CLAIMS

1. A process of controlling the morphology of graphite in a process for the production of graphite, the process comprising:

    contacting at elevated temperature, a metal-containing catalyst with a hydrocarbon gas to catalytically convert at least a portion of the hydrocarbon gas to hydrogen and carbon;

    wherein the temperature is between 600 °C and 1000 °C and a pressure between 0 bar(g) and 100 bar(g), and wherein both the temperature and the pressure are set within predetermined value ranges to selectively synthesise graphitic material with a desired morphology selected from the group consisting of: carbon nano-onions (CNOs).

~~2. A process according to claim 1, wherein the desired morphology is selected from the group comprising graphite fibres, carbon nano-onions (CNOs), carbon micro-shells (CMSs) and graphene.~~

~~3.~~2. A process according to claim~~s~~ 1 ~~or 2~~, wherein the metal-containing catalyst is a metal oxide catalyst.

~~4.~~3. A process according to ~~any one of the proceeding claims~~claim 1 or claim 2, wherein the metal-containing catalyst is an iron oxide catalyst.

~~5.~~4. A process according to claim ~~4~~3, wherein the iron oxide catalyst is selected from Fe_2O_3 and Fe_3O_4 or any mixture thereof.

~~6.~~5. A process according to claim ~~4~~3, wherein the iron oxide catalyst is selected from hematite iron ore and goethite iron ore or any mixture thereof

~~7.~~6. A process according to any one of the ~~proceeding~~ preceding claims, wherein the metal-containing catalyst is unsupported.

~~8.~~7. A process according to any one of claims 1 to ~~7~~5, wherein the metal-containing catalyst is supported on a support.

~~9.~~8. A process according to claim ~~8~~7, wherein the support is of the same chemical composition as the metal-containing catalyst.

~~10.~~9. A process according to any one of the ~~proceeding~~ preceding claims, wherein the hydrocarbon gas is methane.

~~11.~~10. A process according to any one of ~~the proceeding claims~~claim 1 to 8, wherein the hydrocarbon gas is natural gas.

~~12.~~11. A method according to any one of the ~~proceeding~~ preceding claims, ~~CNOs are selectively synthesised where~~wherein the step of:

> contacting at elevated temperatures a metal-containing catalyst with a hydrocarbon gas to catalytically convert at least a portion of the hydrocarbon gas to hydrogen and carbon,

is conducted at a temperature between 700 °C to 900 °C and a pressure between 0 bar(g) to 8 bar(g).

~~13.~~12. A method according to claim ~~12~~11, the temperature is 800 °C to 900 °C and the pressure is 2 bar(g) to 4 bar(g).

~~14. A method according to any one of the preceding claims, wherein graphitic fibres are selectively synthesised where the step of:~~

> ~~contacting at elevated temperatures a metal-containing catalyst with a hydrocarbon gas to catalytically convert at least a portion of the hydrocarbon gas to hydrogen and carbon,~~

~~is conducted at a temperature of 700 °C to 900 °C and a pressure between 0 bar(g) to 8 bar(g) and the metal-containing catalyst is goethite iron oxide.~~

~~15. A method according to claim 14, wherein the temperature is 750 °C to 850 °C and the pressure is 0 bar(g) to 4 bar(g).~~

~~16. A method according to any one of the preceding claims, wherein CMS is selectively synthesised where the step of:~~

> ~~contacting at elevated temperatures a metal-containing catalyst with a hydrocarbon gas to catalytically convert at least a portion of the hydrocarbon gas to hydrogen and carbon,~~

~~is conducted at a temperature of 800 °C to 900 °C and a pressure between 4 bar(g) to 9 bar(g).~~

~~17. A method according to claim 16, wherein the temperature is 850 °C to 900 °C and the pressure is 6 bar(g) to 8 bar(g).~~

~~18. A method according to any one of the preceding claims, wherein graphene is selectively synthesised where the step of:~~

~~contacting at elevated temperatures a metal-containing catalyst with a hydrocarbon gas to catalytically convert at least a portion of the hydrocarbon gas to hydrogen and carbon,~~

~~is conducted at a temperature of 600 °C to 750 °C and pressure is 0 bar(g) to 1 bar(g).~~

~~19. A method according to claim 18, wherein the temperature is 600 °C to 700 °C and the pressure is 0 bar(g).~~

~~20.~~13. Carbon nano-onions (CNOs) produced by the process of any one of claims 1 to ~~13~~12.

~~21. Graphite fibres produced by the process of any one of claims 1 to 11 or 14 to 15.~~

~~22. Carbon micro-shells (CMSs) produced by the process of any one of claims 1 to 11 or 16 to 17.~~

~~23. Graphene produced by the process of any one of claims 1 to 11 or 18 to 19.~~