**CLAIMS:**

1. A process for the thermal treatment of a particulate material, the process comprising the sequential steps of:

introducing the particulate material into a vertical first reactor segment, the particulate material being introduced into the first reactor segment at a top end thereof such the particulate material flows downwardly under gravity through the first reactor segment;

heating the downwardly flowing particulate material from outside the first reactor segment to activate the particulate material, thereby forming a hot activated particulate material; and

compacting the hot activated particulate material to form agglomerates in a compactor, wherein the hot activated particulate material flows downwardly under gravity directly from the first hot reactor segment to the compactor.

2. The process according to claim 1, wherein, prior to the compacting of the hot activated particulate material, additional particulate materials are added to the hot activated particulate material.

3. The process according to claim 1 or 2, the process further comprising:

introducing the formed agglomerates into a top end of a vertical second reactor segment to form a packed bed in the second reactor segment;

heating the agglomerates in the packed bed to induce a target reaction within the agglomerates as the agglomerates move through the packed bed; and

discharging the reacted agglomerates from a bottom end of the second reactor segment.

4. The process according to any one of the preceding claims, wherein an off-gas is discharged from the first reactor segment from an outlet disposed at a top end of the first reactor segment, and wherein the process further comprises:

passing the off-gas through a separator to at least partially separate out entrained solid particles in the off-gas, thereby producing a cleaned off-gas, and

reintroducing the separated solid particles into the first reactor segment at the top end.

5. The process according to any one of the preceding claims, the process further comprising using a first heating system adjacent to and disposed along a length of the first reactor segment to heat the particulate material from outside the first reactor segment.

6. The process according to claim 5, wherein the first heating system comprises electric heating elements and wherein the electric heating elements are powered by one of a renewable energy source or an electrical grid, and wherein, optionally, the first heating system is used as a demand side mechanism for balancing the electrical grid.

7. The process according to claim 5, wherein the first heating system is a furnace segment in thermal connection with the first reactor segment, wherein heat is generated from a combustion reaction.

8. The process according to claim 7, wherein the combustion reaction in the furnace segment in thermal connection with the first reactor segment is oxyfuel combustion using a synthesis gas or gases and a source of oxygen to form a gas product as a furnace segment flue gas.

9. The process according to claim 3, wherein heating the agglomerates in the packed bed in the second reactor segment comprises one or more of:

heating from outside the second reactor segment;

a combustion reaction within the second reactor segment;

injecting a hot gas into the second reactor segment and passing the hot gas through the packed bed of agglomerates; and

electric smelting.

10. The process according to claim 9, wherein heating the agglomerates in the packed bed in the second reactor segment from outside the second reactor segment comprises using a second heating system located adjacent to and disposed along a length of the second reactor segment.

11. The process according to claim 9, wherein heating the agglomerates in the packed bed comprises a combustion reaction within the second reactor segment, the combustion reaction in the second reactor segment achieved by introducing a feed gas into the second reactor segment, the feed gas comprising one or any combination of a synthesis gas or gases; a source of oxygen; and a source of hydrogen.

12. The process according to any one of the preceding claims, the process further comprising one or more of:

homogenising the particulate material and/or fusing the particulate material to produce a particle size distribution in a range of 150µm to 350µm prior to introducing the particulate material into the first reactor segment; and/or

preheating the particulate material prior to introducing the particulate material into the first reactor segment; and/or

cooling and/or crushing the reacted agglomerates discharged from the second reactor segment to allow for handling and/or transport.

13. The process according to any one of the preceding claims, wherein compacting the hot activated particulate material to form the agglomerates is at a linear pressure of up to 200kN/cm$^2$, optionally at a linear pressure of approximately 100 kN/cm$^2$.

14. The process according to any one of the preceding claims, wherein the first reactor segment and/or second reactor segment (when present) is operated at a positive gauge pressure.

15. A system for the thermal treatment of a particulate material, the system comprising:

a vertical first reactor segment configured to receive the particulate material at a top end thereof in order that the particulate material flows under gravity downwardly through the first reactor segment;

a first heating system adjacent to and disposed along a length of the first reactor segment and configured to heat the particulate material flowing downwardly through the reactor segment from outside the reactor segment so as to activate the particulate material; and

a compactor arranged to directly receive the hot activated particulate material from the first vertical reactor segment, the compactor configured to compact the hot activated particulate material to form agglomerates.