CLAIMS

1. A method of cracking a light fuel fraction and a heavy fuel fraction by fluidized catalytic cracking, the method comprising:

feeding the light fuel fraction and a catalyst from a catalyst regenerator into a first reactor, wherein the first reactor is a fluidized bed reactor;

cracking the light fuel fraction in the first reactor to produce an at least partially cracked light fuel fraction;

transporting the at least partially cracked light fuel fraction and the catalyst from the first reactor to a second reactor, wherein the second reactor is a fluidized bed reactor;

feeding the heavy fuel fraction into the second reactor;

cracking the heavy fuel fraction and the at least partially cracked light fuel fraction in the second reactor to produce at least a product fuel and a spent catalyst;

transporting the spent catalyst to the catalyst regenerator and regenerating the catalyst in the catalyst regenerator.

2. The method of claim 1, further comprising transporting additional catalyst from the catalyst regenerator to the second reactor.

3. The method of claim 1, wherein:

a sum of a first average reaction time of the light fuel fraction in the first reactor and a second average reaction time of the at least partially cracked light fuel fraction in the second reactor defines a total residence time of the light fuel fraction;

a single average reaction time of the heavy fuel fraction in the second reactor defines a residence time of the heavy fuel fraction;

a ratio of the total residence time of the light fuel fraction and the residence time of the heavy fuel fraction defines a residence-time ratio; and

the residence-time ratio is from about 1 to about 10.

4. The method of claim 1, wherein:

the flow rate of the catalyst entering the first reactor and/or the second reactor from the catalyst regenerator divided by the flow rate of the light fuel fraction entering the first reactor defines the catalyst-to-light fuel ratio;

the flow rate of the catalyst entering the first reactor and/or the second reactor from the catalyst regenerator divided by the flow rate of the heavy fuel fraction entering the second reactor defines the catalyst-to-heavy fuel ratio;

a ratio of the catalyst-to-light fuel ratio to the catalyst-to-heavy ratio defines a unit catalyst ratio; and

the unit catalyst ratio is from about 1 to about 10.

5. The method of claim 1, wherein the light fuel fraction comprises straight or cracked naphthas with boiling points from about 36 °C to about 250 °C, distillate oils with boiling points from about 10 °C to about 400 °C, or combinations thereof.

6. The method of claim 1, wherein the heavy fuel fraction comprises vacuum distillates with boiling points from about 370 °C to about 565 °C, residues with boiling points above 520 °C, or combinations thereof, the residues being chosen from hydrotreated residues, atmospheric distillation residues, vacuum distillation residues, visbreaking residues, distillation residues, or combinations thereof.

7. The method of claim 1, further comprising:

atomizing the light fuel fraction before feeding the light fuel fraction into the first reactor; and

atomizing the heavy fuel fraction before feeding the heavy fuel fraction into the second reactor.

8. The method of claim 1, wherein the products are light olefins (C_2-C_4), and/or gasoline.

9. The method of claim 1, wherein the spent catalyst is separated from other products of the second reactor in a separation zone.

10. The method of claim 1, wherein the spent catalyst comprises coke deposits.

11. A system for cracking by fluidized catalytic cracking, the system comprising:

a first reactor comprising a catalyst inlet and a light fuel fraction inlet, wherein the first reactor is a fluidized bed reactor;

a second reactor in fluidic communication with the first reactor and comprising a heavy fuel fraction inlet, wherein the second reactor is a fluidized bed reactor;

a catalyst regenerator in fluidic communication with the catalyst inlet of the first reactor;

a catalyst that circulates from the catalyst regenerator to the first reactor to the second reactor and back to the catalyst regenerator;

a light fuel fraction disposed in the first reactor that reacts with the catalyst and is transported to the second reactor;

a heavy fuel fraction disposed in the second reactor that reacts with the catalyst.

12. The system of claim 11, further comprising a transfer line connecting the catalyst regenerator and the second reactor.

13. The system of claim 11, wherein the light fuel fraction in the first reactor is atomized.

14. The system of claim 11, wherein the light fuel fraction comprises straight or cracked naphthas with boiling points from about 36°C to about 250°C, distillate oils with boiling points from about 10°C to about 400°C, or combinations thereof.

15. The system of claim 11, wherein the heavy fuel fraction comprises vacuum distillates with boiling points from about 370 °C to about 565 °C, residues with boiling points above 520 °C, or combinations thereof, the residues being chosen from

hydrotreated residues, atmospheric distillation residues, vacuum distillation residues, visbreaking residues, distillation residues, or combinations thereof.