CLAIMS

What is claimed is:

1. A method for performing pyrolysis on a plastic feedstock, comprising:

mixing a feedstock comprising plastic particles having an average diameter of 3.0 cm or less with a recycled effluent fraction to form a slurry of plastic particles in recycled effluent, a weight ratio of the recycled effluent fraction to the plastic particles being 1.0 or more, the mixing being performed at a temperature of 150°C or less;

introducing the slurry of plastic particles in recycled effluent into a fluidized bed pyrolysis reactor, the slurry of plastic particles in recycled effluent being exposed to a temperature of 300°C or more for a thermal residence time of 30 seconds or less prior to the introduction into the fluidized bed pyrolysis reactor;

pyrolyzing the slurry of plastic particles in recycled effluent in the fluidized bed pyrolysis reactor at a temperature of 500°C to 900°C to form a pyrolysis effluent, the fluidized bed comprising heat transfer particles, the pyrolysis conditions comprising a single pass conversion of 15 wt% to 50 wt% relative to a conversion temperature of 370°C or less, wherein the single pass conversion relative to a conversion temperature of 370°C is the proportion of materials in the input flow, that is, recycled effluent plus fresh feed, that has a boiling point of 370°C or more which is converted to products having a boiling point lower than 370°C;

separating at least a portion of the heat transfer particles from the pyrolysis effluent; and

separating the pyrolysis effluent to form a bottoms fraction comprising the recycled effluent fraction and at least one additional fraction, the bottoms fraction comprising a T10 distillation point (ASTM D2887 or ASTM D7169) of the conversion temperature or less.

2. The method of claim 1, wherein the weight ratio of the recycled effluent fraction to the plastic particles is 1.0 to 5.0.

3. The method of claim 1 or 2, wherein the slurry of plastic particles in recycled effluent is exposed to a temperature of 200°C or more for a thermal residence time of 30 seconds or less prior to the introduction into the fluidized bed pyrolysis reactor, or wherein the slurry of plastic particles in recycled effluent is exposed to a temperature of 300°C or more for a thermal residence time of 10 seconds or less prior to the introduction into the fluidized bed pyrolysis reactor, or a combination thereof.

4. A method for performing pyrolysis on a plastic feedstock, comprising:

mixing a feedstock comprising plastic particles having an average diameter of 3.0 cm or less with a recycled effluent fraction to form a solution of plastic in recycled effluent, a weight ratio of the recycled effluent fraction to the plastic particles being 0.2 or more, preferably of 1.0 or more;

pyrolyzing the solution in a pyrolysis reactor under pyrolysis conditions comprising a temperature of 500°C to 900°C to form a pyrolysis effluent, the pyrolysis conditions comprising a single pass conversion of 40 wt% or less relative to a conversion temperature of 370°C or less, wherein the single pass conversion relative to a conversion temperature of 370°C is the proportion of materials in the input flow, that is, recycled effluent plus fresh feed, that has a boiling point of 370°C or more which is converted to products having a boiling point lower than 370°C; and

separating the pyrolysis effluent to form a bottoms fraction comprising the recycled effluent fraction and at least one additional fraction, the bottoms fraction comprising a T10 distillation point (ASTM D2887 or ASTM D7169) of the conversion temperature or less.

5. The method of claim 4, wherein the mixing comprises mixing the feedstock comprising plastic particles and the recycled effluent at a temperature of 120°C or more for a mixing residence time of 1.0 seconds to 600 seconds; or wherein the mixing comprises forming a mixture at a temperature of 150°C or less, the method further comprising heating the mixture to a temperature of 120°C or more for a mixing residence time of 1.0 seconds to 600 seconds.

6. The method of claim 4 or 5, wherein the pyrolysis reactor comprises at least one of a fluidized bed reactor, a continuously stirred tank reactor, a moving bed reactor, a thermal cracking reactor.

7. The method of any of claims 4 to 6, wherein a kinematic viscosity at 100°C of the solution is 1000 cSt or less.

8. The method of any of the previous claims, wherein the mixing is performed at a temperature of 120°C or less.

9. The method of any of the previous claims, the method further comprising:

performing a second thermal cracking on at least a portion of the at least one additional fraction in a second thermal cracking stage to form an olefin-containing effluent.

10. The method of any of the previous claims, wherein the pyrolysis is performed in the absence of a radical initiator.

11. The method of any of the previous claims, wherein the solution or slurry is pyrolyzed at a temperature of 600°C to 900°C.

12. The method of any of the previous claims, wherein the net conversion of fresh feed relative to the conversion temperature is 95 wt% or more.

13. The method of any of the previous claims, further comprising i) forming the plastic feedstock by physically processing plastic particles to reduce a median particle size of the plastic particles to 3.0 cm or less, ii) forming the plastic particles by physically processing bulk plastic, or iii) a combination of i) and ii).

14. The method of any of the previous claims, wherein separating the at least a portion of the heat transfer particles from the pyrolysis effluent comprises separating the at least a portion of the heat transfer particles from the bottoms fraction.

15. A pyrolysis effluent formed according to the method of any of the previous claims.