CLAIMS:

1. A process for producing hydrogen and graphitic carbon from a gas, which consists essentially of a hydrocarbon gas, said process comprising:

   contacting at a temperature between 600 °C and 1000 °C a catalyst with the gas to catalytically convert at least a portion of the gas to hydrogen and graphitic carbon,

   wherein the catalyst is a naturally occurring iron oxide; and

   wherein the hydrocarbon gas is methane, ethane, ethylene, propane and/or butane.

2. A process for producing hydrogen and graphitic carbon according to claim 1, wherein the pressure is greater than atmospheric pressure.

3. A process for producing hydrogen and graphitic carbon according to claim 1, wherein the pressure is 0 bar (g) to 100 bar (g).

4. A process for producing hydrogen and graphitic carbon according to any one of the preceding claims, wherein the temperature is between 700 °C and 950 °C.

5. A process for producing hydrogen and graphitic carbon according to any one of claims 1 to 4, wherein the temperature is between 800 °C and 900 °C.

6. A process for producing hydrogen and graphitic carbon according to any one of claims 1 to 3, wherein the temperature is between 650 °C and 750 °C.

7. A process for producing hydrogen and graphitic carbon according to any one of the preceding claims, wherein the hydrocarbon gas is methane.

8. A process for producing hydrogen and graphitic carbon according to any one of claims 1 to 6, wherein the gas is natural gas.

9. A process for producing hydrogen and graphitic carbon according to any one of the preceding claims, wherein, the step of contacting the catalyst with the gas is performed in a plurality of pressurised reactors arranged in series.

10. A process for producing hydrogen and graphitic carbon according to claim 9, wherein the arrangement of the reactors in series allows gas to flow from a first reactor to a subsequent reactor and each subsequent reactor in the series operates at a lower pressure than the preceding reactor, allowing gas to travel to reactors of lower pressure.

11. A process for producing hydrogen and graphitic carbon according to claim 10, wherein each reactor is provided with unreacted catalyst.

12. A process for producing hydrogen and graphitic carbon according to claim 9, wherein the arrangement of the reactors in series allows catalyst to flow from a first reactor to a subsequent reactor and each subsequent reactor in the series is operated at a higher pressure than the preceding reactor, allowing catalyst to travel to reactors of higher pressure.

13. A process for producing hydrogen and graphitic carbon according to claim 12, wherein unreacted gas is provided to each reactor.

14. A process for producing hydrogen and graphitic carbon according to claim 9, wherein the arrangement of the reactors in series allows for both the gas and catalyst to flow between reactors in opposite directions.

15. A process for producing hydrogen and graphitic carbon according to claim 14, wherein unreacted catalyst is provided in the lowest pressure reactor and unreacted gas is provided in the highest pressure reactor and catalyst is transferred between the chambers of increasing pressure counter-currently to the gas flow between the chambers.

16. A method for the beneficiation of catalytic metal containing ore comprising a catalytic metal and a non-catalytic gangue species, the method comprising:
contacting at a temperature between 600 °C and 1000 °C the catalytic metal containing ore with a gas to form graphite-coated metal particles and unchanged non-catalytic gangue species, wherein the gas consists essentially of a hydrocarbon gas, and the hydrocarbon gas is methane, ethane, ethylene, propane and/or butane;
separating the graphite-coated metal particles from the unchanged non-catalytic gangue species; and
removing the graphite from the graphite coated metal particles by contacting at a temperature of between 700 °C and 900 °C the graphite-coated metal particles with hydrogen gas to yield the catalytic metal.

17. A method for the beneficiation of catalytic metal containing ore according to claim 16, wherein the catalytic metal containing ore is iron ore.

18. A method for the beneficiation of catalytic metal containing ore according to claim 16 or claim 17, wherein the contacting is performed at a pressure greater than atmospheric pressure.

19. A method for the beneficiation of catalytic metal containing ore according to claim 16 or claim 17, wherein the contacting is performed at a pressure of 0 bar (g) to 100 bar (g).

20. A method for the beneficiation of catalytic metal containing ore according to any one of claims 16 to 19, wherein the method comprises contacting at a temperature of between 700 °C and 950 °C the catalytic metal containing ore with a gas to form graphite-coated metal particles and unchanged non-catalytic gangue species.

21. A method for the beneficiation of catalytic metal containing ore according to any one of claims 16 to 20, wherein the removal of the graphite from the graphite coated metal particles is performed in a pressurised reduction reactor at a pressure of 0 bar (g) to 100 bar (g).

22. A method for the beneficiation of catalytic metal containing ore according to any one of claims 16 to 21, wherein the step of contacting at temperature of 700 °C to 900 °C, the graphite coated metal particles with hydrogen gas produces methane which is recycled to produce hydrogen.

23. A method for the beneficiation of catalytic metal containing ore according to claim 22, wherein the hydrogen produced in the step of recycling the methane is used in the step of contacting at temperature of 700 °C to 900 °C the graphite coated metal particles with hydrogen gas to remove the graphite from the graphite coated metal particles.