CLAIMS

1. A process for controlled manufacturing of olefin trimers and olefin tetramers comprising:

    a. feeding at least one olefin monomer and at least one oxygen-containing moderator into at least one first reactor unit containing a catalyst;

    b. operating at least one of the first reactor unit(s) at a temperature selected from the range 30-140°C and at a pressure selected from the range 800-5000kPa for carrying out catalytic reactions between olefins inside the first reactor unit;

    c. withdrawing a first reactor outlet stream from at least one of the first reactor unit(s);

    d. distilling the first reactor outlet stream in a first distillation column to separate at least a first distillate comprising at least unreacted olefin monomers, and a first bottom product comprising at least dimers of the olefin monomers;

    e. feeding the first bottom product into at least one second reactor unit containing a catalyst;

    f. operating at least one of the second reactor unit(s) at a temperature selected from the range 30-140°C and at a pressure selected from the range 150-5000kPa for carrying out catalytic reactions between olefins inside the second reactor unit;

    g. withdrawing a second reactor outlet stream from at least one of the second reactor unit(s); and

    h. distilling the second reactor outlet stream in a second distillation column to separate a second distillate comprising at least olefin dimers, and a second bottom product comprising at least trimers and/or tetramers of the olefin monomers; and wherein

    the process further comprises controlling the composition of the second reactor outlet stream by:

i. feeding olefin dimers into at least one of the first reactor unit(s) to increase the amount of olefin trimers in the second reactor outlet stream; and/or

ii. feeding olefin dimers into at least one of the second reactor unit(s) to increase the amount of olefin tetramers in the second reactor outlet stream.

2. The process of claim 1, wherein at least a portion of the olefin dimers formed during the process are recycled to at least one of the first reactor unit(s) and/or to at least one of the second reactor unit(s), and wherein a recycling ratio of the olefin dimers between the first reactor unit and the second reactor unit is selected from the range 0-100%.
3. The process of claim 1 or 2, wherein the operating temperature of at least one of the first reactor unit(s) and/or at least one of the second reactor unit(s) is selected from the range 40-120°C or from the range 45-110°C.
4. The process of any one of claims 1-3, wherein the operating weight hour space velocity of at least one of the first reactor unit(s) is selected from the range 1-10 1/h, and/or the operating weight hour space velocity of at least one of the second reactor unit(s) is selected from the range 0.05-100 1/h.
5. The process of any one of claims 1-4, wherein the operating pressure of at least one of the first reactor unit(s) is selected from the range 2400-3000 kPa, and/or the operating pressure of at least one of the second reactor unit(s) is selected from the range 1900-2300 kPa.
6. The process of any one of claims 1-5, wherein the amount of the oxygen-containing moderator in at least one of the first reactor unit(s) is selected from the range 1000-15000 mol-ppm and/or the amount of the oxygen-containing moderator in at least one of the second reactor unit(s) is selected from the range 10-10000 mol-ppm or 10-2500 mol-ppm.
7. The process of any one of claims 1-6, wherein the solvent feed fraction is 0-80 weight-%, preferably 0-60 weight-%.
8. The process of any one of claims 1-7, wherein the inert solvent to fresh olefin monomer is selected from the range 0-80 weight-%.
9. The process of any one of claims 1-8, wherein the olefin monomers comprise olefins having four carbon atoms, preferably isobutene.

10. The process of any one of claims 1-9, wherein the olefin monomers are fed into at least one of the first reactor unit(s) in an olefin feed comprising at least one of the following: C4 olefins, C5 olefins, a mixed feed of C4 and C5 olefins, isobutene, 1-butene, cis-2-butene, trans-2-butene or any mixture thereof; and optionally comprising inerts, n-butane, i-butane, butadiene, distillation fraction, or any mixture thereof.
11. The process of any one of claims 1-10, wherein the catalyst is an acid catalyst, preferably a strongly acidic ion exchange resin catalyst, most preferably macroreticular acid ion exchange resin catalyst.
12. The process of any one of claims 1-11, wherein the oxygen-containing moderator comprises water, demiwater, alcohol, tert-butyl alcohol, or any combination thereof.
13. The process of any one of claims 1-12, comprising increasing the amount of olefin trimers in the final product stream by recycling olefin dimers present in the second distillate to at least one of the first reactor unit(s).
14. The process of claim 13, wherein 0-50 weight-% of the olefin dimers present in the second distillate are recycled to at least one of the first reactor unit(s) to obtain a ratio of trimers to tetramers of 25-0.05 (wt/wt) in the second reactor outlet stream.
15. The process of any one of claims 13-14, comprising distilling the second bottom product in a third distillation column to separate a third distillate comprising trimers of the olefin monomers, and a third bottom product comprising tetramers of the olefin monomers.
16. The process of any one of claims 1-15 comprising increasing the amount of olefin tetramers in the second reactor outlet stream by recycling olefin monomers of the first distillate to at least one of the first reactor unit(s) in order to increase the production of olefin dimers in the first reactor unit, by feeding the first bottom product to at least one of the second reactor unit(s), and by recycling olefin dimers of the second distillate to at least one of the second reactor unit(s).
17. The process of claim 16, wherein 99-100 weight-% of the olefin monomers present in the first distillate are recycled into at least one of the first reactor unit(s) and the first bottom product contains 2-98 weight-% of olefin dimers.

18. The process of any one of claims 16-17, wherein dimers are recycled only to at least one of the second reactor unit(s).

19. An olefin conversion system configured to carry out the process of claims 1-17 and comprising:

    a. at least one first reactor unit configured to receive an acid catalyst;
    b. at least one second reactor unit configured to receive an acid catalyst;
    c. a first distillation column configured to separate olefin monomers from olefin dimers;
    d. a second distillation column configured to separate olefin dimers from olefin trimers and olefin tetramers;
    e. at least one first reactor unit feed line in fluid connection with at least one of the first reactor unit(s), and at least one reservoir for olefin monomers;
    f. a first reactor unit outlet stream line in fluid connection with at least one of the first reactor unit(s) and the first distillation column;
    g. a first recycle line in fluid connection with at least one of the first reactor unit(s) and the first distillation column;
    h. a first bottom product line in fluid connection with the first distillation column and at least one of the second reactor unit(s);
    i. a second reactor outlet stream line in fluid connection with at least one of the second reactor unit(s) and the second distillation column;
    j. a second recycle line in fluid connection with the second distillation column, at least one of the first reactor unit(s), and at least one of the second reactor unit(s);
    k. a second bottom product line in fluid connection with the second distillation column and a reservoir for the end product; and
    l. an optional third distillation column configured to separate olefin trimers from olefin tetramers and comprising a third column feed line in fluid connection with the second bottom product line; and
    m. an optional solvent make-up line connected to the first reactor feed line.

20. The process of any one of the claims 1-18 further comprising hydrogenating to achieve paraffinic products.