

**What is Claimed:**

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

- 5       contacting said paraffins with a catalyst composition at a reaction temperature of 500-800 °C, a space velocity of 0.1-5 hr<sup>-1</sup> or 0.1-1 hr<sup>-1</sup> 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;

10    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  
 15    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  
 20    exposed to a feed stream of propane at a temperature of 625°C, atmospheric pressure and a feed rate of 2 hr<sup>-1</sup> 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

- 25       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),  
 30       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  $1 \text{ hr}^{-1}$  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  $2 \text{ hr}^{-1}$  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  $> 30 \text{ m}^2/\text{g}$ .
4. The process of claim 1 wherein the number average particle size of the catalyst composition is  
5 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.
- 10 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  
15 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.
- 20 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.  
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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  
30 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.

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

10 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.

15 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.