Controlled Generation of Cool Hydrogen from Solid Mixtures

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Cited US Patents:

Patent Number	Date YYYYMM	Main US Class	Inventor
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	x-ref:	252188	
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	x-ref:	252188	
US 3734863	197305	252188	Beckert
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Abstract:
The hydrogen gas evolution rates and the gas temperatures of certain hydrn gas generating compositions are modified by adding compounds such as LiAlH[sub]4 which thermally decompose in the reaction zone producing hydrogen while lowering the reaction temperature; and acetonates, metal oxides, and the like which, when added in relatively small amounts accelerate the hydrogen gas evolution rate.

What is claimed as new and desired to be secured by Letters Patent of the

1. In a hydrogen gas generating composition comprising (1) a hydride having the formula Y(ZH[sub]4)[sub]m wherein Y is a mono- or divalent metal capable of forming complex hydrides and is selected from the group consisting of alkali metals and alkaline earth metals, m is the valency of said mono- or divalent metal and Z is a trivalent metal capable of forming complex hydrides and is selected from the group

consisting of boron and aluminum, or mixtures of said hydrides; and (2) a hydrogen producing reactant having the formula (NH[sub]4)[sub]n X wherein X is an inorganic acid group and n is the valency of said inorganic acid group, and mixtures of said compounds, wherein components (1) and (2) are present in stoichiometric amounts in the hydrogen gas generating composition, the improvement comprising the incorporation in said composition of at least one metal hydride coolant which decomposes endothermically to produce hydrogen gas; and a reaction rate modifier selected from the group consisting of the acetylacetonates of barium, calcium, chromium, cobalt (II), copper (II), iron (II), iron (III), manganese (III), nickel, vanadium, and zinc; molybdenyl (VI) acetylacetonate; uranyl acetylacetonate; vanadyl acetylacetonate; ferric oxide; platinum dioxide; silicon dioxide; silver oxide; palladium metal powder; silver carbonate; lanthanum chloranilate; nickel benzoylacetonate; cuprous oxide; palladium chloride; and mixtures thereof. (Main Claim)

United States is:2. The composition of claim 1 wherein the reaction rate modifier is selected from the group consisting of the acetylacetonates of chromium, cobalt (II), copper (II), iron (II), iron (III), manganese (III), nickel, vanadium and zinc; molybdenyl (VI) acetylacetonate, uranyl acetylacetonate; vanadyl acetylacetonate; ferric oxide; platinum dioxide; silicon dioxide; silver oxide; palladium metal powder; and silver carbonate.

3. The composition of claim 1 wherein the reaction rate modifier comprises up to about 10% by weight of said composition.
4. The composition of claim 3 wherein said hydride is NaAlH[sub]4, said hydrogen producing reactant is NH[sub]4 Cl, said coolant is LiAlH[sub]4 and said rate modifier is ferric oxide.
5. The composition of claim 4 wherein said rate modifier comprises about 5% by weight of said composition.
6. The composition of claim 1 wherein the reaction rate modifier is selected from the group consisting of the acetylacetonates of barium and calcium; lanthanum chloranilate; nickel benzoylacetonate; cuprous oxide; and palladium chloride.
7. In a hydrogen gas generating composition comprising (1) a hydride having the formula Y(ZH[sub]4)[sub]m wherein Y is a mono- or divalent metal capable of forming complex hydrides and is selected from the group consisting of alkali metals and alkaline earth metals, m is the valency of said mono- or divalent metal and Z is a trivalent metal capable of forming complex hydrides and is selected from the group consisting of boron and aluminum, or mixtures of said hydrides; and (2) a hydrogen producing reactant having the formula (NH[sub]4)[sub]n X wherein X is an inorganic acid group and n is the valency of said inorganic acid group, and mixtures of said compounds, wherein components (1) and (2) are present in stoichiometric amounts in the hydrogen gas generating composition, the improvement comprising the incorporation in said composition of at least one metal hydride coolant which decomposes endothermically to produce hydrogen gas; and a reaction rate modifier selected from the group consisting of the acetylacetonates of thorium and zirconium; titanyl acetylacetonate; ferrocene; thorium oxide; titanium dioxide reduced iron powder; uranium tetrachloride; and mixtures thereof.
8. The composition of claim 7 wherein said coolant is selected from the group consisting of LiAlH[sub]4, LiBH[sub]4, MgH[sub]2 and AlH[sub]3.
9. The composition of claim 7 wherein the reaction rate modifier comprises up to about 10% by weight of said composition.
10. The composition of claim 8 wherein said hydride is NaAlH[sub]4, said

hydrogen producing reactant is NH[sub]4 Cl, said coolant is LiAlH[sub]4 and said rate modifier is thorium acetylacetonate.

11. The composition of claim 9 wherein said modifier comprises about 5% by weight of said composition.
12. The composition of claim 7 wherein the reaction rate modifier is selected from the group consisting of zirconium acetylacetonate, titanyl acetylacetonate, ferrocene, thorium oxide, titanium dioxide, reduced iron powder and uranium tetrachloride.
13. The composition of claim 1 wherein said coolant is selected from the group consisting of LiAlH[sub]4, LiBH[sub]4, MgH[sub]2 and AlH[sub]3.
14. The composition of claim 1 further comprising a binder up to about 15% by weight of said composition thereby forming a solid gas generating composition.
15. The composition of claim 14 additionally comprising a suitable plasticizer up to about 30% by weight of said binder thereby improving the mechanical properties of said solid gas generating composition.
16. The composition of claim 14 wherein said binder comprises an isobutyl/styrene copolymer.
17. The composition of claim 7 further comprising a binder up to about 15% by weight of said composition thereby forming a solid gas generating composition.
18. The composition of claim 17 additionally comprising a suitable plasticizer up to about 30% by weight of said binder thereby improving the mechanical properties of said solid gas generating composition.
19. The composition of claim 17 wherein said binder comprises an isobutyl/styrene copolymer.