What is Claimed:

1. A process for continuous dehydrogenating of paraffins having 2-8 carbon atoms, preferably propane or isobutane, comprising:

contacting said paraffins with a catalyst composition at a reaction temperature of 500-800 °C, a space velocity of 0.1-5 hr^{-1} or 0.1-1 hr^{-1} and a pressure of 0.01-0.2 MPa for a reaction period in the range of 0.05 seconds to 10 minutes;

regenerating the catalyst with an oxygen-containing gas wherein said catalyst regeneration is performed at a reaction temperature of 500-800 °C, a pressure of 0.01-0.2 MPa and a regeneration period ranging from 0.05 seconds to 10 minutes;

wherein the catalyst composition comprises:

(a) zinc oxide with optional modifiers selected from the group of Copper, Manganese, and Niobium and a stabilized titania support, comprising: the stabilized titania support stabilized with a stabilizing element(s) comprising zirconium, tungsten, or a rare earth element or combinations thereof; and Zn; wherein the catalyst composition from 10 to 95 wt% titania, 0.1 to 25 wt% of the stabilizing element(s), 0 to 3 wt% of the modifiers; and 0.1 to 10 wt% Zn; and characterizable by a Activity Parameter > 1500, Selectivity Parameter < 0.2 and a stability parameter < 0.005 using a test where the mixed metal oxide catalyst is loaded in a fixed-bed reactor such that the 50 > dT/dP > 10 (diameter of tube to diameter of catalyst particles) and 200 > L/dP > 50 (length of catalyst bed to diameter of catalyst particles) and 2 > dP > 0.5 mm exposed to a feed stream of propane at a temperature of 625ºC, atmospheric pressure and a feed rate of 2 hr^{-1} weight hourly space velocity;

(b) a mixed metal oxide catalyst suitable for the dehydrogenation of paraffins having 2-8 carbon atoms with a catalyst composition of the general formula (AC) (CS) (ST) wherein

AC represents oxides of Transition Metals selected from the group of copper (Cu), iron (Fe), manganese (Mn), niobium (Nb) and zinc (Zn) or mixtures thereof,

CS represents oxides of aluminum (Al), silicon (Si), and titanium (Ti) or mixtures thereof,

ST represents oxides of Rare Earth metals selected from the group of cerium (Ce), dysprosium (Dy), erbium (Er), europium (Eu), gadolinium (Gd), lanthanum (La), neodymium (Nd), praseodymium (Pr), samarium (Sm), terbium (Tb), ytterbium (Yb), yttrium (Y), tungsten (W), zirconium (Zr), or mixtures thereof, and

characterizable by a Activity Parameter > 1500, Selectivity Parameter < 0.2 and a stability parameter < 0.005 measured using a test where the mixed metal oxide catalyst is loaded in a fixed-bed reactor such that the 50 > dT/dP > 10 (diameter of tube to diameter of catalyst particles) and 200 > L/dP > 50 (length of catalyst bed to diameter of catalyst particles) and 2 > dP > 0.5 mm exposed to a feed stream of propane at a temperature of 625°C, atmospheric pressure and a feed rate of 1 hr^{-1} weight hourly space velocity; or

(c) a mixed metal oxide catalyst, comprising a catalyst composition of the general formula (AC) (CS) (ST) (MS) wherein

AC (Active Catalyst) represents oxides of Transition Metals selected from the group of copper (Cu), iron (Fe), manganese (Mn), niobium (Nb) and zinc (Zn) or mixtures thereof,

CS (Catalyst Support) represents oxides of aluminum (Al), silicon (Si), and titanium (Ti) or mixtures thereof,

ST (Support Stabilizer) represents oxides of metals selected from the group of cerium (Ce), dysprosium (Dy), erbium (Er), europium (Eu), gadolinium (Gd), lanthanum (La), neodymium (Nd), praseodymium (Pr), samarium (Sm), terbium (Tb), ytterbium (Yb), yttrium (Y) tungsten (W) and zirconium (Zr) or mixtures thereof,

MS (Mechanical Stabilizer) represents porous spheres selected from the group of alumina, silica, titania, zirconia, kaolin, meta-kaolin, bentonite, attapulgite, or mixtures thereof;

and

characterizable by a Activity Parameter > 1500, Selectivity Parameter < 0.5 and a stability parameter < 0.005 using a test where the mixed metal oxide catalyst is loaded in a fixed-bed reactor such that the 50 > dT/dP > 10 (diameter of tube to diameter of catalyst particles) and 200 > L/dP > 50 (length of catalyst bed to diameter of catalyst particles) and 2 > dP > 0.5 mm exposed to a feed stream of propane at a temperature of 625°C, atmospheric pressure and a feed rate of 2 hr^{-1} weight hourly space velocity.

2. The process of claim 1, wherein said catalyst composition has less than 100 ppm by weight of either platinum (Pt) or chromium (Cr).

3. The process of claim 1 wherein the catalyst composition has a BET surface area > 30 m^2/g.

4. The process of claim 1 wherein the number average particle size of the catalyst composition is in the range of 30-3000 microns.

5. The process of claim 1 wherein the Air Jet Index of the catalyst composition is less than 10 or less than 5.

6. The process of claim 6 wherein the AC (active catalyst) species of the catalyst composition makes up 0.1 to 20 wt% of the total weight of the catalyst, where weight includes the transition metals and associated oxygen needed to balance the oxidation state of the transition metals.

7. The process of claim 6 wherein the active catalyst species makes up 0.1 to 10 wt% of the total weight of the catalyst.

8. The process of claim 6 wherein the active catalyst species makes up 0.1 to 7.5 wt% of the total weight of the catalyst.

9. The process of claim 1 wherein the CS (catalyst support) makes up 10 to 95 wt% of the total weight of the catalyst composition.

10. The process of claim 1 wherein the catalyst support makes up 20 to 90 wt% of the total weight of the catalyst composition.

11. The process of claim 1 wherein the catalyst support makes up 50 to 85 wt% of the total weight of the catalyst composition.

12. The process of claim 1 wherein the ST (catalyst stabilizer) makes up 0.1 to 25 wt% of the total weight of the catalyst composition.

13. The process of claim 1 wherein the catalyst stabilizer makes up 1 to 15 wt% of the total weight of the catalyst composition.

14. The process of claim 1 wherein the catalyst stabilizer makes up 1 to 10 wt% of the total weight of the catalyst composition.

15. The process of claim 1 wherein the catalyst support comprises a mesoporous bead and wherein the number average particle size of the mesoporous bead is in the range of 30-3000 microns.

16. The process according to claim 1 wherein the MS (mechanical stabilizer) species makes up 20 to 85 wt% of the total weight of the catalyst.

17. The process of any of claims 1-16 wherein said contacting is carried out in a fluidized bed reactor or a fixed-bed swing reactor.

18. A catalyst composition comprising zinc oxide with optional modifiers selected from the group of Copper, Manganese, and Niobium and a stabilized titania support, comprising: the stabilized titania support stabilized with a stabilizing element(s) comprising zirconium, tungsten, or a rare earth element or combinations thereof; and Zn; wherein the catalyst composition from 10 to 95 wt% titania, 0.1 to 25 wt% of the stabilizing element(s), 0 to 3 wt% of the modifiers; and 0.1 to 10 wt% Zn; and characterizable by a Activity Parameter > 1500, Selectivity Parameter < 0.2 and a stability parameter < 0.005 using a test where the mixed metal oxide catalyst is loaded in a fixed-bed reactor such that the 50 > dT/dP > 10 (diameter of tube to diameter of catalyst particles) and 200 > L/dP > 50 (length of catalyst bed to diameter of catalyst particles) and 2 > dP > 0.5 mm exposed to a feed stream of propane at a temperature of 625°C, atmospheric pressure and a feed rate of 2 hr^{-1} weight hourly space velocity.

19. The catalyst composition of claim 18, wherein said catalyst composition has less than 100 ppm by weight of either platinum (Pt) or chromium (Cr).

20. The catalyst composition of claim 18 wherein the BET surface area > 30 m^2/g.

21. The catalyst composition of claim 18 wherein the number average particle size of the mixed-metal oxide catalyst is in the range of 30-3000 microns.

22. The catalyst composition of claim 18 wherein the Air Jet Index is less than 10 or less than 5.

23. A mixed metal oxide catalyst suitable for the dehydrogenation of paraffins having 2-8 carbon atoms with a catalyst composition of the general formula (AC) (CS) (ST) wherein

a) AC represents oxides of Transition Metals selected from the group of copper (Cu), iron (Fe), manganese (Mn), niobium (Nb) and zinc (Zn) or mixtures thereof,

b) CS represents oxides of aluminum (Al), silicon (Si), and titanium (Ti) or mixtures thereof,

c) ST represents oxides of Rare Earth metals selected from the group of cerium (Ce), dysprosium (Dy), erbium (Er), europium (Eu), gadolinium (Gd), lanthanum (La), neodymium (Nd), praseodymium (Pr), samarium (Sm), terbium (Tb), ytterbium (Yb), yttrium (Y), tungsten (W), zirconium (Zr), or mixtures thereof, and

characterizable by a Activity Parameter > 1500, Selectivity Parameter < 0.2 and a stability parameter < 0.005 measured using a test where the mixed metal oxide catalyst is loaded in a fixed-bed reactor such that the 50 > dT/dP > 10 (diameter of tube to diameter of catalyst particles) and 200 > L/dP > 50 (length of catalyst bed to diameter of catalyst particles) and 2 > dP > 0.5 mm exposed to a feed stream of propane at a temperature of 625°C, atmospheric pressure and a feed rate of 1 hr^{-1} weight hourly space velocity.

24. The catalyst composition of claim 23 wherein the AC (active catalyst) species makes up 0.1 to 20 wt% of the total weight of the catalyst, where weight includes the transition metals and associated oxygen needed to balance the oxidation state of the transition metals.

25. The catalyst composition of claim 23 wherein the active catalyst species makes up 0.1 to 10 wt% of the total weight of the catalyst.

26. The catalyst composition according to claim 23 wherein the active catalyst species makes up 0.1 to 7.5 wt% of the total weight of the catalyst.

27. The catalyst composition according to claim 23 wherein the CS (catalyst support) makes up 10 to 95 wt% of the total weight of the catalyst.

28. The catalyst composition according to claim 23 wherein the catalyst support makes up 20 to 90 wt% of the total weight of the catalyst.

29. The catalyst composition according to claim 23 wherein the catalyst support makes up 50 to 85 wt% of the total weight of the catalyst.

30. The catalyst composition according to claim 23 wherein the ST (catalyst stabilizer) makes up 0.1 to 25 wt% of the total weight of the catalyst.

31. The catalyst composition according to claim 23 wherein the catalyst stabilizer makes up 1 to 15 wt% of the total weight of the catalyst.

32. The catalyst composition according to claim 23 wherein the catalyst stabilizer makes up 1 to 10 wt% of the total weight of the catalyst.

33. The catalyst composition of claim 23, wherein said catalyst composition has less than 100 ppm by weight of either platinum (Pt) or chromium (Cr).

34. The catalyst composition of claim 23 wherein the BET surface area > 30 m^2/g.

35. The catalyst composition of claim 18, wherein the catalyst support comprises a mesoporous bead and wherein the number average particle size of the mesoporous bead is in the range of 30-3000 microns.

36. The catalyst composition of claim 23 wherein the number average particle size of the mixed-metal oxide catalyst is in the range of 30-3000 microns.

37. A mixed metal oxide catalyst, comprising a catalyst composition of the general formula (AC) (CS) (ST) (MS) wherein

a) AC (Active Catalyst) represents oxides of Transition Metals selected from the group of copper (Cu), iron (Fe), manganese (Mn), niobium (Nb) and zinc (Zn) or mixtures thereof,

b) CS (Catalyst Support) represents oxides of aluminum (Al), silicon (Si), and titanium (Ti) or mixtures thereof,

c) ST (Support Stabilizer) represents oxides of metals selected from the group of cerium (Ce), dysprosium (Dy), erbium (Er), europium (Eu), gadolinium (Gd), lanthanum (La), neodymium (Nd), praseodymium (Pr), samarium (Sm), terbium (Tb), ytterbium (Yb), yttrium (Y) tungsten (W) and zirconium (Zr) or mixtures thereof,

d) MS (Mechanical Stabilizer) represents porous spheres selected from the group of alumina, silica, titania, zirconia, kaolin, meta-kaolin, bentonite, attapulgite, or mixtures thereof;

and

characterizable by a Activity Parameter > 1500, Selectivity Parameter < 0.5 and a stability parameter < 0.005 using a test where the mixed metal oxide catalyst is loaded in a fixed-bed reactor such that the 50 > dT/dP > 10 (diameter of tube to diameter of catalyst particles) and 200 > L/dP > 50 (length of catalyst bed to diameter of catalyst particles) and 2 > dP > 0.5 mm exposed to a feed stream of propane at a temperature of 625°C, atmospheric pressure and a feed rate of 2 hr^{-1} weight hourly space velocity.

38. The catalyst composition according to claim 37 wherein the MS (mechanical stabilizer) species makes up 20 to 85 wt% of the total weight of the catalyst.

39. A method for preparing a catalyst composition as defined in any one of claims 18-38 comprising the steps of:

a) contacting a stabilized catalyst support with a solution comprising a salt of the active catalyst metal or mixtures thereof to make a catalyst intermediate,

b) calcining the catalyst intermediate to produce the mixed metal oxide catalyst.

40. A method of making a catalyst composition as defined in any one of claims 18-38 comprising the steps of:

a) dissolving organic alkoxides of catalyst support and stabilizing elements in an organic solvent;

b) hydrolyzing the organic alkoxide solution, preferably in the presence of an acid or base catalyst, to produce a gel; and

c) drying and calcining the resultant gel to produce the catalyst support of the catalyst composition as defined in any one of claims 18-38.

41. The method of making a catalyst composition as defined in any one of claims 18-38 wherein the catalyst support is synthesized using inorganic salts comprising the steps of:

a) dissolving salts of catalyst support and stabilizing elements in a solvent;

b) coprecipitating the salts using a precipitating agent;

c) drying and calcining the resultant precipitate to produce the catalyst support of the catalyst composition as defined in any one of claims 18-38.

42. A method for preparing a catalyst composition as defined in any one of claims 18-38 comprising the steps of

a) dissolving salts of active material, catalyst support and stabilizing elements in a solvent;

b) coprecipitating the salts using a precipitating agent;

c) drying and calcining the resultant precipitate to produce the mixed metal oxide catalyst.

43. A method for preparing a catalyst composition as defined in any one of claims 18-38 comprising the steps of:

a) providing a salt solution comprising salts of Al, Si, Ti, or Zr or mixtures thereof dissolved in water;

b) impregnating mesoporous beads with the salt solution;

c) drying and calcining the mesoporous beads to produce ~~the~~ a grafted catalyst support;

d) contacting the catalyst support with a solution comprising a salt of a rare earth metal or mixtures thereof;

followed by addition of rare-earth and transition metals comprising the steps of

e) calcining said catalyst support by heating said catalyst support impregnated with rare earth metals to produce a stabilized catalyst support;

f) contacting the stabilized catalyst support with a solution comprising a salt of a transition metal or mixtures thereof to make a catalyst intermediate; wherein the transition metal is selected from the group of consisting of: copper (Cu), iron (Fe), manganese (Mn), niobium (Nb) and zinc (Zn) or mixtures thereof; and

g) calcining the catalyst intermediate to produce the mixed metal oxide catalyst.

44. A method for preparing a catalyst composition as defined in any of claims 18-38 comprising the steps of:

a) dissolving organic alkoxides of catalyst support and support stabilizer in an organic solvent,

b) contacting the organic alkoxide solution or mixtures thereof with porous spheres,

c) drying and calcining the porous spheres to produce the grafted catalyst support,

d) contacting the grafted catalyst support with a solution comprising a salt of active catalyst metal or mixtures thereof,

e) calcining the catalyst intermediate to produce the mixed metal oxide catalyst.

45. A method for preparing a catalyst composition as defined in any one of claims 18-38 comprising the steps of:

a) providing a salt solution comprising salts of catalyst support and stabilizing elements dissolved in a solvent;

b) impregnating porous spheres with the salt solution;

c) drying and calcining the porous spheres to produce the grafted catalyst support;

d) contacting the grafted catalyst support with a solution comprising a salt of a transition metal or mixtures thereof to make a catalyst intermediate; wherein the transition metal is selected from the group of consisting of: copper (Cu), iron (Fe), manganese (Mn), niobium (Nb) and zinc (Zn) or mixtures thereof; and

e) calcining the catalyst intermediate to produce the mixed metal oxide catalyst.

46. A method for preparing a catalyst composition as defined in any one of claims 18-38 comprising the steps of:

a) providing a salt solution comprising salts of active catalyst, catalyst support, and stabilizing elements dissolved in a solvent;

b) impregnating porous spheres with the salt solution;

c) drying and calcining the porous spheres to produce the mixed metal oxide catalyst.

47. The method according to any of claims 39-46, wherein the catalyst support or the mixed metal oxide catalyst is calcined at 500-1,100°C, preferably at 550-800°C and most preferably at 550-650°C for 2-6 hrs in an oxygen containing atmosphere, preferably air.

48. The method according to claim 43 wherein the volume average pore diameter of the mesoporous bead is in the range of 3 to 500 nm or 3-25 nm.

~~49. A method of preparing a catalyst composition according to claims 18-38 wherein the catalyst is synthesized using salts comprising the steps of:~~

~~a) dissolving salts of Zn, Ti,, Zr and/or Silica, Rare Earth metals and Modifiers in a solvent;~~

~~b) coprecipitating the salts using a precipitating agent;~~

~~c) drying and calcining the resultant precipitate to produce the mixed-metal oxide catalyst~~

~~50~~49. A process of dehydrogenating a paraffin (preferably propane or isobutane), comprising contacting the paraffin with the catalyst described in any of the foregoing claims in a reaction chamber under conditions sufficient to dehydrogenate the paraffin and resulting in an olefin.