CLAIMS

1. A process for preparing 1,1,1,2,2-pentafluoropropane (245cb), the process comprising:

gas phase catalytic dehydrochlorination of a composition comprising 1,1,1-trifluoro-2,3-dichloropropane (243db) to produce an intermediate composition comprising 3,3,3-trifluoro-2-chloro-prop-1-ene ($CF_3CCl=CH_2$, 1233xf), hydrogen chloride (HCl) and air; and

gas phase catalytic fluorination with hydrogen fluoride (HF) of the intermediate composition to produce a reactor product composition comprising 245cb, HF, HCl and air;

wherein the process is carried out with a co-feed of air, wherein the amount of air co-fed to the process is from 0.1 to 500 mol %, based on the amount of organics.

2. A process according to claim 1 wherein the dehydrochlorination step is carried out in a first reactor and the fluorination step is carried out in a second reactor.

3. A process according to claim 1 or 2 wherein the amount of air co-fed to the process is from 1 to 200 mol %, based on the amount of organics.

4. A process according to claim 3 wherein the amount of air co-fed to the process is from 2 to 100 mol %, based on the amount of organics.

5. A process according to claim 4 wherein the amount of air co-fed to the process is from 5 to 100 mol %, based on the amount of organics.

6. A process according to claim 5, wherein the amount of air co-fed to the process is from 10 to 100 mol %, based on the amount of organics.

7. A process according to claim 6 wherein the amount of air co-fed to the process is from 15 to 95 mol %, based on the amount of organics.

8. A process according to claim 7 wherein the amount of air co-fed to the process is from 20 to 90 mol %, based on the amount of organics.

9. A process according to claim 8 wherein the amount of air co-fed to the process is from 25 to 85 mol %, based on the amount of organics.

10. A process according to any of claims 2 to 9 wherein air is co-fed to both first and second reactors and wherein the amount of air co-fed to the first reactor is less than the amount, on a molar basis, of air co-fed to the second reactor.

11. A process according to claim 10 wherein the amount of air co-fed to the first reactor is less than half the amount of air co-fed to the second reactor.

12. A process according to claim 11 wherein the amount of air co-fed to the first reactor is less than a quarter of the amount of air co-fed to the second reactor.

13. A process according to claim 12 wherein the amount of air co-fed to the first reactor is less than a tenth of the amount of air co-fed to the second reactor.

14. A process according to any of claims 2 to 13 wherein the intermediate composition exits the first reactor and is fed directly to the second reactor.

15. A process for preparing 1,1,1,2,2-pentafluoropropane (245cb), the process comprising:
gas phase catalytic dehydrochlorination in a first reactor of a composition comprising 1,1,1-trifluoro-2,3-dichloropropane (243db) to produce an intermediate composition comprising 3,3,3-trifluoro-2-chloro-prop-1-ene ($CF_3CCl=CH_2$, 1233xf) and hydrogen chloride (HCl); and
gas phase catalytic fluorination with hydrogen fluoride (HF) in a second reactor of the intermediate composition to produce a reactor product composition comprising 245cb, HF, HCl and air;
wherein the process is carried out with a co-feed of air to the second reactor, wherein the amount of air co-fed to the second reactor is from 5 to 100 mol %, based on the amount of organics.

16. A process according to claim 15 wherein the amount of air co-fed to the second reactor is from 10 mol % to 100 mol %, based on the amount of organics.

17. A process according to claim 16 wherein the amount of air co-fed to the second reactor is from 15 to 95 mol %, based on the amount of organics.

18. A process according to claim 17 wherein the amount of air co-fed to the second reactor is from 20 to 90 mol %, based on the amount of organics.

~~18. A process according to claim 17 wherein the amount of air co-fed to the second reactor is from 20 to 90 mol %, based on the amount of organics.~~

19. A process according to claim 18 wherein the amount of air co-fed to the second reactor is from 25 to 85 mol %, based on the amount of organics.

20. A process according to any of claims 15 to 19 wherein air is additionally co-fed to the first reactor and the intermediate composition further comprises air.

21. A process according to claim 20 wherein the amount of air co-fed to the first reactor is from 0.1 to 100 mol %, based on the amount of organics.

22. A process according to claim 21 wherein the amount of air co-fed to the first reactor is from 0.2 to 50 mol %, based on the amount of organics.

23. A process according to claim 22 wherein the amount of air co-fed to the first reactor is from 0.3 to 20 mol %, based on the amount of organics.

24. A process according to claim 23 wherein the amount of air co-fed to the first reactor is from 0.4 to 10 mol %, based on the amount of organics.

25. A process according to claim 24 wherein the amount of air co-fed to the first reactor is from 0.4 to 5 mol %, based on the amount of organics.

26. A process according to any of claims 15 to 25 wherein the intermediate composition exits the first reactor and is fed directly to the second reactor.

27. A process according to any of the preceding claims wherein the catalytic dehydrochlorination of 243db is carried out in the presence of HF and the intermediate composition further contains HF.

28. A process according to claim 27 wherein the composition comprising 243db additionally contains HF, with a molar ratio of HF:243db of from 0.5:1 to 40:1.

29. A process according to claim 28 wherein the molar ratio of HF:243db is from 1:1 to 15:1.

30. A process according to any of claims 2 to 29 wherein molar ratio of HF:1233xf in the second reactor of from 1:1 to 45:1.

31. A process according to claim 30 wherein the molar ratio of HF:1233xf in the second reactor is from 2:1 to 20:1.

32. A process according to claim 31 wherein the molar ratio of HF:1233xf in the second reactor is from 3:1 to 15:1.

33. A process according to any of claims 30 to 32 wherein an additional feed of HF is provided to the second reactor.

34. A process according to any of the preceding claims wherein the air is compressed prior to being co-fed.

35. A process according to any of the preceding claims wherein the air is dried prior to being co-fed.

36. A process according to any of the preceding claims wherein the reactor product composition is separated into a stream comprising 245cb and HF and a stream comprising HCl and air.

37. A process according to claim 36 wherein the stream comprising 245cb and HF is separated into a 245cb-rich stream and a HF-rich stream.

38. A process according to claim 37 wherein the 245cb-rich stream is subjected to a scrubbing step in which residual HF is substantially removed from the 245cb-rich stream to produce a 245cb-rich stream substantially free from HF.

39. A process according to any of the preceding claims wherein the 245cb is separated from any further fluorocarbons present to produce a substantially pure 245cb product.

40. A process according to any of the preceding claims wherein the catalytic dehydrochlorination is carried out at a temperature of from 200 to 450 ºC and a pressure of from 0.1 to 30 bara.

41. A process according to claim 40 wherein the catalytic dehydrochlorination is carried out at a temperature of from 250 to 380 ºC and a pressure of from 1 to 20 bara.

42. A process according to claim 41 wherein the catalytic dehydrochlorination is carried out at a temperature of from 300 to 350 ºC and a pressure of from 5 to 20 bara.

43. A process according to any of the preceding claims wherein the catalytic dehydrochlorination is carried out in the presence of a bulk form or supported catalyst comprising activated carbon, a zero-valent metal, a metal oxide, a metal oxyhalide, a metal halide, or mixtures of the foregoing.

44. A process according to claim 43 wherein the metal is a transition metal, an alkaline earth metal or aluminium.

45. A process according to claim 43 or 44 wherein the catalyst is based on chromia, preferably a zinc/chromia catalyst.

46. A process according to any of the preceding claims wherein the catalytic fluorination is carried out at a temperature of from 200 to 450 ºC and a pressure of from 0.1 to 30 bara.

47. A process according to claim 46 wherein the catalytic fluorination is carried out at a temperature of from 250 to 420 ºC and a pressure of from 1 to 20 bara.

48. A process according to claim 47 wherein the catalytic fluorination is carried out at a temperature of from 300 to 380 ºC and a pressure of from 5 to 20 bara.

49. A process according to any of the preceding claims wherein the catalytic fluorination is carried out in the presence of a bulk form or supported catalyst comprising activated carbon, a zero-valent metal, a metal oxide, a metal oxyhalide, a metal halide, or mixtures of the foregoing.

50. A process according to claim 49 wherein the metal is a transition metal, an alkaline earth metal or aluminium.

51. A process according to claim 49 or 50 wherein the catalyst is based on chromia.

52. A process according to claim 51 wherein the catalyst is based on a zinc/chromia catalyst.

53. A process according to any of preceding claims wherein the HF in the reactor product composition is at least partially recycled to the catalytic dehydrochlorination of the composition comprising 243db and HF.

54. A process according to claim 37 wherein the HF in the HF-rich stream is recycled to the catalytic dehydrochlorination of the composition comprising 243db and HF.

55. A process according to claim 54 wherein the HF-rich stream is separated into an HF stream and an organic stream, wherein the HF stream is recycled to the catalytic dehydrochlorination of the composition comprising 243db and HF.

56. A process according to any of the preceding claims wherein the reactor product composition further contains 2,3,3,3-tetrafluoropropene (1234yf).

57. A process according to any of the preceding claims further comprising feeding the 245cb into a dehydrofluorination reactor to produce a dehydrofluorination product comprising 2,3,3,3-tetrafluoropropene (1234yf) and HF.

58. A process according to claim 56 wherein the 245cb is catalytically dehydrofluorinated to 1234yf in the gas phase.