In another example, U.S. Patent No. 6,559,092 to Dufresne *et al.* describes impregnating a high boiling (*e.g.,* 150 °C to 500 °C) liquid carbon-containing compound (*e.g.,* gas oil) in the pores of a hydrotreating catalyst, carbonizing the carbon-containing compound and then sulfurizing the catalyst. In yet another example, U.S. Patent No. 9,272,276 to Robinson *et al.* describes a soft coking process that provides a layer of coke to be created on the catalyst surface during or along with *in situ* sulfiding using a liquid hydrocarbon source and then introducing cracked hydrocarbon feeds to the reactor.

[0005] Despite the foregoing, the above-mentioned methods require several steps that add processing time, complications, and costly delays when introducing a cracked feedstock to a catalyst bed.

SUMMARY OF THE INVENTION

[0005a] In one aspect, provided herein is a treated sulfided hydroconversion catalyst, wherein the treated sulfided hydroconversion catalyst is prepared by: (a) combining an inactive hydroconversion catalyst with a solid hydrocarbon containing material having a melting point of 50 °C or greater to produce an unsulfided hydroconversion catalyst/solid hydrocarbon containing material mixture; and (b) sulfiding the inactive hydroconversion catalyst by contacting the unsulfided hydroconversion catalyst/solid hydrocarbon containing material mixture with a gaseous stream comprising hydrogen (H_2) and a sulfur-containing compound at a temperature sufficient to sulfide the inactive hydroconversion catalyst and carbonize at least a portion of the solid hydrocarbon containing material on the sulfided inactive hydroconversion catalyst, thereby providing a treated sulfided hydroconversion catalyst further comprising a hydrocarbon containing material wherein at least a portion of the solid hydrocarbon containing material is carbonized, and wherein the treated sulfided hydroconversion catalyst comprises 2 wt.% to 15 wt.% carbon produced from the carbonization.

[0006] A discovery has been made that provides a solution to at least some of the problems associated with the coke and gum formation on hydroconversion catalysts during startup with cracked feedstocks. The solution is premised on methods to combine (*e.g.,* blend) an inactive hydroconversion catalyst with a low melting hydrocarbon solid under conditions that allows the hydrocarbon solid to melt and penetrate the pores of the catalyst. Thus, forming a "coating" or carbonaceous layer on the interior surface of the pores. The inactive hydroconversion catalyst can be an unused catalyst with the catalytic metals being in their metal oxide form that has not been subjected to a sulfiding treatment, or a used catalyst

CLAIMS

1. A treated sulfided hydroconversion catalyst, wherein the treated sulfided hydroconversion catalyst is prepared by:

(a) combining an inactive hydroconversion catalyst with a solid hydrocarbon containing material having a melting point of 50 °C or greater to produce an unsulfided hydroconversion catalyst/solid hydrocarbon containing material mixture; and

(b) sulfiding the inactive hydroconversion catalyst by contacting the unsulfided hydroconversion catalyst/solid hydrocarbon containing material mixture with a gaseous stream comprising hydrogen (H_2) and a sulfur-containing compound at a temperature sufficient to sulfide the inactive hydroconversion catalyst and carbonize at least a portion of the solid hydrocarbon containing material on the sulfided inactive hydroconversion catalyst, thereby providing a treated sulfided hydroconversion catalyst further comprising a hydrocarbon containing material wherein at least a portion of the solid hydrocarbon containing material is carbonized, and wherein the treated sulfided hydroconversion catalyst comprises 2 wt.% to 15 wt.% carbon produced from the carbonization.

2. The treated sulfided hydroconversion catalyst of claim 1, wherein the inactive hydroconversion catalyst in step (a) is at a temperature lower than the melting point of the solid hydrocarbon containing material at the time the inactive hydroconversion catalyst is contacted with the solid hydrocarbon containing material.

3. The treated sulfided hydroconversion catalyst of claim 2, further comprising heating the unsulfided hydroconversion catalyst/solid hydrocarbon containing material mixture to a temperature sufficient to melt the solid hydrocarbon containing material.

4. The treated sulfided hydroconversion catalyst of claim 1, wherein the inactive hydroconversion catalyst in step (a) is at a temperature greater than the melting point of the solid hydrocarbon containing material at the time the inactive hydroconversion catalyst is contacted with the solid hydrocarbon containing material.

5. The treated sulfided hydroconversion catalyst of any one of claims 2 to 4, wherein the temperature difference between the inactive hydroconversion catalyst and the melting point of the solid hydrocarbon containing material is 120 °C or less, preferably 10 °C to 90 °C, or more preferably 30 °C to 75 °C.

6. The treated sulfided hydroconversion catalyst of any one of claims 1 to 5, wherein the melting point of the solid hydrocarbon containing material is 50 °C to 150 °C, preferably 50 °C to 120 °C.

7. The treated sulfided hydroconversion catalyst of any one of claims 2 to 6, wherein the melted hydrocarbon containing material coats surface of the pores of the unsulfided inactive hydroconversion catalyst.

8. The treated sulfided hydroconversion catalyst of any one of claims 1 to 7, wherein the solid hydrocarbon containing material is a paraffin wax, a microcrystalline wax, a synthetic wax, an animal wax, a plant wax or blends thereof.

9. The treated sulfided hydroconversion catalyst of claim 8, wherein the paraffin wax has a melting point of 50 °C to 70 °C, or about 60.5 °C.

10. The treated sulfided hydroconversion catalyst of claim 8, wherein the paraffin wax has a melting point of 90 °C to 120 °C, or about 95 °C.

11. The treated sulfided hydroconversion catalyst of any one of claims 1 to 10, wherein mixing step (a) comprises contacting the inactive hydroconversion catalyst with at least 1 wt. %,

preferably 5 wt. % to 25 wt. %, of the solid hydrocarbon containing material based on the total weight of the inactive hydroconversion catalyst and the solid hydrocarbon containing material.

12. The treated sulfided hydroconversion catalyst of any one of claims 1 to 11, wherein the temperature sufficient to sulfide the catalyst and carbonize at least a portion of the solid hydrocarbon containing material on the inactive hydroconversion catalyst is 175 °C to 500 °C.

13. The treated sulfided hydroconversion catalyst of any one of claims 1 to 12, wherein the gaseous sulfur-containing compound is hydrogen sulfide gas (H_2S).

14. The treated sulfided hydroconversion catalyst of any one of claims 1 to 13, wherein the gaseous stream comprises 1 % to 10 % by volume of the sulfur containing compound, at least 0.5 % by volume of H_2.

15. The treated sulfided hydroconversion catalyst of any one of claims 1 to 14, wherein the produced treated sulfided hydroconversion catalyst comprises 2 wt. % to 25 wt. % sulfur.

16. The treated sulfided hydroconversion catalyst of any one of claims 1 to 15, wherein the inactive hydroconversion catalyst comprises at least one catalytically active transition metal or oxide thereof.

17. The treated sulfided hydroconversion catalyst of claim 16, wherein the catalytically active transition metal is supported on a metal oxide support, preferably alumina (Al_2O_3), titania (TiO_2), or silica (SiO_2).

18. The treated sulfided hydroconversion catalyst of any one of claims 1 to 17, wherein step (a) and step (b) are performed *ex-situ* of a hydroconversion processing unit.

19. The treated sulfided hydroconversion catalyst of anyone of claims 1 to 13 and 15-18, wherein step (a) and step (b) are performed *in-situ* in a hydroconversion processing unit.