CLAIMS

1. A process for producing olefins and/or dienes, the process comprising:

thermally cracking a hydrocarbon containing feed comprising C5+ hydrocarbons at a temperature in the range from 550°C to 750°C to produce a cracked hydrocarbon effluent containing a mixture of olefins and paraffins, wherein a conversion due to thermally cracking reaction of hydrocarbons contained in the hydrocarbon containing feed is in a range from 20% to less than 40%, on a molar basis;

catalytically cracking the cracked hydrocarbon effluent to produce a catalytically cracked effluent containing additional olefins and/or dienes.

2. The process of claim 1, wherein the cracked hydrocarbon effluent is not separated prior to the catalytically cracking step.

3. The process of claim 1, further comprising cooling the cracked hydrocarbon effluent via direct or indirect heat exchange.

4. The process of claim 1, further comprising separating the catalytically cracked effluent into one or more fractions selected from a hydrogen fraction, a methane fraction, a C2 fraction, an ethylene fraction, an ethane fraction, a C3 fraction, a propylene fraction, a propane fraction, a C4 fraction, a butadiene fraction, a butene fraction, a butane fraction, and a C5+ containing fraction.

5. The process of claim 1, further comprising mixing steam, carbon dioxide, and/or nitrogen with the hydrocarbon containing feed to form a diluted feed mixture.

6. The process of claim 5, wherein the diluted feed mixture has a steam to hydrocarbon ratio in the range from 0.05 to 0.2, by weight.

7. A system for producing olefins and/or dienes according to the process of claim 1, the system comprising:

a reaction zone for thermally cracking a hydrocarbon containing feed comprising C5+ hydrocarbons at a temperature in the range from 550°C to 750°C to produce a cracked hydrocarbon effluent containing a mixture of olefins and paraffins wherein the reaction zone is configured to convert hydrocarbons contained in the hydrocarbon containing feed in a range from 20% to less than 40%, on a molar basis, by thermally cracking reaction;

a catalytic cracking reaction zone for catalytically cracking the cracked hydrocarbon effluent to produce a catalytically cracked hydrocarbon effluent containing additional olefins and/or dienes.

8. The system of claim 7, further comprising a feed line for transferring the cracked hydrocarbon effluent to the catalytic cracking reaction zone without componential separation.

9. The system of claim 7, further comprising a feed line for mixing a hydrocarbon feed with the cracked hydrocarbon

effluent to decrease a temperature of the cracked hydrocarbon effluent.

10. The system of claim 7, wherein the reaction zone for thermally cracking comprises a pyrolysis reactor.

11. The system of claim 7, wherein the catalytic cracking reaction zone comprises a riser reactor.

12. The system of claim 7, wherein the catalytic cracking reaction zone comprises two or more fixed beds in parallel operated in a staggered fashion.

13. The system of claim 7, further comprising a feed line for mixing the hydrocarbon containing feed with one or more of steam, carbon dioxide, or nitrogen.

14. A process for producing olefins and/or dienes, the process comprising:

heating a hydrocarbon feedstock, comprising one or more C5+ hydrocarbons, in a convection zone of a pyrolysis reactor to form a heated hydrocarbon mixture;

mixing the heated hydrocarbon mixture with steam to form a mixed feedstock having a steam to hydrocarbon ratio in the range from 0.04 to 0.2;

heating the mixed feedstock in the convection zone of the pyrolysis reactor;

reacting the mixed feedstock in the radiant zone of the pyrolysis reactor at a temperature in the range from 550°C to 750°C to convert a portion of the hydrocarbons to produce a

cracked hydrocarbon effluent containing a mixture of olefins and paraffins;

feeding the entirety of the cracked hydrocarbon effluent to a catalytic cracking reaction zone for catalytically cracking the cracked hydrocarbon effluent to produce a catalytically cracked hydrocarbon effluent containing additional olefins and/or dienes;

separating the catalytically cracked hydrocarbon effluent to recover one or more fractions selected from a hydrogen fraction, a methane fraction, a C2 fraction, an ethylene fraction, an ethane fraction, a C3 fraction, a propylene fraction, a propane fraction, a C4 fraction, a butadiene fraction, a butene fraction, a butane fraction, and a C5+ containing fraction.

15. The process of claim 14, wherein the catalytic cracking reaction zone comprises a riser reactor.

16. The process of claim 15, further comprising feeding a naphtha fraction to the riser reactor.

17. The process of claim 14, wherein the catalytic cracking reaction zone comprises two or more fixed beds in parallel operated in a staggered fashion.

18. The process of claim 14, further comprising cooling the cracked hydrocarbon effluent via direct or indirect heat exchange.

19. A system for producing olefins and/or dienes according to the process of claim 16, the system comprising:

a convection zone of a pyrolysis reactor for heating a hydrocarbon feedstock, comprising one or more C5+ hydrocarbons, to form a heated hydrocarbon mixture;

a mixing unit for mixing the heated hydrocarbon mixture with steam to form a mixed feedstock having a steam to hydrocarbon ratio in the range from 0.04 to 0.2;

a radiant zone of the pyrolysis reactor for reacting the mixed feedstock to produce a cracked hydrocarbon effluent containing a mixture of olefins and paraffins, wherein the radiant zone is configured to operate at a temperature in a range from 550°C to 750°C and to convert 20 mol% to less than 40 mol% of hydrocarbons contained in the mixed feedstock by thermally cracking reaction;

a catalytic cracking reaction zone configured for receiving an entirety of the cracked hydrocarbon effluent and for catalytically cracking hydrocarbons in the cracked hydrocarbon effluent to produce a catalytically cracked hydrocarbon effluent containing additional olefins and/or dienes;

a separator for separating the catalytically cracked hydrocarbon effluent to recover one or more fractions selected from a hydrogen fraction, a methane fraction, a C2 fraction, an ethylene fraction, an ethane fraction, a C3 fraction, a propylene fraction, a propane fraction, a C4 fraction, a butadiene fraction, a butene fraction, a butane fraction, and a C5+ containing fraction.