

CLAIMS

1. A method for operating an integrated system for producing olefins, the method comprising:
 - contacting a hydrogenation feed with a first hydrogenation catalyst to produce a hydrogenated effluent, the hydrogenation feed comprising at least a portion of a first process effluent from a first olefin production process and at least a portion of a second process effluent from a second olefin production process, wherein: the hydrogenation feed comprises at least hydrogen, ethylene, carbon monoxide, acetylene, methyl acetylene, and propadiene;
 - the first hydrogenation catalyst has a temperature operating range of at least 40 degrees Celsius, the temperature operating range being a difference between a runaway temperature and a cleanup temperature at a given hydrogenation feed composition, wherein the runaway temperature is the temperature at which 3 % of ethylene in the hydrogenation feed is reacted and the cleanup temperature is the temperature at which the acetylene concentration in the hydrogenated effluent is equal to a threshold acetylene concentration; and
 - the hydrogenated effluent comprises methyl acetylene (MA), propadiene (PD), or both; and
 - contacting at least a portion of the hydrogenated effluent with a second hydrogenation catalyst, wherein the contacting causes hydrogenation of at least a portion of the methyl acetylene, propadiene, or both, from the hydrogenated effluent to produce an MAPD hydrogenated effluent having a reduced concentration of methyl acetylene, propadiene, or both compared to the portion of the hydrogenated effluent prior to contact with the second hydrogenation catalyst.
2. The method of claim 1, wherein the first process effluent comprises a cracked gas produced by cracking at least a portion of a first hydrocarbon feed in a steam cracking system, the cracked gas comprising at least hydrogen, carbon monoxide, acetylene, methyl acetylene, and propadiene.
3. The method of either of claims 1 or 2, wherein the second process effluent comprises a fluidized catalytic dehydrogenation (FCDh) effluent produced by dehydrogenating at least a

portion of a second hydrocarbon feed in an FCDh system, the FCDh effluent comprising at least hydrogen and carbon monoxide.

4. The method of any of the preceding claims, in which a combined concentration of methyl acetylene and propadiene in the portion of the hydrogenated effluent contacted with the second hydrogenation catalyst is less than or equal to 10 wt.%.
5. The method of any of the preceding claims, further comprising passing at least a portion of the MAPD hydrogenated effluent to the FCDh system.
6. The method of any of the preceding claims, in which the MAPD hydrogenated effluent comprises propane.
7. The method of any of the preceding claims, further comprising combining at least a portion of the second hydrocarbon feed with the portion of the hydrogenated effluent before or during contacting of the portion of the hydrogenated effluent with the second hydrogenation catalyst.
8. The method of any of the preceding claims, wherein the hydrogenation feed comprises at least 95% of the carbon monoxide from the first process effluent and the second process effluent.
9. The method of any of the preceding claims, wherein contact of the hydrogenation feed with the first hydrogenation catalyst produces a conversion of methyl acetylene in the hydrogenation feed of less than 80%.
10. The method of any of the preceding claims, wherein contact of the hydrogenation feed with the first hydrogenation catalyst produces a conversion of propadiene in the hydrogenation feed of less than 10%.
11. The method of any of the preceding claims, wherein the hydrogenation feed is contacted with the first hydrogenation catalyst in an acetylene hydrogenation unit.
12. The method of claim 11, wherein the first hydrogenation catalyst having a temperature operating range of greater than or equal to 40 °C reduces or prevents thermal runaway of the acetylene hydrogenation unit in response to a disruption in flow of the first process effluent or the second process effluent.

13. The method of any of the preceding claims, further comprising separating the first process effluent and the second process effluent into the hydrogenation feed and an acetylene-depleted stream.
14. The method of claim 13, in which a first separation system for separating the first process effluent and the second process effluent into the hydrogenation feed and acetylene-depleted stream has a front end depropanizer configuration.
15. The method of claim 1, in which the threshold acetylene concentration is 1 part per million by volume.