What Is Claimed Is:

1. An electrochemical power system that generates at least one of electricity and thermal energy comprising a vessel closed to atmosphere, the vessel comprising

at least one cathode;

at least one anode,

at least one bipolar plate, and

reactants that constitute hydrino reactants during cell operation with separate electron flow and ion mass transport, the reactants comprising at least two components chosen from:

a) at least one source of H_2O;

b) at least one source of catalyst or a catalyst comprising at least one of the group chosen from nH, OH, OH^-, nascent H_2O, H_2S, or MNH_2, wherein n is an integer and M is alkali metal; and

c) at least one source of atomic hydrogen or atomic hydrogen,

one or more reactants to form at least one of the source of catalyst, the catalyst, the source of atomic hydrogen, and the atomic hydrogen;

one or more reactants to initiate the catalysis of atomic hydrogen; and

a support,

wherein the combination of the cathode, anode, reactants, and bipolar plate maintains a chemical potential between each cathode and corresponding anode to permit the catalysis of atomic hydrogen to propagate, and

the system further comprising an electrolysis system.

2. The electrochemical power system of Claim 1, wherein the electrolysis system intermittently electrolyzes H_2O to provide the source of atomic hydrogen or atomic hydrogen and discharges the cell such that there is a gain in the net energy balance of the cycle.

3. The electrochemical power system of Claim 1, wherein the reactants comprise at least one electrolyte chosen from:

at least one molten hydroxide;

at least one eutectic salt mixture;

at least one mixture of a molten hydroxide and at least one other compound;

at least one mixture of a molten hydroxide and a salt;

at least one mixture of a molten hydroxide and halide salt;

at least one mixture of an alkaline hydroxide and an alkaline halide;

LiOH-LiBr, LiOH-LiX, NaOH-NaBr, NaOH-NaI, NaOH-NaX, and KOH-KX, wherein X represents a halide),

at least one matrix, and

at least one additive.

4. The electrochemical power system of Claim 1, further comprising a heater.

5. The electrochemical power system of Claim 1, wherein the cell temperature above the electrolyte melting point is in at least one range chosen from about 0 to 1500 °C higher than the melting point, from about 0 to 1000 °C higher than the melting point, from about 0 to 500 °C higher than the melting point, 0 to about 250 °C higher than the melting point, and from about 0 to 100 °C higher than the melting point.

6. The electrochemical power system of Claim 1, wherein the matrix comprises at least one of

oxyanion compounds, aluminate, tungstate, zirconate, titanate, sulfate, phosphate, carbonate, nitrate, chromate, and manganate, oxides, nitrides, borides, chalcogenides, silicides, phosphides, and carbides, metals, metal oxides, nonmetals, and nonmetal oxides;

oxides of alkali, alkaline earth, transition, inner transition, and earth metals, and Al, Ga, In, Sn, Pb, S, Te, Se, N, P, As, Sb, Bi, C, Si, Ge, and B, and other elements that form oxides or oxyanions;

at least one oxide such as one of an alkaline, alkaline earth, transition, inner transition, and rare earth metal, and Al, Ga, In, Sn, Pb, S, Te, Se, N, P, As, Sb, Bi, C, Si, Ge, and B, and other elements that form oxides, and one oxyanion and further comprise at least one cation from the group of alkaline, alkaline earth, transition, inner transition, and rare earth metal, and Al, Ga, In, Sn, and Pb cations;

$LiAlO_2$, MgO, Li_2TiO_3, or $SrTiO_3$;

an oxide of the anode materials and a compound of the electrolyte;

at least one of a cation and an oxide of the electrolyte;

an oxide of the electrolyte MOH (M = alkali);

an oxide of the electrolyte comprising an element, metal, alloy, or mixture of the group of Mo, Ti, Zr, Si, Al, Ni, Fe, Ta, V, B, Nb, Se, Te, W, Cr, Mn, Hf, Co, and M', wherein M' represents an alkaline earth metal;

MoO_2, TiO_2, ZrO_2, SiO_2, Al_2O_3, NiO, FeO or Fe_2O_3, TaO_2, Ta_2O_5, VO, VO_2, V_2O_3, V_2O_5, B_2O_3, NbO, NbO_2, Nb_2O_5, SeO_2, SeO_3, TeO_2, TeO_3, WO_2, WO_3, Cr_3O_4, Cr_2O_3, CrO_2, CrO_3, MnO, Mn_3O_4, Mn_2O_3, MnO_2, Mn_2O_7, HfO_2, Co_2O_3, CoO, Co_3O_4, Co_2O_3, and MgO;

an oxide of the cathode material and optionally an oxide of the electrolyte;

Li_2MoO_3 or Li_2MoO_4, Li_2TiO_3, Li_2ZrO_3, Li_2SiO_3, $LiAlO_2$, $LiNiO_2$, $LiFeO_2$, $LiTaO_3$, $LiVO_3$, $Li_2B_4O_7$, Li_2NbO_3, Li_2SeO_3, Li_2SeO_4, Li_2TeO_3, Li_2TeO_4, Li_2WO_4, Li_2CrO_4, $Li_2Cr_2O_7$, Li_2MnO_4, Li_2HfO_3, $LiCoO_2$, and M'O, wherein M' represents an alkaline earth metal, and MgO;

an oxide of an element of the anode or an element of the same group, and

Li_2MoO_4, MoO_2, Li_2WO_4, Li_2CrO_4, and $Li_2Cr_2O_7$ with a Mo anode, and

the additive comprises at least one of S, Li_2S, oxides, MoO_2, TiO_2, ZrO_2, SiO_2, Al_2O_3, NiO, FeO or Fe_2O_3, TaO_2, Ta_2O_5, VO, VO_2, V_2O_3, V_2O_5, B_2O_3, NbO, NbO_2, Nb_2O_5, SeO_2, SeO_3, TeO_2, TeO_3, WO_2, WO_3, Cr_3O_4, Cr_2O_3, CrO_2, CrO_3, MgO, TiO2, Li2TiO3, LiAlO2, Li_2MoO_3 or Li_2MoO_4, Li_2ZrO_3, Li_2SiO_3, $LiNiO_2$, $LiFeO_2$, $LiTaO_3$, $LiVO_3$, $Li_2B_4O_7$, Li_2NbO_3, Li_2SeO_3, Li_2SeO_4, Li_2TeO_3, Li_2TeO_4, Li_2WO_4, Li_2CrO_4, $Li_2Cr_2O_7$, Li_2MnO_3, or $LiCoO_2$, MnO, and CeO_2.

7. The electrochemical power system of Claim 1, wherein at least one of the following reactions occurs:

a) at least one of H and H_2 is formed at the discharge anode from electrolysis of H_2O;

b) at least one of O and O_2 is formed at the discharge cathode from electrolysis of H_2O;

c) the hydrogen catalyst is formed by a reaction of the reaction mixture, and

d) hydrinos are formed during discharge to produce at least one of electrical power and thermal power.

8. The electrochemical power system of Claim 1, wherein at least one of the following reactions occurs:

a) OH^- is oxidized and reacts with H to form nascent H_2O that serves as a hydrino catalyst;

b) OH^- is oxidized to oxygen ions and H;

c) at least one of oxygen ions, oxygen, and H_2O are reduced at the discharge cathode;

d) H and nascent H_2O catalyst react to form hydrinos; and

e) hydrinos are formed during discharge to produce at least one of electrical power and thermal power.

9. The electrochemical power system of Claim 1, wherein the at least one reaction of the oxidation of OH^- and the reduction of at least one of oxygen ions, oxygen, and H_2O occur during cell discharge to produce a current over time that exceeds the current over time during the electrolysis phase of the intermittent electrolysis.

10. The electrochemical power system of Claim 1, wherein the anode half-cell reaction is

$OH^- + 2H$ to $H_2O + e^- + H(1/4)$

wherein the reaction of a first H with OH^- to form H_2O catalyst and e^- is concerted with the H_2O catalysis of a second H to hydrino.

11. The electrochemical power system of Claim 1, wherein the discharge anode half-cell reaction has a voltage of at least one of

about 1.2 volts thermodynamically corrected for the operating temperature relative to the standard hydrogen electrode, and

a voltage in at least one of the ranges of about 1.5V to 0.75V, 1.3V to 0.9V, and 1.25V to 1.1V relative to a standard hydrogen electrode and 25 °C, and

the cathode half-cell reactions has a voltage of at least one of

about 0 V thermodynamically corrected for the operating temperature, and

a voltage in at least one of the ranges of about -0.5V to +0.5V, -0.2V to +0.2V, and -0.1V to +0.1V relative to the standard hydrogen electrode and 25 °C.

12. The electrochemical power system of Claim 1, wherein the cathode comprises NiO, the anode comprises at least one of Ni, Mo, H242 alloy, and carbon, and the bimetallic junction comprises at least one of Hastelloy, Ni, Mo, and H242 that is a different metal than that of the anode.

13. The electrochemical power system of Claim 1, comprising at least one stack of cells wherein the bipolar plate comprises a bimetallic junction separating the anode and cathode.

14. The electrochemical power system of Claim 1, wherein the cell is supplied with H_2O, wherein the H_2O vapor is in the pressure is in at least one range chosen from about 0.001 Torr to 100 atm, about 0.001 Torr to 0.1 Torr, about 0.1 Torr to 1 Torr, about 1 Torr to 10 Torr, about 10 Torr to 100 Torr, about 100 Torr to 1000 Torr, and about 1000 Torr to 100 atm, and

the balance of pressure to achieve at least atmospheric pressure is provided by a supplied inert gas comprising at least one of a noble gas and N_2.

15. The electrochemical power system of Claim 1, further comprising a water vapor generator to supply H_2O to the system.

16. The electrochemical power system of Claim 1, wherein the cell is intermittently switched between charge and discharge phases,

wherein (i) the charging phase comprises at least the electrolysis of water at electrodes of opposite voltage polarity, and (ii) the discharge phase comprises at least the formation of H_2O catalyst at one or both of the electrodes;

wherein (i) the role of each electrode of each cell as the cathode or anode reverses in switching back and forth between the charge and discharge phases, and (ii) the current polarity reverses in switching back and forth between the charge and discharge phases, and

wherein the charging comprises at least one of the application of an applied current and voltage.

17. The electrochemical power system of Claim 16, wherein at least one of the applied current and voltage has a waveform comprising

a duty cycle in the range of about 0.001% to about 95%;

a peak voltage per cell within the range of about 0.1 V to 10 V;

a peak power density of about 0.001 W/cm^2 to 1000 W/ cm^2, and

an average power within the range of about 0.0001 W/cm^2 to 100 W/cm^2

wherein the applied current and voltage further comprises at least one of

direct voltage, direct current, and at least one of

alternating current and voltage waveforms, wherein the waveform comprises frequencies within the range of about 1 to about 1000 Hz.

18. The electrochemical power system of Claim 17, wherein the waveform of the intermittent cycle comprises at least one of constant current, power, voltage, and resistance, and variable current, power, voltage, and resistance for at least one of the electrolysis and discharging phases of the intermittent cycle, wherein the parameters for at least one phase of the cycle comprise

the frequency of the intermittent phase is in at least one range chosen from about 0.001 Hz to 10 MHz, about 0.01 Hz to 100 kHz, and about 0.01 Hz to 10 kHz;

the voltage per cell is in at least one range chosen from about 0.1 V to 100 V, about 0.3 V to 5 V, about 0.5 V to 2 V, and about 0.5 V to 1.5 V;

the current per electrode area active to form hydrinos is in at least one range chosen from about 1 microamp cm^{-2} to 10 A cm^{-2}, about 0.1 milliamp cm^{-2} to 5 A cm^{-2}, and about 1 milliamp cm^{-2} to 1 A cm^{-2};

the power per electrode area active to form hydrinos is in at least one range chosen from about 1 microW cm^{-2} to 10 W cm^{-2}, about 0.1 milliW cm^{-2} to 5 W cm^{-2}, and about 1 milliW cm^{-2} to 1 W cm^{-2};

the constant current per electrode area active to form hydrinos is in the range of about 1 microamp cm^{-2} to 1 A cm^{-2};

the constant power per electrode area active to form hydrinos is in the range of about 1 milliW cm^{-2} to 1 W cm^{-2};

the time interval is in at least one range chosen from about 10^{-4} s to 10,000 s, 10^{-3} s to 1000 s, and 10^{-2} s to 100 s, and 10^{-1} s to 10 s;

the resistance per cell is in at least one range chosen from about 1milliohm to 100 Mohm, about 1 ohm to 1 Mohm, and 10 ohm to 1 kohm;

conductivity of a suitable load per electrode area active to form hydrinos is in at least one range chosen from about 10^{-5} to 1000 ohm^{-1} cm^{-2}, 10^{-4} to 100 ohm^{-1} cm^{-2}, 10^{-3} to 10 ohm^{-1} cm^{-2}, and 10^{-2} to 1 ohm^{-1} cm^{-2}, and

at least one of the discharge current, voltage, power, or time interval is larger than that of the electrolysis phase to give rise to at least one of power or energy gain over the cycle.

19. The electrochemical power system of Claim 1, wherein the voltage during discharge is maintained above that which prevents the anode from excessively corroding.

20. The electrochemical power system of Claim 1, wherein the catalyst-forming reaction is given by

$O_2 + 5H^+ + 5e^-$ to $2H_2O + H(1/p)$;

the counter half-cell reaction is given by

H_2 to $2H^+ + 2e^-$; and

the overall reaction is given by

$3/2H_2 + 1/2O_2$ to $H_2O + H(1/p)$.

21. The electrochemical power system of Claim 1, wherein at least one of the following products is formed from hydrogen:

a) a hydrogen product with a Raman peak at integer multiple of 0.23 to 0.25 cm^{-1} plus a matrix shift in the range of 0 to 2000 cm^{-1};

b) a hydrogen product with a infrared peak at integer multiple of 0.23 to 0.25 cm^{-1} plus a matrix shift in the range of 0 to 2000 cm^{-1};

c) a hydrogen product with a X-ray photoelectron spectroscopy peak at an energy in the range of 500 to 525 eV plus a matrix shift in the range of 0 to 10 eV;

d) a hydrogen product that causes an upfield MAS NMR matrix shift;

e) a hydrogen product that has an upfield MAS NMR or liquid NMR shift of greater than -5 ppm relative to TMS;

f) a hydrogen product with at least two electron-beam emission spectral peaks in the range of 200 to 300 nm having a spacing at an integer multiple of 0.23 to 0.3 cm^{-1} plus a matrix shift in the range of 0 to 5000 cm^{-1}; and

g) a hydrogen product with at least two UV fluorescence emission spectral peaks in the range of 200 to 300 nm having a spacing at an integer multiple of 0.23 to 0.3 cm^{-1} plus a matrix shift in the range of 0 to 5000 cm^{-1}.

22. The electrochemical power system of Claim 1 comprising

a hydrogen anode comprising a hydrogen permeable electrode;

a molten salt electrolyte comprising a hydroxide; and

at least one of an O_2 and a H_2O cathode, wherein

the cell temperature that maintains at least one of a molten state of the electrolyte and the membrane in a hydrogen permeable state is in at least one range chosen from about 25 to 2000 °C, about 100 to 1000 °C, about 200 to 750 °C, and about 250 to 500 °C,

the cell temperature above the electrolyte melting point in at least one range of about 0 to 1500 °C higher than the melting point, 0 to 1000 °C higher than the melting point, 0 to 500 °C higher than the melting point, 0 to 250 °C higher than the melting point, and 0 to 100 °C higher than the melting point;

the membrane thickness is in at least one range chosen from about 0.0001 to 0.25 cm, 0.001 to 0.1 cm, and 0.005 to 0.05 cm;

the hydrogen pressure is maintained in at least one range chosen from about 1 Torr to 500 atm, 10 Torr to 100 atm, and 100 Torr to 5 atm;

the hydrogen permeation rate is in at least one range chosen from about 1 X 10^{-13} mole s^{-1} cm^{-2} to 1 X 10^{-4} mole s^{-1} cm^{-2}, 1 X 10^{-12} mole s^{-1} cm^{-2} to 1 X 10^{-5} mole s^{-1} cm^{-2}, 1 X 10^{-11} mole s^{-1} cm^{-2} to 1 X 10^{-6} mole s^{-1} cm^{-2}, 1 X 10^{-10} mole s^{-1} cm^{-2} to 1 X 10^{-7} mole s^{-1} cm^{-2}, and 1 X 10^{-9} mole s^{-1} cm^{-2} to 1 X 10^{-8} mole s^{-1} cm^{-2}.

23. The electrochemical power system of Claim 1 comprising

a hydrogen anode comprising a hydrogen sparging electrode;

a molten salt electrolyte comprising a hydroxide, and

at least one of an O_2 and a H_2O cathode, wherein

the cell temperature that maintains a molten state of the electrolyte is in at least one range chosen from about 0 to 1500 °C higher than the electrolyte melting point, 0 to 1000 °C higher than the electrolyte melting point, 0 to 500 °C higher than the electrolyte melting point, 0 to 250 °C higher than the electrolyte melting point, and 0 to 100 °C higher than the electrolyte melting point;

the hydrogen flow rate per geometric area of the H_2 bubbling or sparging electrode is in at least one range chosen from about 1 X 10^{-13} mole s^{-1} cm^{-2} to 1 X 10^{-4} mole s^{-1} cm^{-2}, 1 X 10^{-12} mole s^{-1} cm^{-2} to 1 X 10^{-5} mole s^{-1} cm^{-2}, 1 X 10^{-11} mole s^{-1} cm^{-2} to 1 X 10^{-6} mole s^{-1} cm^{-2}, 1 X 10^{-10} mole s^{-1} cm^{-2} to 1 X 10^{-7} mole s^{-1} cm^{-2}, and 1 X 10^{-9} mole s^{-1} cm^{-2} to 1 X 10^{-8} mole s^{-1} cm^{-2};

the rate of reaction at the counter electrode matches or exceeds that at the electrode at which hydrogen reacts;

the reduction rate of at least one of H_2O and O_2 is sufficient to maintain the reaction rate of H or H_2, and

the counter electrode has a surface area and a material sufficient to support the sufficient rate.

24. A power system that generates thermal energy comprising:

at least one vessel capable of a pressure of at least one of atmospheric, above atmospheric, and below atmospheric;

at least one heater,

reactants that constitute hydrino reactants comprising:

a) a source of catalyst or a catalyst comprising nascent H_2O;

b) a source of atomic hydrogen or atomic hydrogen;

c) reactants to form at least one of the source of catalyst, the catalyst, the source of atomic hydrogen, and the atomic hydrogen; and

one or more reactants to initiate the catalysis of atomic hydrogen wherein the reaction occurs upon at least one of mixing and heating the reactants.

25. The power system of Claim 24 wherein the reaction to form at least one of the source of catalyst, the catalyst, the source of atomic hydrogen, and the atomic hydrogen comprise at least one reaction chosen from

a dehydration reaction;

a combustion reaction;

a reaction of a Lewis acid or base and a Bronsted-Lowry acid or base;

an oxide-base reaction;

an acid anhydride-base reaction;

an acid-base reaction;

a base-active metal reaction;

an oxidation-reduction reaction;

a decomposition reaction;

an exchange reaction, and

an exchange reaction of a halide, O, S, Se, Te, NH_3, with compound having at least one OH;

a hydrogen reduction reaction of a compound comprising O, and

the source of H is at least one of nascent H formed when the reactants undergo reaction and hydrogen from a hydride or gas source and a dissociator.

Claims

1. An electrochemical power system comprising:

a vessel closed to atmosphere, the vessel comprising a cell, wherein the cell comprises:

at least one cathode configured to reduce O_2 and H_2O;

at least one anode configured to oxidize a species comprising hydrogen;

at least one bipolar plate; and

an electrolyte matrix comprising MOH-MX, wherein M is an alkali metal and X is a halogen;

wherein the electrochemical power system further comprises an electrolysis system.

2. The electrochemical power system recited in claim 1, wherein the electrolysis system is configured to electrolyze H_2O intermittently.

3. The electrochemical power system recited in claim 1, wherein the electrolyte matrix is chosen from at least one of the following:

at least one molten hydroxide;

at least one eutectic salt mixture;

at least one mixture of a molten hydroxide and at least one other compound;

at least one mixture of a molten hydroxide and a salt;

at least one mixture of a molten hydroxide and halide salt;

at least one mixture of an alkaline hydroxide and an alkaline halide;

LiOH-LiBr, LiOH-LiX, NaOH-NaBr, NaOH-NaI, NaOH-NaX, and KOH-KX, wherein X is a halogen.

4. The electrochemical power system recited in claim 1, further comprising a heater.

5. The electrochemical power system recited in claim 1, wherein the cell temperature is in at least one range chosen from the following ranges:

0 to 1500 °C higher than the melting point of the electrolyte matrix,

0 to 1000 °C higher than the melting point of the electrolyte matrix,

0 to 500 °C higher than the melting point of the electrolyte matrix,

0 to 250 °C higher than the melting point of the electrolyte matrix, and

0 to 100 °C higher than the melting point of the electrolyte matrix.

6. The electrochemical power system recited in claim 1, wherein the electrolyte matrix comprises at least one of the following:

oxyanion compounds, aluminate, tungstate, zirconate, titanate, sulfate, phosphate, carbonate, nitrate, chromate, and manganate, oxides, nitrides, borides, chalcogenides, silicides, phosphides, and carbides, metals, metal oxides, nonmetals, and nonmetal oxides;

oxides of alkali metal, alkaline earth metal, transition metal, inner transition metal, and rare earth metal, and Al, Ga, In, Sn, Pb, S, Te, Se, N, P, As, Sb, Bi, C, Si, Ge, and B, and other elements that form oxides or oxyanions;

at least one oxide such as one of an alkali metal, alkaline earth metal, transition metal, inner transition metal, and rare earth metal, and Al, Ga, In, Sn, Pb, S, Te, Se, N, P, As, Sb, Bi, C, Si, Ge, and B, and other elements that form oxides, and one oxyanion and further comprise at least one cation from the group of alkali metal, alkaline earth metal, transition metal, inner transition metal, and rare earth metal, and Al, Ga, In, Sn, and Pb cations;

$LiAlO_2$, MgO, Li2TiO_3, or $SrTiO_3$;

an oxide of the anode materials and a compound of the electrolyte;

at least one of a cation and an oxide of the electrolyte;

an oxide of the electrolyte MOH (M = alkali);

an oxide of the electrolyte comprising an element, metal, alloy, or mixture of the group of Mo, Ti, Zr, Si, Al, Ni, Fe, Ta, V, B, Nb, Se, Te, W, Cr, Mn, Hf, Co, and M' (M' represents an alkaline earth metal);

MoO_2, TiO_2, ZrO_2, SiO_2, Al_2O_3, NiO, FeO or Fe_2O_3, TaO_2, Ta_2O_5, VO, VO_2, V_2O_3, V_2O_5, B_2O_3, NbO, NbO_2, Nb_2O_5, SeO_2, SeO_3, TeO_2, TeO_3, WO_2, WO_3, Cr_3O_4, Cr_2O_3, CrO_2, CrO_3, MnO, Mn_3O_4, Mn_2O_3, MnO_2, Mn_2O_7, HfO_2, Co_2O_3, CoO, Co_3O_4, Co_2O_3, and MgO;

an oxide of the cathode material and optionally an oxide of the electrolyte;

Li_2MoO_3 or Li_2MoO_4, Li_2TiO_3, Li_2ZrO_3, Li_2SiO_3, $LiAlO_2$, $LiNiO_2$, $LiFeO_2$, $LiTaO_3$, $LiVO_3$, $Li_2B_4O_7$, Li_2NbO_3, Li_2SeO_3, Li_2SeO_4, Li_2TeO_3, Li_2TeO_4, Li_2WO_4, Li_2CrO_4, $Li_2Cr_2O_7$, Li_2MnO_4, Li_2HfO_3, $LiCoO_2$, and M'O (wherein M' represents an alkaline earth metal), and MgO;

an oxide of an element of the anode or an element of the same group, and Li_2MoO_4, MoO_2, Li_2WO_4, Li_2CrO_4, and $Li_2Cr_2O_7$ with a Mo anode, and

the additive comprising at least one of S, Li_2S, oxides, MoO_2, TiO_2, ZrO_2, SiO_2, Al_2O_3, NiO, FeO or Fe_2O_3, TaO_2, Ta_2O_5, VO, VO_2, V_2O_3, V_2O_5, B_2O_3, NbO, NbO_2, Nb_2O_5, SeO_2, SeO_3, TeO_2, TeO_3, WO_2, WO_3, Cr_3O_4, Cr_2O_3, CrO_2, CrO_3, MgO, TiO_2, Li_2TiO_3, $LiAlO_2$, Li_2MoO_3 or Li_2MoO_4, Li_2ZrO_3, Li_2SiO_3, $LiNiO_2$, $LiFeO_2$, $LiTaO_3$, $LiVO_3$, $Li_2B_4O_7$, Li_2NbO_3, Li_2SeO_3, Li_2SeO_4, Li_2TeO_3, Li_2TeO_4, Li_2WO_4, Li_2CrO_4, $Li_2Cr_2O_7$, Li_2MnO_3, or $LiCoO_2$, MnO, and CeO_2.

7. The electrochemical power system recited in claim 1, further configured so that at least one of the following reactions occurs:

the oxidation of OH^-, and

the reduction of at least one of an oxygen ion, oxygen, and H_2O.

8. The electrochemical power system recited in claim 1, wherein:

the cathode comprises NiO;

the anode comprises at least one of Ni, Mo, H242 alloy, and carbon; and

the bipolar plate comprises a bimetallic junction, the bimetallic junction comprising at least one of Hastelloy, Ni, Mo, and H242; and

wherein no more than one of the anode and the bimetallic junction comprises any of Ni, Mo, Hastelloy, and H242 alloy.

9. The electrochemical power system recited in claim 1, further comprising at least one stack of cells comprising the bipolar plate, the bipolar plate comprising a bimetallic junction that separates the anode and the cathode.

10. The electrochemical power system recited in claim 1, further comprising a water vapor generator configured to supply H_2O to the system.

11. The electrochemical power system recited in claim 1, further configured to enable switching between charge and discharge phases, wherein:

(i) an electrode is configured to reverse its role as the cathode or anode when switching between the charge and discharge phases; and

(ii) a current polarity is configured to reverse when switching between the charge and discharge phases;

wherein the charge phase comprises at least one of the application of an applied current and the application of an applied voltage.

12. The electrochemical power system recited in claim 1, further configured to maintain a voltage above which the anode is prevented from excessively corroding.

13. The electrochemical power system recited in claim 1, further comprising a molten salt electrolyte, the molten salt electrolyte comprising a hydroxide,

wherein a cell temperature that maintains a molten state of the electrolyte is in at least one range chosen from 25 to 2000 °C, 100 to 1000 °C, 200 to 750 °C, and 250 to 500 °C;

the cell temperature being in at least one of 0 to 1500 °C higher than an electrolyte matrix melting point, 0 to 1000 °C higher than the electrolyte matrix melting point, 0 to 500 °C higher than the electrolyte matrix melting point, 0 to 250 °C higher than the electrolyte matrix melting point, and 0 to 100 °C higher than the electrolyte matrix melting point;

wherein a hydrogen pressure is maintained in at least one of 1 Torr to 500 atm, 10 Torr to 100 atm, and 100 Torr to 5 atm; and

wherein a hydrogen permeation rate is in at least one of 1×10^{-13} mole s^{-1} cm^{-2} to 1×10^{-4} mole s^{-1} cm^{-2}, 1×10^{-12} mole s^{-1} cm^{-2} to 1×10^{-5} mole s^{-1} cm^{-2}, 1×10^{-11} mole s^{-1} cm^{-2} to 1×10^{-6} mole s^{-1} cm^{-2}, 1×10^{-10} mole s^{-1} cm^{-2} to 1×10^{-7} mole s^{-1} cm^{-2}, and 1×10^{-9} mole s^{-1} cm^{-2} to 1×10^{-8} mole s^{-1} cm^{-2}.

14. An electrochemical power system comprising:

at least one vessel having a pressure;

at least one cathode configured to reduce O_2 and H_2O;

at least one anode configured to oxidize a species comprising hydrogen;

at least one bipolar plate; and

an electrolyte matrix comprising MOH-MX, wherein M is an alkali metal and X is a halogen; and

at least one heater.