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(54) **Title**: A PROCESS FOR PREPARING ALKENE FROM ALKANE

(57) **Abstract**: The present disclosure provides a process for dehydrogenation of a feed comprising at least one aikane selected from the group consisting of n-butane and isobutane to obtain at least one compound selected from the group consisting of 1-butene, cis-2-butene, trans-2-butene, isobutene and combinations thereof, said process comprises reacting the feed with at least one hydrogen acceptor in the presence of at least one pincer ligated iridium catalyst in a non-reactive medium at a temperature in the range of 100°C to 250°C. The dehydrogenation is carried out at lower temperature and yield is higher.

Title: A PROCESS FOR PREPARING ALKENE FROM ALKANE

FIELD OF THE DISCLOSURE:

The present disclosure relates to a process for preparing alkene from alkane.

BACKGROUND:

An alkene is an unsaturated chemical compound containing at least one carbon-to-carbon double bond. Alkenes are conventionally produced, inter alia, by hydrocarbon cracking. Alkanes are broken apart at high temperatures, often in the presence of a zeolite catalyst, to produce a mixture of primarily aliphatic alkenes and lower molecular weight alkanes (produced by loss of CO_2). The mixture is feedstock dependent and separated by fractional distillation. This is mainly used for the manufacture of lower alkenes (up to six carbons).

In catalytic dehydrogenation an alkane loses hydrogen at high temperatures to produce a corresponding alkene. This process is also known as reforming. This process is endothermic, but it is driven towards the alkene at high temperatures by entropy.

Alkenes like butene can be used as monomers for polybutene. Isomers of butene (C_4H_8) exist as 1-butene, cis-2-butene, trans-2-butene and isobutylene. All four isomers are gases at room temperature, but can be liquefied by lowering the temperature or raising the pressure.

These gases are colourless, but do have distinct odours, and are highly flammable. These are not naturally present in petroleum in high percentages, but can be produced from petrochemicals or by catalytic cracking of petroleum. Although they are stable compounds, the carbon-carbon double bond makes them more reactive than similar alkanes.

Because of the double bonds, 4-carbon alkenes can act as monomers in the formation of polymers and can be used as petrochemical intermediates and as a feed for preparation of conjugated diene such as 1,3-butadiene. They are also used in the production of synthetic rubber. But-1-ene is a linear or normal alpha-olefin and isobutylene is a branched alpha-olefin. In a low percentage, but-1-ene is used as one of the comonomers, along with other alpha-olefins, in the production of high density polyethylene and linear low density polyethylene. Butyl rubber is made by cationic polymerization of isobutylene with about 2 - 7% isoprene. Isobutylene is also used for the production of methyl *tert*-butyl ether (MTBE) and isooctane, both of which improve the combustion of gasoline.

Further, it is known that a stream containing C_4 hydrocarbons is produced in the fluid catalytic cracking (FCC) unit and crude distillation unit (CDU). The stream typically consists of alkanes such as n-butane and isobutane along with alkenes such as isobutene and butenes. The butenes can be isolated from the C_4 stream and used for further applications as mentioned above. However, higher value addition of this C_4 stream can be achieved by dehydrogenating the alkanes present in it so that the stream can be enriched with butenes and isobutene as major components.

The art has developed and is continuing to develop a number of alternative methods to produce dehydrogenated hydrocarbons in commercial quantities. In the dehydrogenation reaction, selectivity in formation of the preferred product is desirable. Accordingly, one of the problems faced in the hydrocarbon dehydrogenation is the development of a process for maximum conversion of starting material into the desired product.

Further, hydrocarbon dehydrogenation reactions are mostly carried out at a relatively high temperature requiring high energy consumption and specialized equipment which in-turn contributes to a relatively higher production cost. The application of high temperatures for dehydrogenation of the hydrocarbons leads to ‘atom loss’ in the form of carbon dioxide and therefore, lesser yield of the final product/s.

Some of the representative patent documents which disclose dehydrogenation of hydrocarbon are discussed herein below.

US patent 6982305 discloses dehydrogenation of alkane to make an olefin in the presence of a Group VIII dehydrogenation catalyst (including Iridium) and then polymerizing the olefin (ethylene, propylene, 1-butene, 1-pentene, 1-hexene, 1-octene, and mixtures thereof) in the presence of an olefin polymerization catalyst, and an optional hydrocarbon solvent. However, US6982305 does not disclose selective preparation of alkene from alkane.

US 20040181104 discloses catalytic dehydrogenation of ethyl benzene using iridium-based pincer catalyst in the presence of a hydrogen acceptor. It specifically discloses the dehydrogenation of alkyl aromatic compound and not the C_4 alkanes.

PCT publication WO2012061272 discloses a method of making a C_5 or C_6 conjugated linear diene compound which involves reacting a C_5 or C_6 linear monoene with a hydrogen acceptor in the presence of a hydrogen transfer catalyst such as iridium pincer complex catalyst to produce a C_5 or C_6 conjugated linear diene. However, WO2012061272 application does not disclose the conversion of C_4-alkane to alkene. Further, it does not disclose the dehydrogenation of butane.

None of the prior art patent documents disclose selective preparation of C_4-alkenes from C_4-alkanes. Further, none of the documents disclose a method for the preparation of C_4-alkenes from C_4-alkanes at lower temperature.

Furthermore, none of these documents disclose selective conversion of linear and branched butane.

Accordingly, there is need for a selective method for dehydrogenation of a feed comprising alkanes selected from the group consisting of n-butane and isobutane to obtain at least one compound selected from the group consisting of 1-butene, cis-2-butene, trans-2-butene, isobutene and combinations thereof which can be carried out in a single pot at relatively low temperature.

Definitions:

As used in the present disclosure, the following words and phrases are generally intended to have the meanings as set forth below, except to the extent that the context in which they are used to indicate otherwise.

The expression "non-reactive medium" means a fluid that does not take part in the reaction at particular experimental conditions and only provides a medium for the reaction to occur.

The expression "Pincer ligated" means a chelating agent that binds to three adjacent coplanar sites, usually on a transition metal in a meridional configuration.

The expression "Turnover number" means the number of moles of substrate that a mole of catalyst can convert before becoming inactivated.

OBJECTS:

Some of the objects of the present disclosure, which at least one embodiment herein satisfies, are as follows:

It is an object of the present disclosure to provide a process for dehydrogenating a feed comprising at least one alkane selected from the group consisting of n-butane and isobutane to obtain at least one compound selected from the group consisting of 1-butene, cis-2-butene, trans-2-butene, isobutene and combinations thereof that is simple, energy efficient and cost-effective.

It is another object of the present disclosure to provide a process for dehydrogenating a feed comprising at least one alkane selected from the group consisting of n-butane and isobutane to obtain at least one compound selected from the group consisting of 1-butene, cis-2-butene, trans-2-butene, isobutene and combinations thereof that is carried out in single pot.

It is still another object of the present disclosure to provide a process for dehydrogenating a feed comprising at least one alkane selected from the group consisting of n-butane and isobutane to obtain at least one compound selected from the group consisting of 1-butene, cis-2-butene, trans-2-butene, isobutene and combinations thereof that gives high yield.

It is yet another object of the present disclosure to provide a process for dehydrogenating a feed comprising alkanes n-butane and isobutane to obtain at least one compound selected from the group consisting of 1-butene, cis-2-butene, trans-2-butene, isobutene and combinations thereof that is selective for the conversion of linear and branched alkane.

It is a further object of the present disclosure to provide a process for dehydrogenating a feed comprising at least one alkane selected from the group consisting of n-butane and isobutane to obtain at least one compound selected from the group consisting of 1-butene, cis-2-butene, trans-2-butene, isobutene and combinations thereof that is carried out under mild conditions.

Other objects and advantages of the present disclosure will be more apparent from the following description when read in conjunction with the accompanying figures, which are not intended to limit the scope of the present disclosure.

Summary:

In accordance with the present disclosure there is provided a process for dehydrogenation of a feed comprising at least one alkane selected from the group consisting of n-butane and isobutane to obtain at least one compound selected from the group consisting of 1-butene, cis-2-butene, trans-2-butene, isobutene and combinations thereof; said process comprises reacting the feed with at least one hydrogen acceptor in the presence of at least one pincer ligated iridium catalyst in a non-reactive medium at a temperature in the range of 100°C to 250°C.

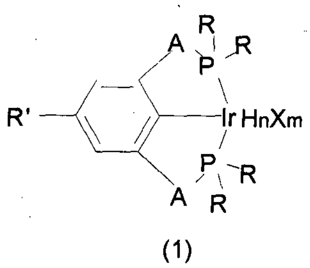
In one embodiment of the present disclosure the feed is n-butane and the alkenes are 1-butene, cis-2-butene and trans-2-butene.

In another embodiment of the present disclosure the 'feed' is a pure chemical selected from the group consisting of n-butane and isobutane or a stream containing at least one alkane selected from the group consisting of n-butane and isobutane along with butenes and isobutene; and combination thereof or a fresh C_4 stream from fluid catalytic cracking (FCC) unit or crude distillation unit (CDU).

Typically, the hydrogen acceptor is at least one selected from the group consisting of t-butyl ethylene, norbornene, isobutylene and diisobutylene.

Typically, the concentration of the hydrogen acceptor ranges from 25 to 45 w/w% of the total reaction mixture.

Typically, the pincer ligated iridium catalyst is a compound of formula 1 or 2



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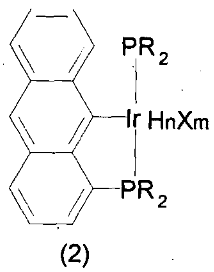


(2)

Wherein A = O, CH_2 or a combination of O and CH_2
R' = H, MeO and NR2,
R = tert-Butyl, isopropyl, cylopentyl and cyclohexyl ,
H_nX_m where n = 0 to 4, and
X = halogen and m= 0 to 2.

Typically, the ratio of the pincer ligated iridium catalyst to the feed ranges from 1:1000 to 1:10000.

Typically, the ratio of the hydrogen acceptor to the feed ranges between 2:1 and 1:3.

Typically, the non-reactive medium is at least one selected from the group consisting of mesitylene, 1,2,4,5-tetramethylbenzene and 2,2,4,4,6,6,8,8-octamethylnonane.

Typically, the ratio of the non-reactive medium to the feed ranges from 1:1 to 1:5.

In one embodiment the pincer ligated iridium catalyst is a catalyst supported on at least one inorganic support selected from the group consisting of alumina, silica and zeolite or metal surface through physical adsorption or covalent bond linkage.

Typically, the dehydrogenation is carried for a time period of 1 to 6 hours.

DETAILED DESCRIPTION:

In accordance with one aspect of the present disclosure there is provided a process for dehydrogenating a feed comprising at least one alkane selected from the group consisting of n-butane and isobutane. The inventors of the present disclosure specifically focused on selectively converting a feed comprising at least one alkane selected from the group consisting of n-butane and isobutane into at least one compound selected from the group consisting of 1-butene, cis-2-butene, trans-2-butene, isobutene and combinations thereof, at a lower temperature in a short reaction time.

It is envisaged that the temperature condition for the dehydrogenating reaction should be such that there is barely any loss of the reactant in the form of the carbon dioxide. It is found that the dehydrogenation reaction of alkane can be carried at a temperature ranging from 100°C to 250°C. In this temperature range the atom efficiency is close to 100% as there is no loss due to the formation of carbon dioxide that usually takes place at higher temperature. Further, the inventors after conducting the experiments found that the selective dehydrogenation of linear or branched alkane can be achieved by using different pincer ligated iridium homogeneous catalyst.

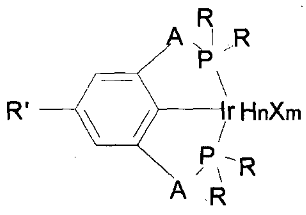
In accordance with the present disclosure the feed consists of at least one compound selected from the group consisting of n-butane and isobutane. The product formed on dehydrogenation contains alkenes such as 1-butene, isobutene, trans-2-butene, cis-2- butane; and butadiene.

In one embodiment, the feed is a C_4 stream from fluid catalytic cracking (FCC) unit and crude distillation unit (CDU) containing n-butane, isobutane, isobutene and butenes. Value addition of the stream can be achieved by converting the alkanes present in it to alkenes by dehydrogenation. This conversion also eliminates the cost involved in separating the alkenes present in the stream.

Though any C_2-C_{20} olefin can be employed as a hydrogen acceptor in the dehydrogenation reaction of the present disclosure C_4 to C_8 olefins are preferred as hydrogen acceptors. The hydrogen acceptor used in the process of the present disclosure is at least one selected from the group consisting of tert-butylethylene, norbornene, isobutylene and diisobutylene. The hydrogen acceptor is believed to promote the rate of the dehydrogenation reaction by accepting the hydrogen atoms from the catalyst thereby resulting in the active catalyst species which then reacts with alkane reactant. Further, the formation of the alkene can be regulated by controlling the quantity of the hydrogen acceptor. Up to a certain extent, increase in the quantity of the hydrogen acceptor results in the higher yield of the alkene.

Accordingly, increase in the yield of alkene as a function of quantity of the hydrogen acceptor may be exponential, directly proportional or incremental. Therefore, to obtain optimized results the concentration of the hydrogen acceptor is maintained between 25 and 45 w/w% with respect to the total mass of the reaction mixture.

The dehydrogenation reaction of the present disclosure is catalyzed by a hydrogen transfer catalyst. Pincer ligated iridium homogeneous catalyst is used to transfer the hydrogen from the alkane to the hydrogen acceptor. Pincer ligated iridium catalyst is at least one selected from the group represented by a formula 1 or 2



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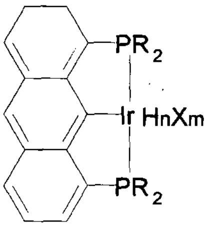


(2)

Wherein A = O, CH_2 or a combination of O and CH_2
R' = H, MeO and NR2,
R = tert-Butyl, isopropyl, cylopentyl and cyclohexyl,
H_nX_m where n = 0 to 4, and
X = halogen and m= 0 to 2.

In accordance with the present disclosure, a step of predrying of the feed is sufficient and no further treatment of feed is required as the catalyst is stable in the presence of impurities present in the feed/stream.

Depending upon the need of the reaction conditions the catalyst may be supported on at least one inorganic support selected from the group consisting of alumina, silica, zeolites or metal surface. The catalyst and support are attached to each other either through physical adsorption or through covalent bond linkage.

The hydrogen transfer catalyst i.e. pincer ligated iridium catalyst reacts with hydrogen acceptor for example tert-butyl ethylene to give 2,2-dimethyl butane and thereby generating a co-ordinatively unsaturated catalytically active species. The catalytically active species then oxidatively reacts with n-alkane by activating C-H bond to give rise to the alkyl hydride. The alkyl hydride then undergoes reductive elimination to form 1-alkene. 1-alkene can always reinsert in a 2,1-fashion under the employed reaction conditions and then due to 2,1-elimination, 2-alkene gets formed. Thus, as per the process of the present disclosure both 1-alkene and 2-alkene are formed upon dehydrogenation of n-alkane.

In the context of the present disclosure the 'feed' is a pure chemical selected from the group consisting of n-butane and isobutane or a stream containing at least one alkane selected from the group consisting of n-butane and isobutane along with butenes and isobutene; and combination thereof or a fresh C_4 stream from fluid catalytic cracking (FCC) unit or crude distillation unit (CDU).

In one embodiment n-butane is subjected to dehydrogenation to form 1-butene, cis-2-butene and trans-2-butene. The pincer ligated iridium catalyst reacts with tert-butylethylene to give 2,2-dimethyl butane and thereby generating a co-ordinatively unsaturated catalytically active species. The catalytically active species then oxidatively reacts with n-butane by activating C-H bond to give rise to the butyl hydride. The butyl hydride then undergoes reductive elimination to form 1-butene. 1-butene can always reinsert in a 2,1-fashion under the employed reaction conditions and then due to 2,1-elimination, 2-butene is formed.

The non-reactive medium means a fluid that does not take part in the reaction at particular experimental conditions and only provides a medium for the reaction to occur. Such non-reactive medium is one where C-H activation cannot occur which includes significantly substituted aromatic or aliphatic compound having high boiling points. Further, the non-reactive medium either aromatic or aliphatic is such selected that no two hydrogen atoms are adjacent to each other so that the non-reactive medium does not compete with the dehydrogenation reaction of alkane into alkene. Based on this criteria, the non-reactive medium is at least one selected from the group consisting of mesitylene, 1,2,4,5-tetramethylbenzene and 2,2,4,4,6,6,8,8-octamethylnonane.

Inventors of the present disclosure still further found that to drive a dehydrogenation reaction in the desired direction the components of the reaction are to be used in a specific proportion/ratio. The concentration of the hydrogen acceptor in the reaction mixture ranges between 25 and 45 w/w% of the total reaction mixture. The ratio of the hydrogen acceptor to feed ranges between 2:1 and 1:3, whereas the ratio of the non-reactive medium to feed ranges between 1:1 and 1:5, and the ratio of the pincer ligated iridium catalyst to alkane ranges between 1:1000 and 1:10000.

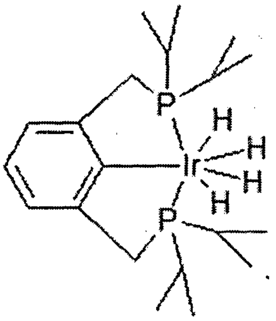
In another embodiment C_4 stream from fluid catalytic cracking (FCC) unit or crude distillation unit (CDU) containing at least one alkane selected from the group consisting of n-butane and isobutane is subjected to dehydrogenation to form 1-butene, cis-2-butene, trans-2-butene, isobutene and butadiene.

The present disclosure is further described in light of the following examples which are set forth for illustration purpose only and not to be construed for limiting the scope of the disclosure.

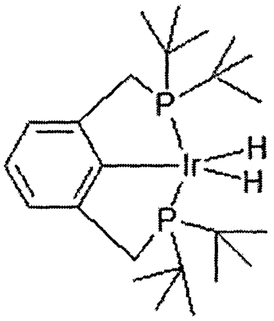
Reactions were carried out in 100ml PARR reactors. TBE, catalyst and mesitylene were added to a reactor in the glove box. The reactor was brought out and n-butane or feed as required was charged into the reactor while cooling the reactor. The reaction mixture was heated under stirring for the required amount of time. After the reaction the reactor was cooled and vented into a balloon for sampling the gas, the amount of gas sample obtained was weighted.

Subsequently the liquid sample was weighed and taken for analysis. Both the gas and liquid samples were analyzed by GC.

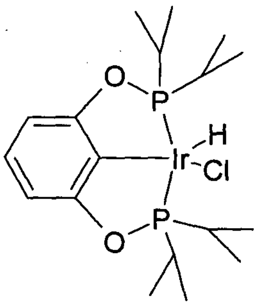
The pincer ligated iridium catalyst (A or B or C) used in the illustrative examples is represented by the following formula.



Catalyst A



Catalyst B



Catalyst C

Example 1:

10 ml Mesitylene and 16 ml t-butyl ethylene (TBE) and 25 mg of catalyst A were added to a 100 ml PARR reactor in the glove box. The reactor was brought out and 14.5 g of n-butane was charged into the reactor while cooling the reactor to -70 °C. The reaction mixture was heated to 190 °C under stirring for 1hour. After cooling the reactor to 10^0 C, the entire contents were collected as a liquid and analyzed by GC.

Example 2:

8 ml Mesitylene and 16 ml t-butyl ethylene (TBE) and 25 mg of catalyst A were added to a 100 ml PARR reactor in the glove box. The reactor was brought out and 17 g of n-butane was charged into the reactor while cooling the reactor to -70 °C. The reaction mixture was heated to 190 °C under stirring for 4hours. After cooling the reactor to 10^0 C, the entire contents were collected as a liquid and analyzed by GC.

Example 3

8 ml Mesitylene and 16 ml t-butyl ethylene (TBE) and 25 mg of catalyst A were added to a 100 ml PARR reactor in the glove box. The reactor was brought out and 11 g of n-butane was charged into the reactor while cooling the reactor to -70 °C. The reaction mixture was heated to 190 °C under stirring for 6hours. After cooling the reactor to 10^0 C, the entire contents were collected as a liquid and analyzed by GC.

Example 4

8 ml Mesitylene and 16 ml t-butyl ethylene (TBE) and 25 mg of catalyst A were added to a 100 ml PARR reactor in the glove box. The reactor was brought out and 15 g of n-butane was charged into the reactor while cooling the reactor to -70 °C. The reaction mixture was heated to 190 °C under stirring for 2hours. After cooling the reactor to 10^0 C, the entire contents were collected as a liquid and analyzed by GC.

Example 5

8 ml Mesitylene and 16 ml t-butyl ethylene (TBE) and 75 mg of catalyst B were added to a 100 ml PARR reactor in the glove box. The reactor was brought out and 11 g of n-butane was charged into the reactor while cooling the reactor to -70 °C. The reaction mixture was heated to 190 °C under stirring for 24hours. After cooling the reactor to 10^0 C, the entire contents were collected as a liquid and analyzed by GC.

Example 6

8 ml Mesitylene and 16 ml t-butyl ethylene (TBE) and 75 mg of catalyst B were added to a 100 ml PARR reactor in the glove box. The reactor was brought out and 12 g of n-butane was charged into the reactor while cooling the reactor to -70 °C. The reaction mixture was heated to 190 °C under stirring for 6hours.

After cooling the reactor to 10^0 C, the entire contents were collected as a liquid and analyzed by GC.

Example 7

8 ml Mesitylene and 16 ml t-butyl ethylene (TBE) and 50 mg of catalyst C and 11 mg of potassium tert-butoxide were added to a 100 ml PARR reactor in the glove box. The reactor was brought out and 11.5 g of n-butane was charged into the reactor while cooling the reactor to -70 °C. The reaction mixture was heated to 190 °C under stirring for 2hours. After cooling the reactor to 10^0 C, the entire contents were collected as a liquid and analyzed by GC.

The results are shown in Table No. 1

Table No. 1:

Ex No	**catalyst**	***n*-butane: catalyst**	**Temp (°C)**	**Time (h)**	**Butane Conversion (%)**	**Products**			**TON#**
						***trans*-2-butene**	**1-butene**	***cis*-2-butene**	
1	A	5330	190	1	21.2	10.1	4.9	6.2	1130
2	A	6249	190	4	25.2	13.4	2.6	9.3	1572
3	A	4043	190	6	30.6	16.5	3.3	10.8	1238
4	A	5513	190	2	19.1	9.9	3.1	6.1	1052
5	B	1348	190	24	4.8	2.6	0.7	1.6	65
6	B	1470	190	6	4.5	2.2	1.0	1.3	65
7	C	2129	190	2	10.3	5.6	1.3	3.4	218

TON-Turnover number

The process of example 1 was repeated except that C_4 stream from fluid catalytic cracking (FCC) unit or crude distillation unit (CDU) was used instead of n-butane. The composition of the stream is shown in Table 2.

Table No. 2

Component	%
Propane	0.24
Propylene	0.04
Isobutane	27.93
N-butane	69.87
Butene	0.03
Isobutylene	0.64
Isopentane	1.24

Example 8

8 ml Mesitylene and 16 ml t-butyl ethylene (TBE) and 25 mg of catalyst A were added to a 100 ml PARR reactor in the glove box. The reactor was brought out and 13 g of C_4 stream was charged into the reactor while cooling the reactor to -10 °C. The reaction mixture was heated to 190 °C under stirring for 4hours. After cooling the reactor to 10^0 C, the entire contents were collected as a liquid and analyzed by GC.

Example 9

8 ml Mesitylene and 16 ml t-butyl ethylene (TBE) and 50 mg of catalyst A were added to a 100 ml PARR reactor in the glove box. The reactor was brought out and 17 g of C_4 stream was charged into the reactor while cooling the reactor to -10 °C. The reaction mixture was heated to 190 °C under stirring for 4hours. After cooling the reactor to 10^0 C, the entire contents were collected as a liquid and analyzed by GC.

Example 10

8 ml Mesitylene and 16 ml t-butyl ethylene (TBE) and 50 mg of catalyst C and 11 mg of potassium tert-butoxide were added to a 100 ml PARR reactor in the glove box. The reactor was brought out and 22.5 g of C_4 Stream was charged into the reactor while cooling the reactor to -10 °C. The reaction mixture was heated to 190 °C under stirring for 2hours. After cooling the reactor to 10^0 C, the entire contents were collected as a liquid and analyzed by GC.

The results are shown in Table No. 3

Table No. 3

Ex. No.	**Catalyst**	***feed:* cat**	**Temp. (°C)**	**Time (h)**	**Butane Conv (%)**	**isoButane Conv (%)**	**Products**				**TON**
							***trans*-2-butene**	**1-butene**	***cis*-2-butene**	**Butadiene**	
8	A	4779	190	4	14.8	12.4	5.6	2.8	3.2	0.3	683
9	A	3124	190	4	32.2	23.8	14	3.0	9.3	0.6	920
10	C	4135	190	2	13.8	27.5	5.3	2.6	3.3	0	702

TON-Turnover number

It is found that when the dehydrogenation was carried out with the catalyst A, the conversion of both butane and isobutane was achieved. When the catalyst C was used the conversion of isobutane was found to be in excess (approximately twice) as compared to n-butane.

ECONOMICAL SIGNIFICANCE AND TECHNICAL ADVANCEMENT:

- The process of the present disclosure employs milder conditions for the dehydrogenation of feed as compared to the prior art processes.
- The process of the present disclosure is economic and energy efficient.
- The process of the present disclosure is carried out in a short duration of time (1-6 hrs.) as compared to the known process.
- The reaction of the present disclosure has high atom efficiency since there is no loss due to the formation of CO_2.
- The process of the present disclosure is give high conversion. The process is devoid of side reaction and no by-products are produced.
- The catalyst used in the present process can be recycled.
- Selective dehydrogenation of either the linear or the branched alkane can be achieved by using appropriate catalyst.
- Butane and isobutane present in the C_4 feed can be dehydrogenated by continuous recycling.

Throughout this specification the word “comprise”, or variations such as “comprises” or “comprising”, will be understood to imply the inclusion of a stated element, integer or step, or group of elements, integers or steps, but not the exclusion of any other element, integer or step, or group of elements, integers or steps.

The use of the expression “at least” or “at least one” suggests the use of one or more elements or ingredients or quantities, as the use may be in the embodiment of the disclosure to achieve one or more of the desired objects or results.

Any discussion of documents, acts, materials, devices, articles or the like that has been included in this specification is solely for the purpose of providing a context for the disclosure. It is not to be taken as an admission that any or all of these matters form a part of the prior art base or were common general knowledge in the field relevant to the disclosure as it existed anywhere before the priority date of this application.

The numerical values mentioned for the various physical parameters, dimensions or quantities are only approximations and it is envisaged that the values higher/lower than the numerical values assigned to the parameters, dimensions or quantities fall within the scope of the disclosure, unless there is a statement in the specification specific to the contrary.

While considerable emphasis has been placed herein on the specific features of the preferred embodiment, it will be appreciated that many additional features can be added and that many changes can be made in the preferred embodiment without departing from the principles of the disclosure. These and other changes in the preferred embodiment of the disclosure will be apparent to those skilled in the art from the disclosure herein, whereby it is to be distinctly understood that the foregoing descriptive matter is to be interpreted merely as illustrative of the disclosure and not as a limitation.

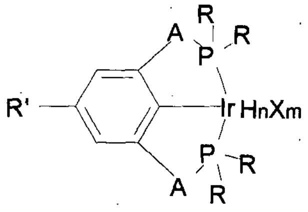
CLAIMS:

1. A process for dehydrogenation of a feed comprising at least one alkane selected from the group consisting of n-butane and isobutane to obtain at least one compound selected from the group consisting of 1-butene, cis-2-butene, trans-2-butene, isobutene and combinations thereof, said process comprises reacting the feed with at least one hydrogen acceptor in the presence of at least one pincer ligated iridium catalyst in a non-reactive medium at a temperature in the range of 100°C to 250°C.

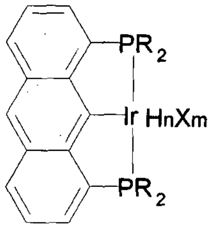
2. The process as claimed in claim 1, wherein the hydrogen acceptor is at least one selected from the group consisting of t-butyl ethylene, norbornene, isobutylene and diisobutylene.

3. The process as claimed in claim 1, wherein the concentration of the hydrogen acceptor ranges from 25 to 45 w/w% of the total reaction mixture.

4. The process as claimed in claim 1, wherein the pincer ligated iridium catalyst is a compound of formula 1 or 2;



(1)



(2)

Wherein A = O, CH_2 or a combination of O and CH_2
R' = H, MeO and NR2,
R = tert-butyl, isopropyl, cylopentyl and cyclohexyl,
H_nX_m where n = 0 to 4, and
X = halogen and m= 0 to 2.

5. The process as claimed in claim 1, wherein the ratio of the pincer ligated iridium catalyst to the feed ranges from 1:1000 to 1:10000.

6. The process as claimed in claim 1, wherein ratio of the hydrogen acceptor to the feed ranges from 2:1 to 1:3.

7. The process as claimed in claim 1, wherein the non-reactive medium is at least one selected from the group consisting of mesitylene, 1,2,4,5-tetramethylbenzene and 2,2,4,4,6,6,8,8-octamethylnonane.

8. The process as claimed in claim 1, wherein the ratio of the non-reactive medium to the feed ranges from 1:1 to 1:5.

9. The process as claimed in claim 1, wherein the pincer ligated iridium catalyst is a catalyst supported on at least one inorganic support selected

from the group consisting of alumina, silica and zeolite or metal surface through physical adsorption or covalent bond linkage.

10. The process as claimed in claim 1, wherein the dehydrogenation is carried for a time period of 1 to 6 hours.

11. The process as claimed in claim 1, wherein the said process is characterized in that the turnover number of catalyst ranges from 65 to 1572.

12. The process as claimed in claim 1, wherein the said process is characterized in that the conversion of alkane ranges from 4.8% to 32.2%.