forming a doped catalyst support having a boron, and/or silicon and/or phosphorus content in the range of 1 wt% to 13 wt% for each dopant added, expressed as an oxide and based on the total weight of the catalyst; wherein the total amount of dopant is in the range of 1 – 26 wt.%; wherein the amount of boron in the catalyst is in the range of 2 to 13 wt%, expressed as an oxide (B_2O_3) based on the total weight of the catalyst;

drying and calcining the catalyst support;

impregnating the calcined catalyst support with a solution comprised of at least one Group VIB metal source and/or at least one Group VIII metal source;

drying the impregnated catalyst support at 80-150°C;

further impregnating the dried impregnated catalyst support with an amount of a mercapto-carboxylic acid wherein the amount of the mercapto-carboxylic acid is at least 0.4 to 3 equivalents to the sulfur amount necessary for forming sulfides of the Group VI and VIII components; and

ageing the impregnated catalyst support for a period of time between 60 and 160 °C.

[0003d] In another aspect, there is provided a method which comprises contacting a hydrocarbon feed with a catalyst as defined above, under hydrotreating conditions so as to hydrotreat the hydrocarbon feed.

[0003e] In another aspect, there is provided a method which comprises contacting a hydrocarbon feed with a catalyst as defined above, under hydrotreating conditions so as to hydrotreat the hydrocarbon feed, wherein the catalyst is activated without the addition of additional sulfur compounds.

[0004] Thus, in one embodiment of the disclosure there is provided a catalyst that has at least one Group VIB (of the Periodic Table) metal component, at least one Group VIII (of the Periodic Table) metal component, at least one organic compound selected from mercapto-carboxylic acids, and a boron-containing support and/or a phosphorus-containing and/or a silicon-containing support.

CLAIMS:

1. A catalyst comprising:

a catalyst support;

at least one Group VIB metal component;

at least one Group VIII metal component;

at least one mercapto-carboxylic acid;

wherein the catalyst support contains at least one dopant comprising either boron, and/or silicon, and/or phosphorus in the range of 1 to 13 wt%, expressed as an oxide and based on the total weight of the catalyst for each dopant added; wherein the total amount of dopant is in the range of 1 – 26 wt.%; wherein the amount of boron in the catalyst is in the range of 2 to 13 wt%, expressed as an oxide (B_2O_3) based on the total weight of the catalyst; and

wherein the amount of the at least one mercapto-carboxylic acid is in the amount from 0.4 to 3 equivalents to the sulfur amount necessary for forming sulfides of the Group VIB and VIII components.

2. The catalyst according to claim 1 wherein the Group VIB metal component comprises molybdenum and/or tungsten.

3. The catalyst according to claim 1 or 2 wherein the Group VIII metal component comprises nickel and/or cobalt.

4. The catalyst according to any one of claims 1-3 wherein the mercapto-carboxylic acid is thioglycolic acid, thiolactic acid, mercapto succinic acid, cysteine or thio propionic acid.

5. The catalyst according to claim 4 further comprising an additional carboxylic acid.

6. The catalyst according to any one of claims 1-5, wherein the dopant is boron in the range of 2 wt% to 8 wt%, expressed as an oxide (B_2O_3) and based on the total weight of the catalyst.

7. The catalyst according to any one of claims 1-5, wherein the dopant is phosphorus in the range of 2 wt% to 10 wt%, expressed as an oxide (P_2O_5) and based on the total weight of the catalyst.

8. The catalyst according to claims any one of 1-5, wherein the dopant is silicon in the range of 1 wt% to 9 wt%, expressed as an oxide (SiO_2) and based on the total weight of the catalyst.

9. The catalyst according to claim 6, 7, or 8 wherein the catalyst support is impregnated with the Group VIB metal component, the Group VIII metal component, and the mercapto-carboxylic acid.

10. The catalyst according to claim 9 wherein the catalyst support is further impregnated with a phosphorous component.

11. The catalyst according to any of the preceding claims, wherein the catalyst support comprises alumina.

12. A method of producing a catalyst, the method comprising:

forming a doped catalyst support having a boron, and/or silicon and/or phosphorus content in the range of 1 wt% to 13 wt% for each dopant added, expressed as an oxide and based on the total weight of the catalyst; wherein the total amount of dopant is in the range of 1 – 26 wt.%; wherein the amount of boron in the catalyst is in the range of 2 to 13 wt%, expressed as an oxide (B_2O_3) based on the total weight of the catalyst;

drying and calcining the catalyst support;

impregnating the calcined catalyst support with a solution comprised of a mercapto-carboxylic acid, at least one Group VIB metal source and/or at least one Group VIII metal source, wherein the amount of the mercapto-carboxylic acid is at least 0.4 to 3 equivalents to the sulfur amount necessary for forming sulfides of the Group VIB and VIII components; and

ageing the impregnated catalyst support for a period of time between 60 and 160 °C.

13. A method of producing a catalyst, the method comprising

forming a doped catalyst support having a boron, and/or silicon and/or phosphorus content in the range of 1 wt% to 13 wt% for each dopant added, expressed as an oxide and based on the total weight of the catalyst; wherein the total amount of dopant is in the range of 1 – 26 wt.%; wherein the amount of boron in the catalyst is in the range of 2 to 13 wt%, expressed as an oxide (B_2O_3) based on the total weight of the catalyst;

drying and calcining the catalyst support;

impregnating the calcined catalyst support with a solution comprised of at least one Group VIB metal source and/or at least one Group VIII metal source;

drying the impregnated catalyst support at 80-150°C;

further impregnating the dried impregnated catalyst support with an amount of a mercapto-carboxylic acid wherein the amount of the mercapto-carboxylic acid is at least 0.4 to 3 equivalents to the sulfur amount necessary for forming sulfides of the Group VIB and VIII components; and

ageing the impregnated catalyst support for a period of time between 60 and 160 °C.

14. The method according to claim 12 or 13, wherein the amount of the boron component source is sufficient so that the boron content of the catalyst produced is in the range of 2 wt% to 8 wt%, expressed as an oxide (B_2O_3) and based on the total weight of the catalyst.

15. The method according to claim 12 or 13, wherein the phosphorus component source is sufficient so that the phosphorus content in the catalyst produced is in the range of 2 wt% to 10 wt%, expressed as an oxide (P_2O_5) and based on the total weight of the catalyst.

16. The method according to claim 12 or 13, wherein the silicon component source is sufficient so that the silicon content in the catalyst produced is in the the range of 2 wt% to 9 wt%, expressed as an oxide (SiO_2) and based on the total weight of the catalyst.

17. The method according to any one of claims 12-16 wherein the mercapto-carboxylic acid is thioglycolic acid, thiolactic acid, mercapto succinic acid, cysteine or thio propionic acid.

18. The method according to any one of claims 12-16 further comprising impregnating the catalyst support in the form of an extrudate with a carboxylic acid.

19. A method which comprises contacting a hydrocarbon feed with a catalyst according to any of the preceding claims, under hydrotreating conditions so as to hydrotreat the hydrocarbon feed.

20. A method which comprises contacting a hydrocarbon feed with a catalyst according to any of the preceding claims, under hydrotreating conditions so as to hydrotreat the hydrocarbon feed, wherein the catalyst is activated without the addition of additional sulfur compounds.