
a
Potential (V)
Specific Capacity (mAh g-1)
Ni-H2 Cell:
NiMoCo Anode
Pt/C Anode
b
Specific Capacity (mAh g-1)
Cycle Number
NiMoCo Anode
Pt/C Anode
Ni-H2 Cell:
Cathode: Ni(OH)2
c
Potential (V)
Specific Capacity (mAh g-1)
Co-H2 cell:
Cathode: Zn-Co3O4
Anode: NiMoCo
d
Specific Capacity (mAh g-1)
Cycle Number
Co-H2 cell:
Cathode: Zn-Co3O4
Anode: NiMoCo
e
Potential (V)
Capacity (mAh cm-2)
Zn-H2 cell:
Cathode: NiMoCo
Anode: Zn
f
Capacity (mAh cm-2)
Cycle Number
Zn-H2 cell:
Cathode: NiMoCo
Anode: Zn

Fig. 4

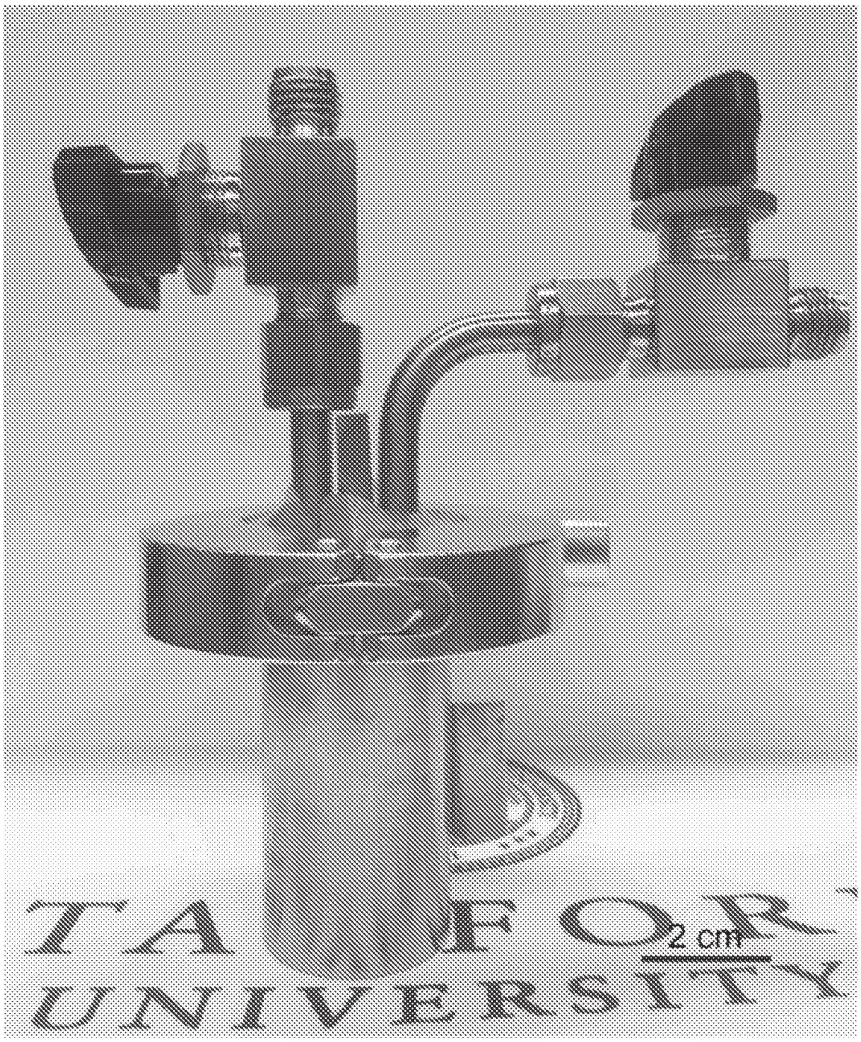

Fig. 5

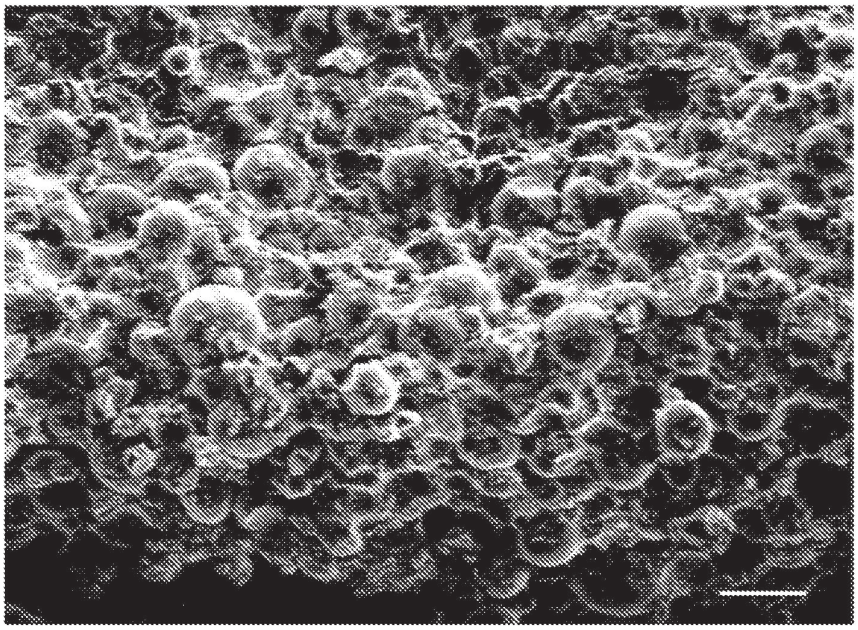

Fig. 6

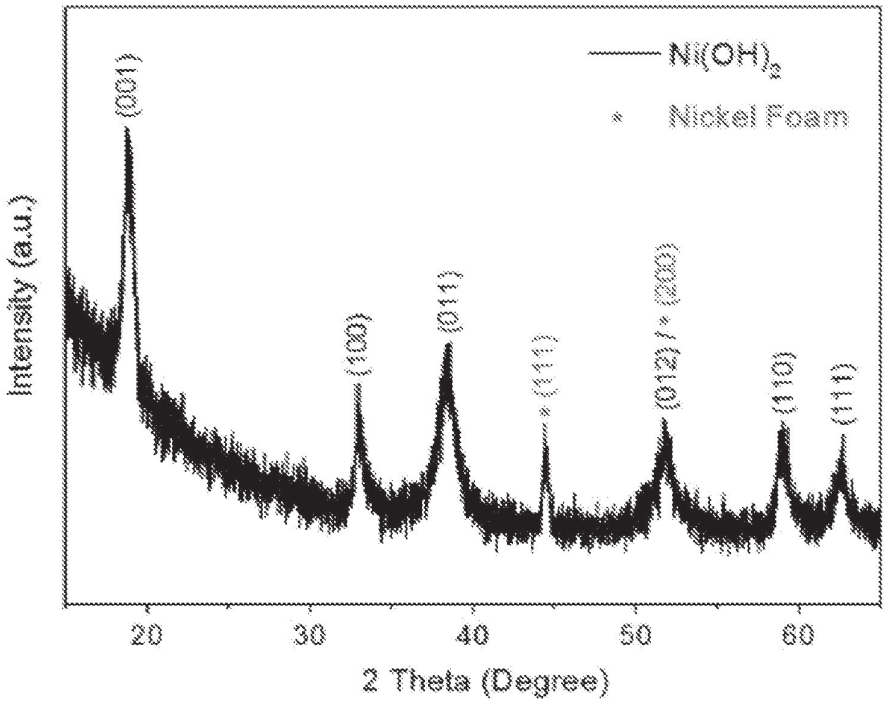
Ni(OH)2
* Nickel Foam
(001)
(100)
(011)
* (111)
(012) / * (200)
(110)
(111)
Intensity (a.u.)
20
30
40
50
60
2 Theta (Degree)

Fig. 7

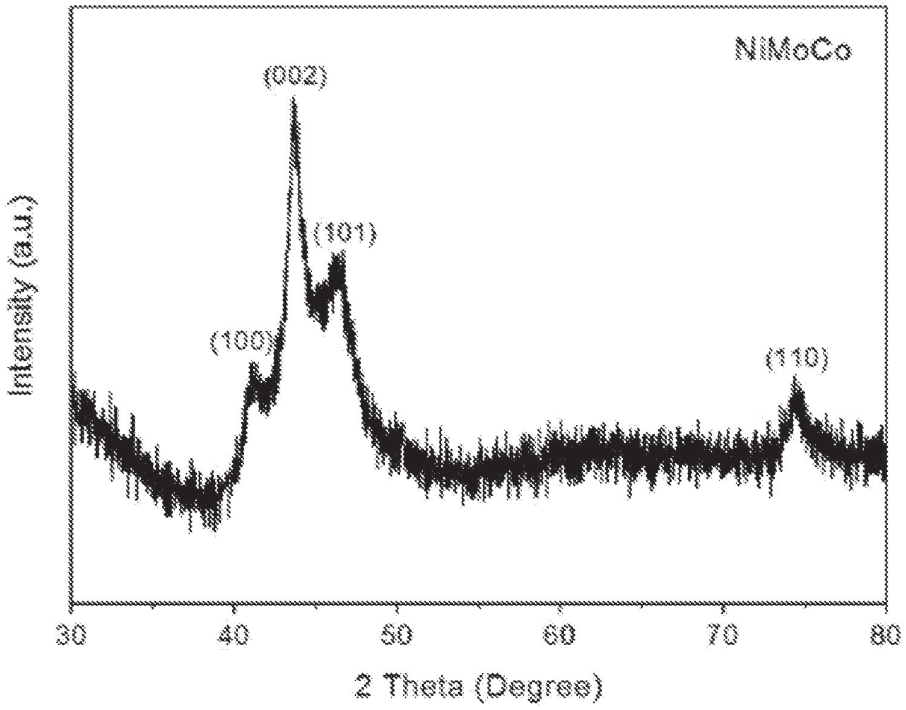
NiMoCo
(002)
(101)
(100)
(110)
Intensity (a.u.)
30
40
50
60
70
80
2 Theta (Degree)

Fig. 8

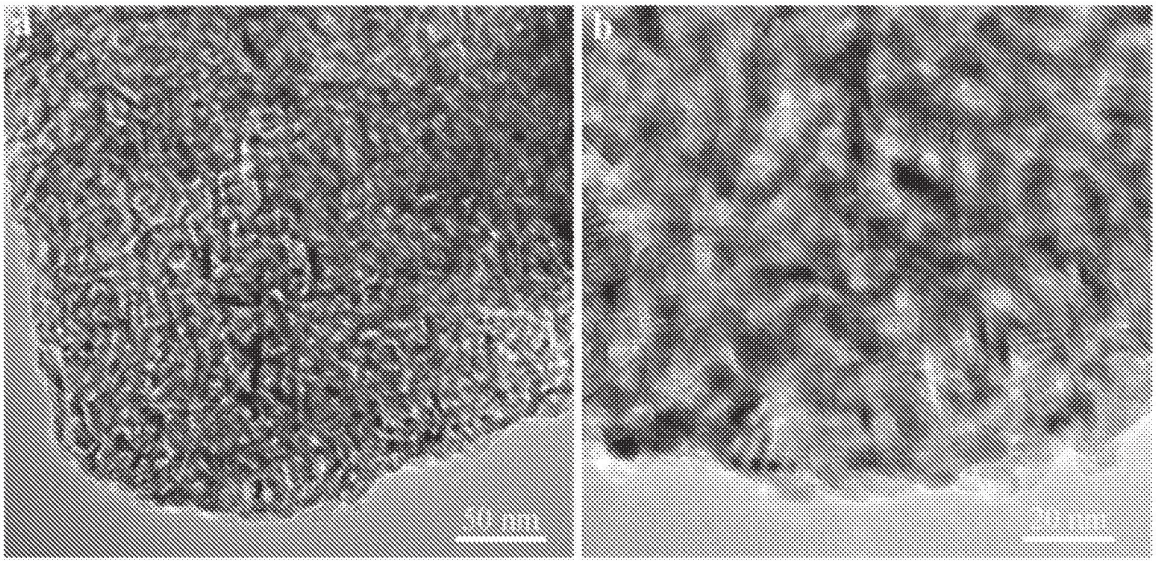

Fig. 9

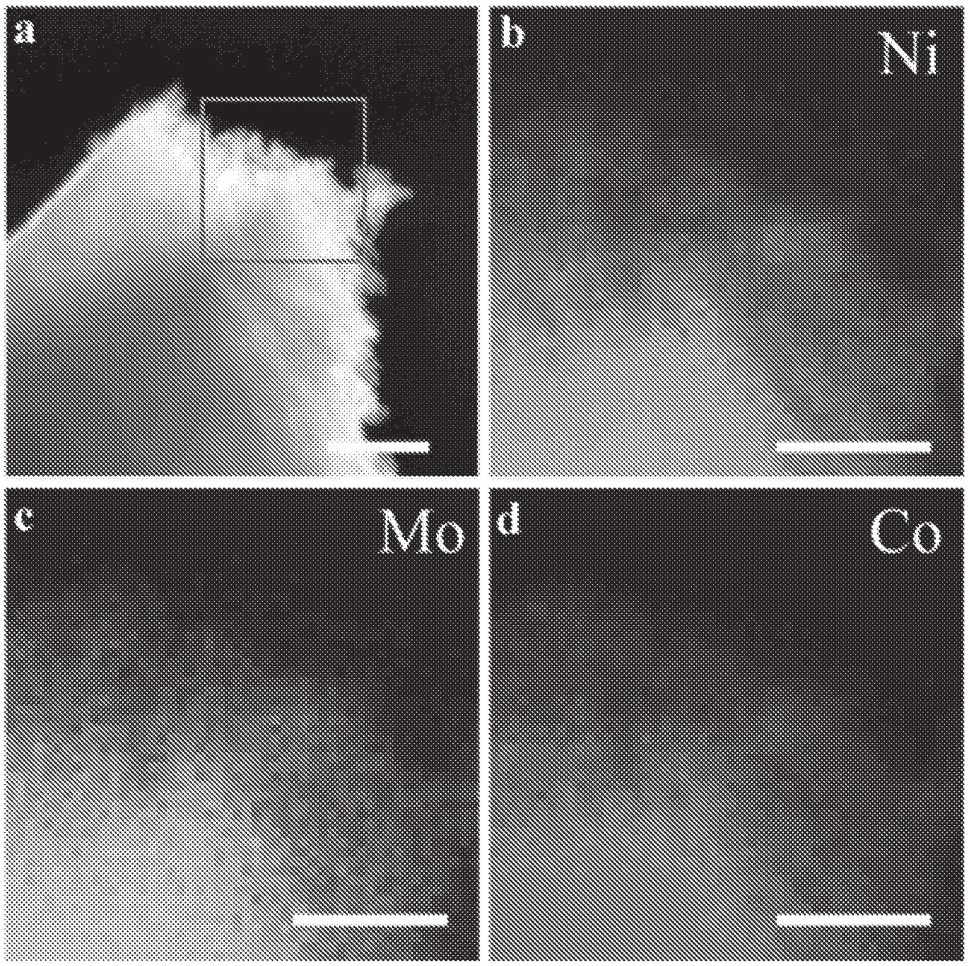

Fig. 10

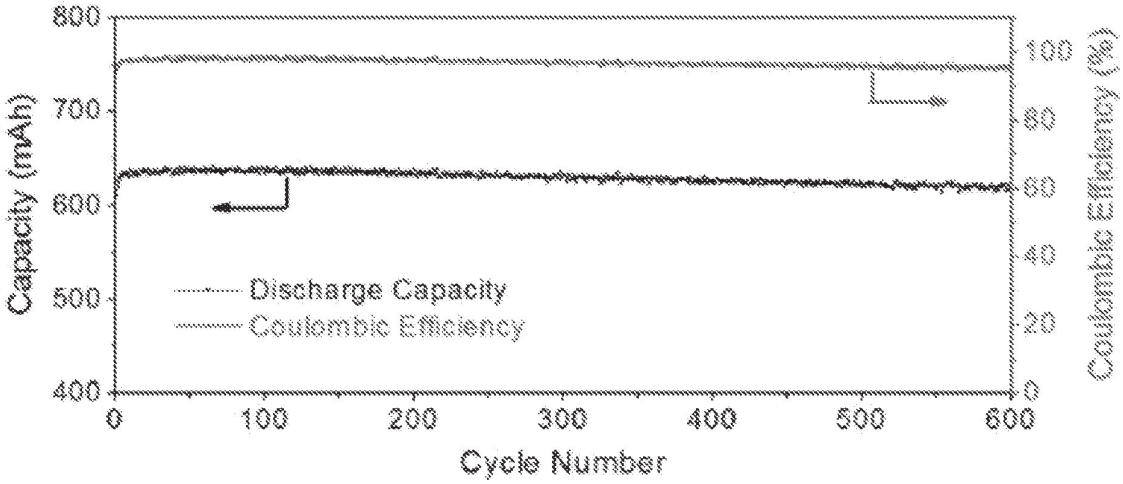
Capacity (mAh)
Coulombic Efficiency (%)
Cycle Number
Discharge Capacity
Coulombic Efficiency
800
700
600
500
400
100
80
60
40
20
0
0
100
200
300
400
500
600

Fig. 11

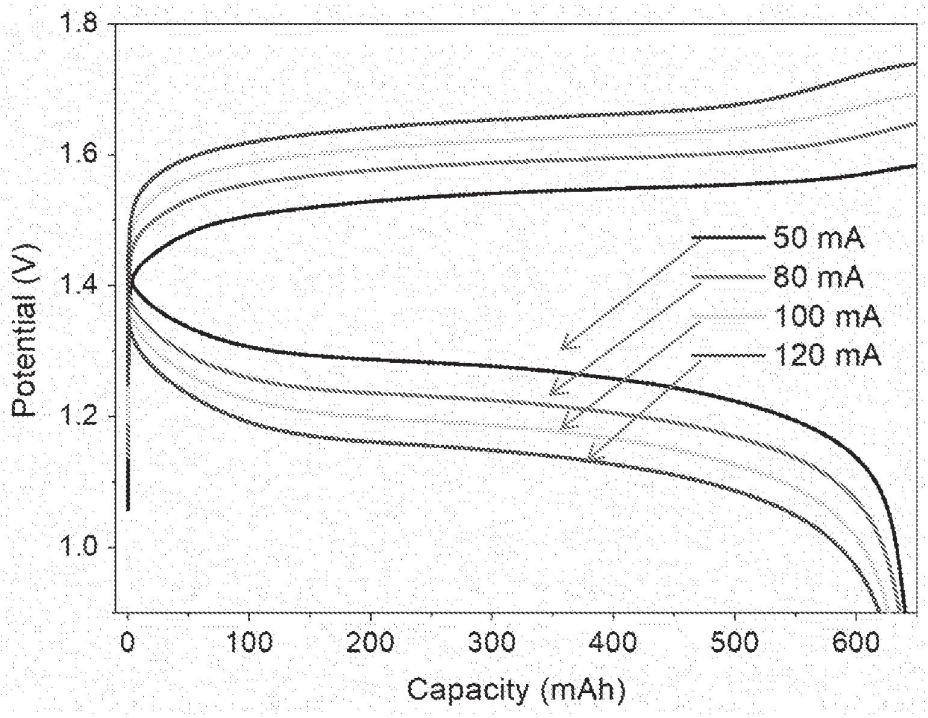
Potential (V)
Capacity (mAh)
50 mA
80 mA
100 mA
120 mA
1.8
1.6
1.4
1.2
1.0
0
100
200
300
400
500
600

Fig. 12

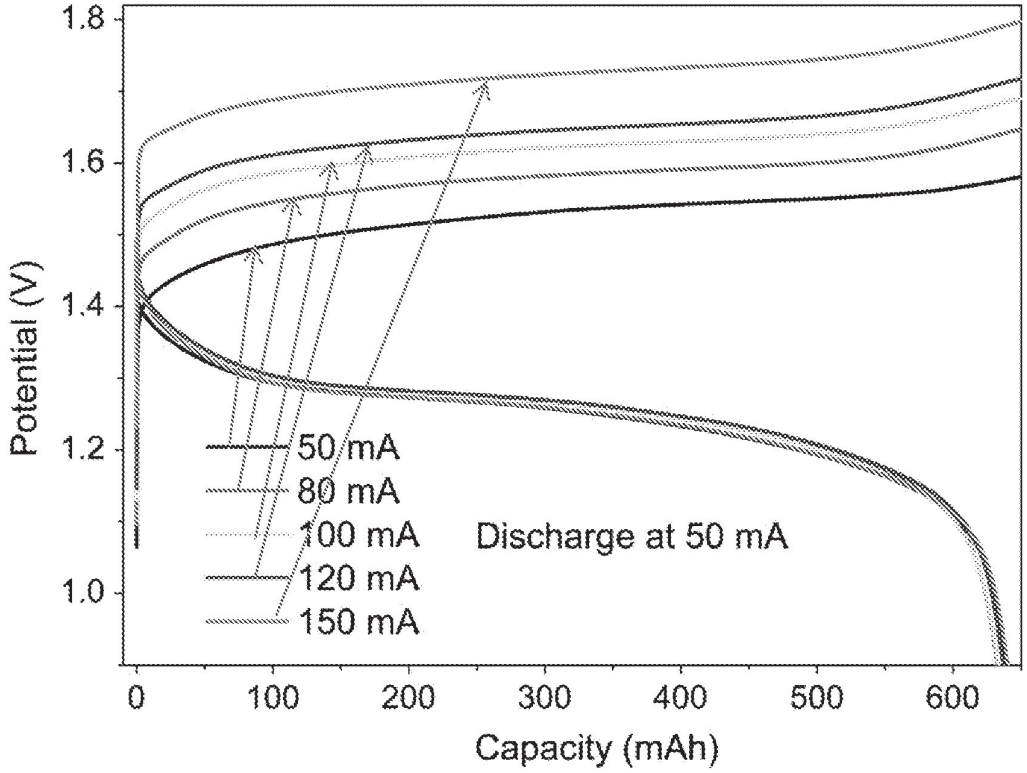
1.8
1.6
1.4
1.2
1.0
Potential (V)
0
100
200
300
400
500
600
Capacity (mAh)
50 mA
80 mA
100 mA
120 mA
150 mA
Discharge at 50 mA

Fig. 13

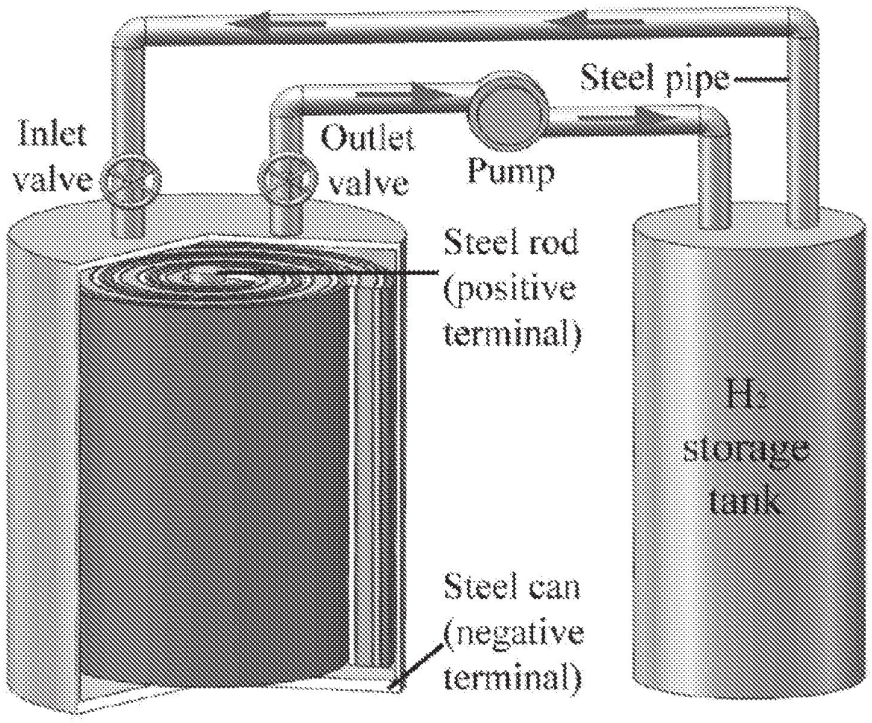
Steel pipe
Inlet valve
Outlet valve
Pump
Steel rod (positive terminal)
H_2 storage tank
Steel can (negative terminal)

Fig. 14

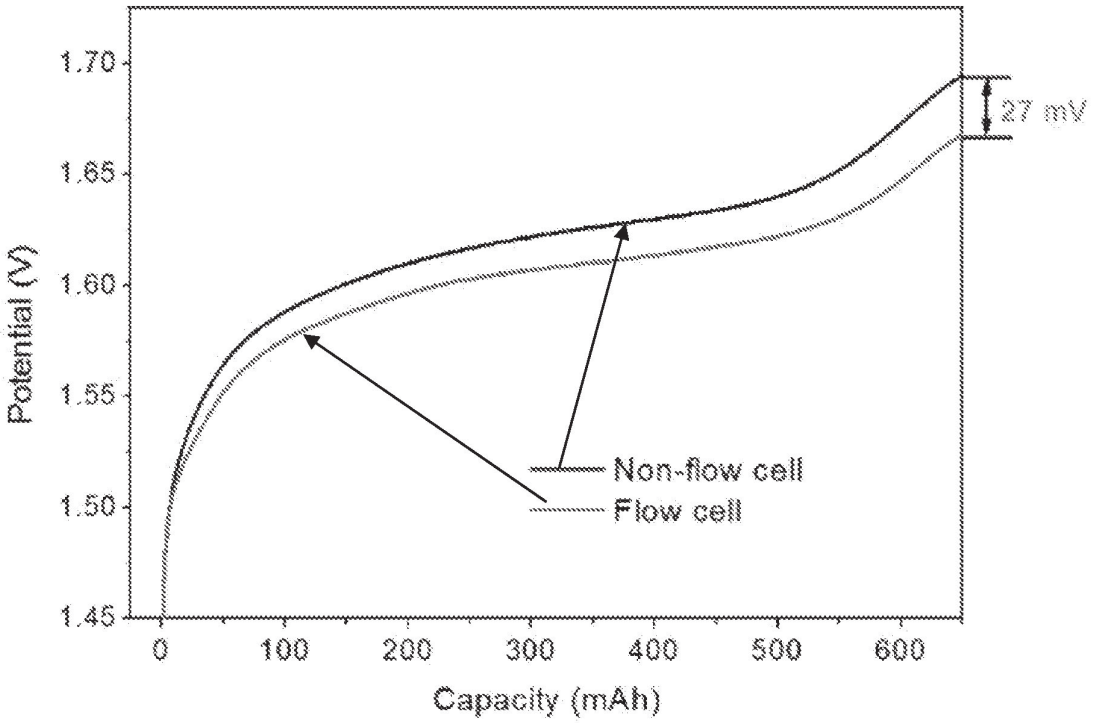
1.70
1.65
1.60
1.55
1.50
1.45
Potential (V)
0
100
200
300
400
500
600
Capacity (mAh)
27 mV
Non-flow cell
Flow cell

Fig. 15

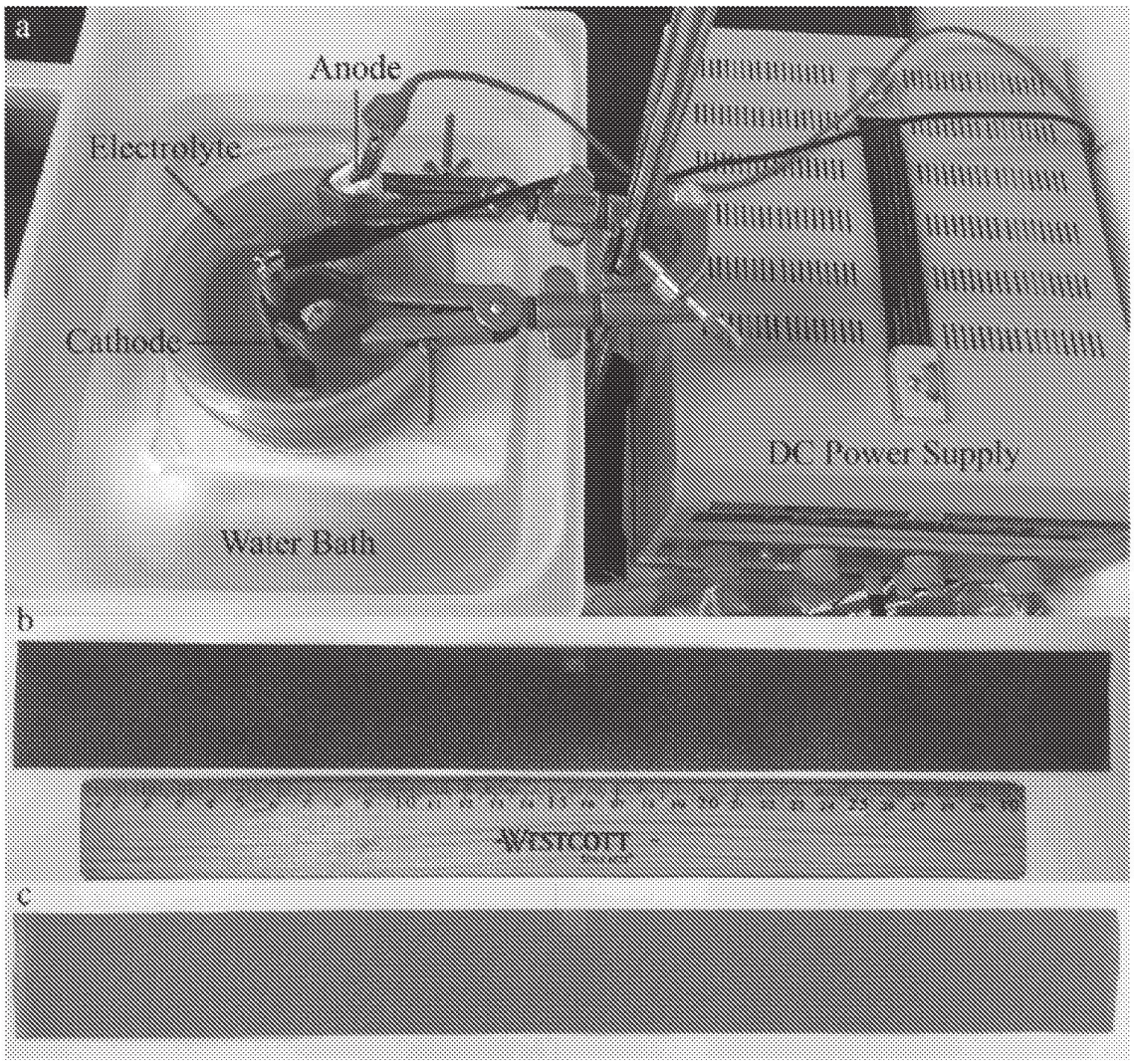
a
Anode
Electrolyte
Cathode
Water Bath
DC Power Supply
b
WESTCOTT
c

Fig. 16

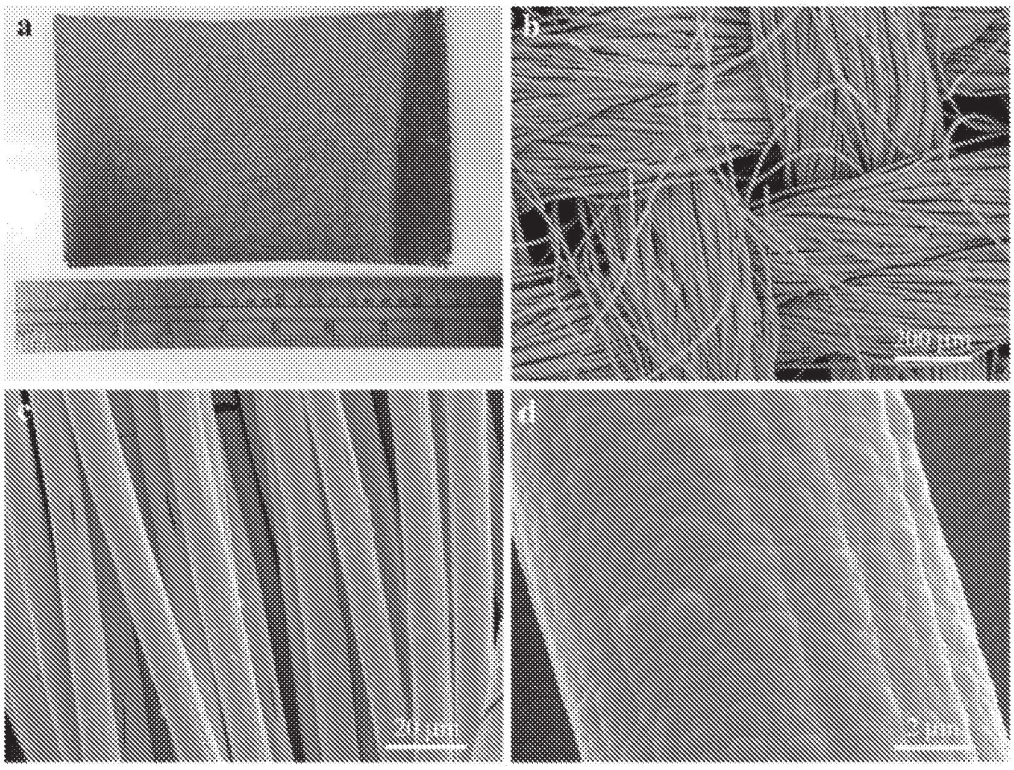

Fig. 17

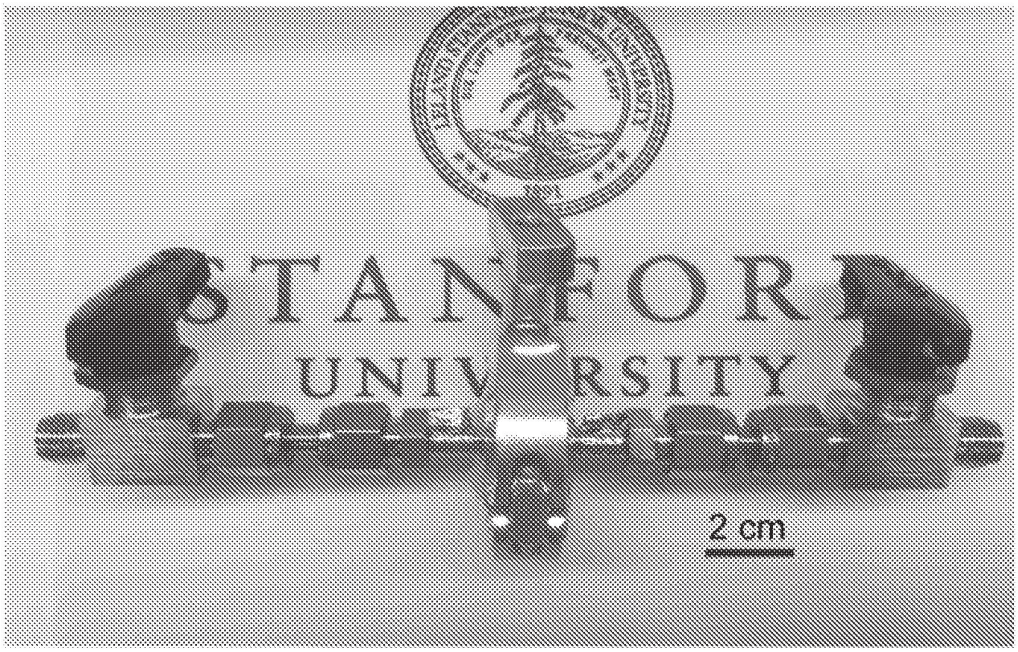

Fig. 18

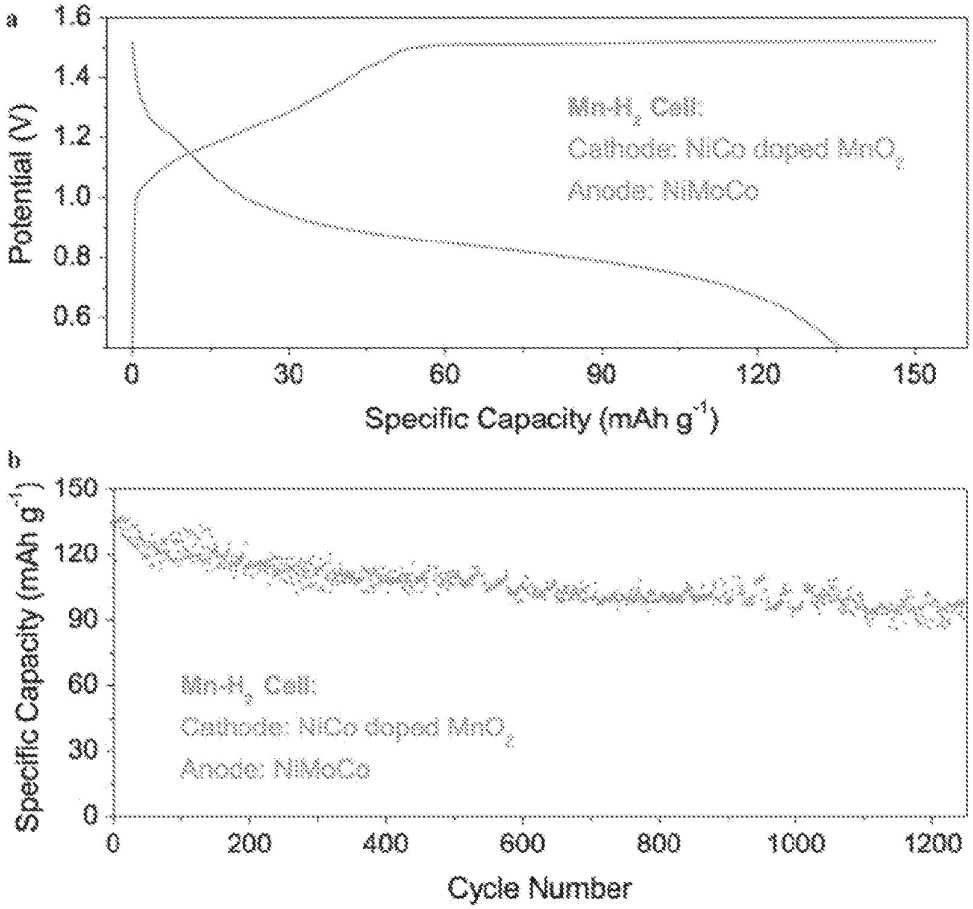
a
Potential (V)
1.6
1.4
1.2
1.0
0.8
0.6
0
30
60
90
120
150
Specific Capacity (mAh g-1)
Mn-H2 Cell:
Cathode: NiCo doped MnO2
Anode: NiMoCo
b
Specific Capacity (mAh g-1)
150
120
90
60
30
0
0
200
400
600
800
1000
1200
Cycle Number
Mn-H2 Cell:
Cathode: NiCo doped MnO2
Anode: NiMoCo

Fig. 19

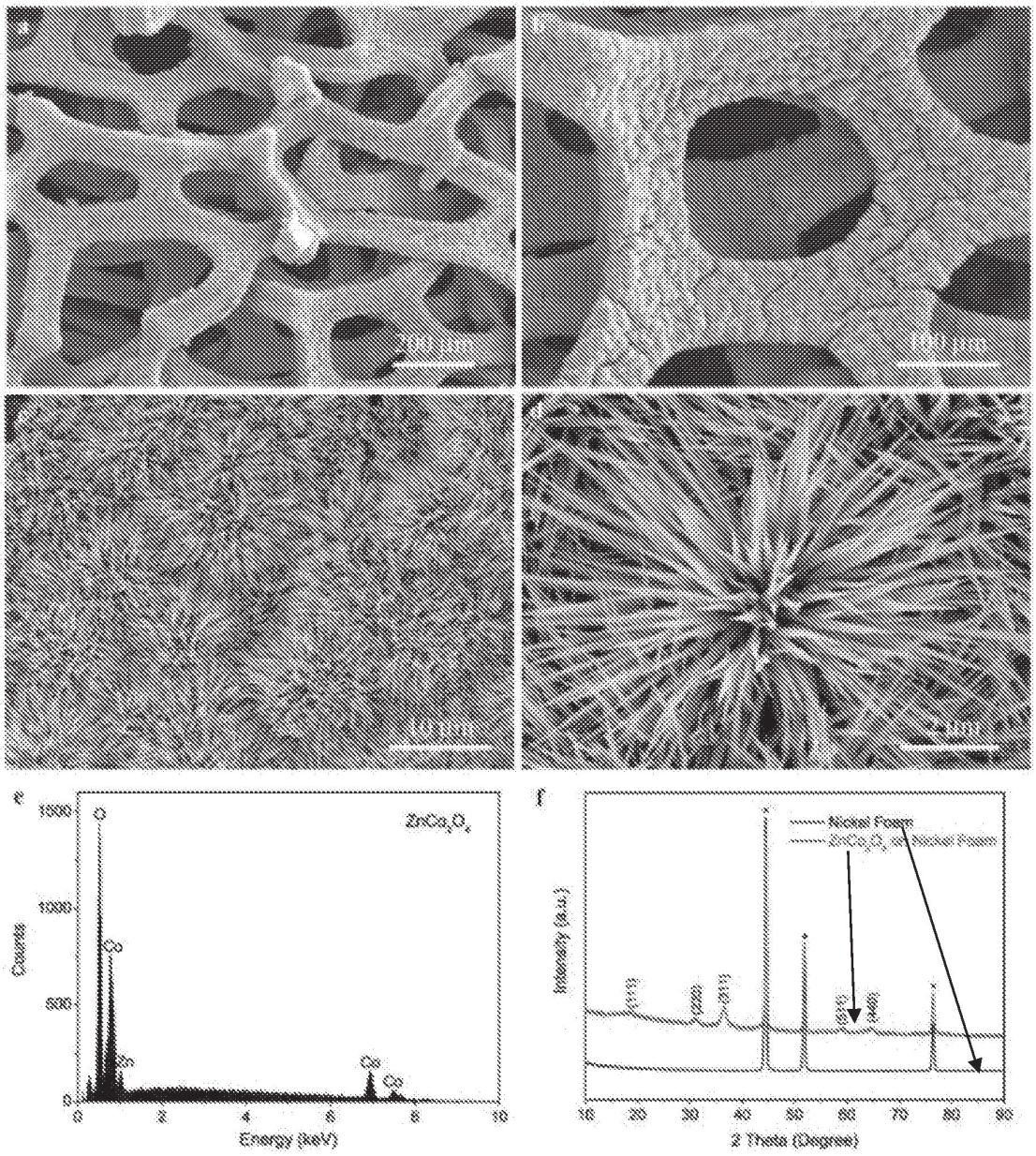
a
b
c
d
e
f
ZnCo2O4
O
Co
Counts
Energy (keV)
Nickel Foam
ZnCo2O4 on Nickel Foam
Intensity (a.u.)
2 Theta (Degree)

Fig. 20

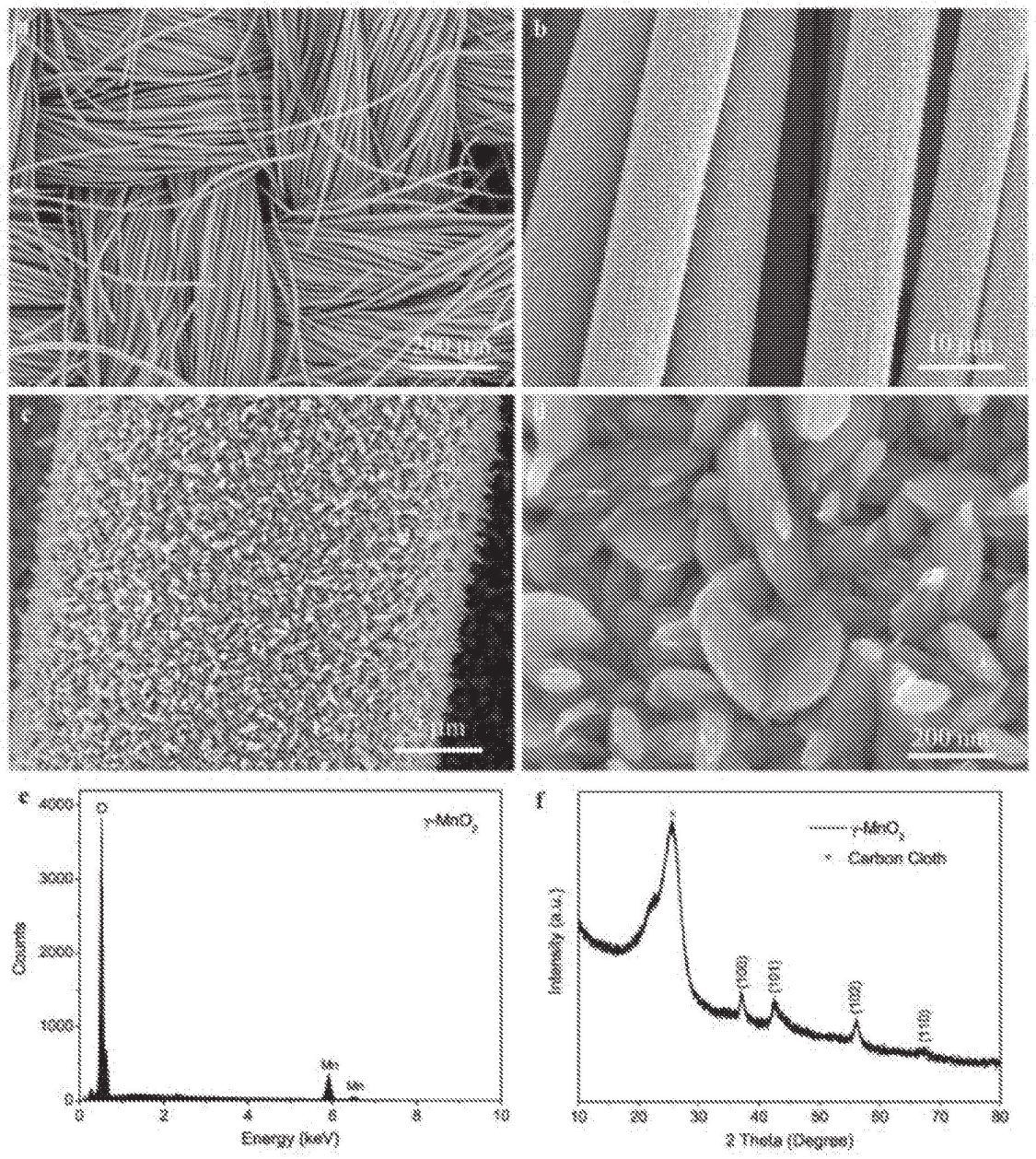
a
b
c
d
e
O
γ-MnO2
Counts
Energy (keV)
Mn
Mn
f
γ-MnO2
Carbon Cloth
Intensity (a.u.)
(110)
(101)
(100)
(111)
2 Theta (Degree)

Fig. 21

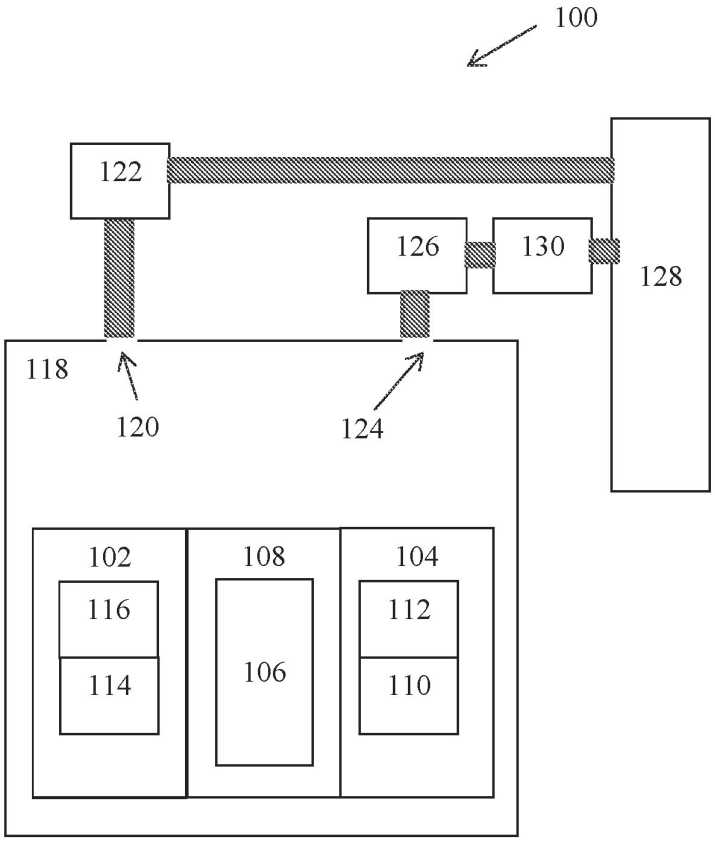

Fig. 22