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(54) Process for increasing octane and reducing sulfur content of olefinic gasolines.

(57) In a process for simultaneously reducing the sulfur content and increasing the octane number of an olefinic containing feedstock, the feedstock is contacted in a single stage process with a noble metal-containing crystalline zeolite having a Constraint Index less than 2 and a framework SiO_2 /Al_2 O_3 molar ratio no less than 50, under conditions sufficient to yield a product of increased octane number with respect to the octane number of the feedstock.

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PROCESS FOR INCREASING OCTANE AND REDUCING SULFUR CONTENT OF OLEFINIC GASOLINES

This invention relates to a process for increasing the octane number while simultaneously reducing the sulfur content of olefinic gasolines derived from cracking processes, specifically catalytic cracking processes.

New regulations requiring reduction of lead in gasoline will lead to the need for higher average gasoline pool octanes. In addition, there is likely to be continued interest in reducing sulfur oxide (SOx) emissions, especially as gasolines derived from fluidized catalytic cracking (FCC) processes are integrated more into the unleaded gasoline pools for use in automobiles equipped with catalytic converters.

The possibility of catalytically reforming FCC naphtha to upgrade a gasoline pool was considered by L. A. Gerritsen, "Catalytic Reforming of FCC Naphtha for Production of Lead-Free Gasoline", Ketjen Symposium, Amsterdam, 1984. Such prior art disclosed reforming a FCC naphtha fraction over a bimetallic Pt-Re catalyst, but it was found that higher severity and increased throughput conditions of the process resulted in a deterioration of the cycle length of the catalyst in the reformer.

Many crystalline silicate zeolites are now known to the prior art. However, direct reforming of olefinic gasolines derived from catalytic cracking of gas oils leads to rapid aging of conventional reforming catalysts due to the relatively high sulfur content (0.05 to 0.5 wt %) of these gasolines. The olefinic composition of these gasolines also leads to relatively high hydrogen consumption and corresponding exotherm during the

desulfurization necessary prior to reforming with conventional catalysts.

Certain hydrothermally stable catalysts, such as those taught in U. S. Patent No. 3,493,519, employ an ammonium-Y crystalline aluminosilicate which is calcined in the presence of rapidly flowing steam. The resultant steamed product is base-exchanged with an ammonium salt and treated with a chelating agent capable of combining with aluminum at pH between 7 and 9. These aluminum-deficient catalysts are reported to exhibit enormously high activity (alpha value).

Other treatments of synthetic faujasite (NH_4Y) prepared by ammonium ion-exchange of sodium faujasite are reported in U.S. Patent No. 3,591,488. These steamed zeolites, after heat treatment, are base-exchanged with cations, such as ammonium ion, and/or metal ions selected from Groups II-A, I-B to VII-B, VIII of the Periodic Table and rare earth ions with atomic numbers 51 to 71, such as Mg, Ca, Sr, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Y, W, Re, Os, Ir, Pt, Au and Hg ions, preferably those ions of Groups II-A, VIII and rare earths. A final zeolite product having an alkali metal content below about 0.5 wt %, preferably below about 0.2 wt %, is reported. The resultant product has a silica-to-alumina mole ratios typically greater than 5 to 10, depending on the nature of the zeolite, preferably greater than 20, and more preferably greater than about 50.

The problem of sulfur contamination of catalysts has been generally recognized in the prior art, as taught, for example, in U. S. Patent No. 4,456,527. However, the prior art approached the catalyst contamination problem by employing separate sulfur removal steps to reduce the sulfur content below 500 parts per billion (ppb), preferably less than 250 ppb, more preferably less than 100 ppb, and most preferably less than 50 ppb.

Thus, although the prior art recognized the problems of catalyst contamination associated with high sulfur-containing

feedstocks, none of the prior art recommendations has permitted direct reforming of an olefinic gasoline derived from FCC or TCC catalytic cracking of gas oils, in which rapid aging of the reforming catalyst due to the relatively high sulfur content of these gasolines is minimized or avoided. An object of the present invention is therfore to provide such a reforming process.

Accordingly, the invention resides in a process for simultaneously reducing the sulfur content and increasing the octane number of an olefinic-containing feedstock comprising contacting said olefinic-containing feedstock in a single stage process with a noble metal-containing crystalline zeolite having a Constraint Index less than 2 and a framework SiO_2/Al_2O_3 molar ratio no less than 50, under conditions sufficient to yield a product of increased octane number with respect to the octane number of said olefinic-containing feedstock.

The process of the present invention is directed to the reforming and desulfurization of olefinic gasolines derived from cracking processes, catalytic or otherwise. Without wishing to be limited to any set process, the description of the present invention will be directed to primarily catalytic cracking processes. By utilizing a noble metal-containing large pore, high silica-to-alumina mole ratio zeolite-containing catalyst, the olefinic gasoline may be processed at high temperatures and yield a product having increased octane number and reduced sulfur content.

Reforming

By way of definition, reforming generally means a process of boosting the octane number of a naphtha or gasoline oil to an octane number that is acceptable for use. For example, straight run naphtha from crude oil might have an octane number of 40, too low for use as a gasoline. This unacceptable characteristic may be improved by reforming. The naphtha may also contain an unacceptable level of sulfur, e.g., 50 parts per million (ppm), which is reduced by reforming under conditions set forth in this invention.

Most of today's reforming catalysts, e.g., platinum-on-alumina, require that the sulfur in the fuel oil be reduced to a level of about 0.2 ppm or less in order for the catalyst to survive. Conventional reformers run at temperatures of between 900° and 1000°F (482°-538°C) and pressures between 100 and 500 psig (790-3550 kPa). Hydrogen is co-fed with the naphtha in a ratio of about 5:1. With conventional reformers, small amounts of chlorine, and sometimes water, are co-fed with the hydrocarbon feed in order to keep the catalyst active.

The requirement for chlorine and for the reduction of sulphur is disadvantageous to the reforming process. Because of this, standard reforming operations cannot be used for olefinic feeds, which are the feedstocks used in the present invention.

The present invention has a number of advantages over conventional reforming. First, most of the reforming catalysts are limited to feedstocks having a 350°F (177°C) end point in the naphtha feedstock. Any feedstock higher than the 350°F (177°C) end point will tend to age the catalyst too rapidly. However, the present catalyst may tolerate much higher end point feedstocks. Secondly, there is no requirement to pass chlorine over the catalyst in order to keep the catalyst active, as the zeolite of the present invention provides the acidity needed for the reaction to take place. Third, there is no requirement to reduce the sulphur content by a pre-hydrotreatment step, as the use of the catalyst of the present invention under conventional reforming conditions both removes sulphur and raises the octane number of the feedstock product.

Feedstock

The feedstock for the present invention is generally a gasoline derived from catalytic cracking or thermocracking. The catalytic cracking process may be either a fluid catalytic cracking (FCC) process or a thermofor catalytic cracking (TCC) process. The feed stock may contain sulphur in concentrations greater than about

100 ppm, which normally would have to be reduced by hydrotreatment in order to allow the feed to be processed over a conventional reforming catalyst. Further, the feedstock contains olefins, which additionally would require hydrotreatment in order to be passed over a conventional reforming catalyst. Further still, the feedstock for the present invention may have a boiling range which exceeds the boiling range of feedstocks conventionally processed over conventional reforming catalysts.

Catalysts

The catalysts used in the process of the invention are large pore zeolites having a Constraint Index less than 2 and a framework silica-to-alumina mole ratio of at least 50:1 and preferably greater than about 500:1. Constraint Index is a convenient measure of the extent to which a zeolite provides control to molecules of varying sizes to its internal structure. Zeolites which provide a highly restricted access to and egress from its internal structure have a high value for the Constraint Index, and zeolites of this kind usually have pores of small size, e.g., less than 5 Angstroms. On the other hand, zeolites which provide relatively free access to the internal zeolite structure have a low value for the Constraint Index and usually pores of large size, i.e., greater than 8 Angstroms. The method by which Constraint Index is determined is described fully in U. S. Patent No. 4,016,218.

Zeolites having a Constraint Index less than 2 are well known in the art and generally have a pore size in excess of 7 Angstom, that is sufficiently large to admit the vast majority of components normally found in a feed chargestock. Suitable large pore zeolites for use in the present process are Zeolite Beta, Zeolite L, Zeolite Y (e.g. Ultrastable Y and Dealuminized Y), Mordenite, ZSM-3, ZSM-4, ZSM-18 and ZSM-20.

Constraint Index (CI) values for representative large pore zeolites are:

	CI (At Test Temperature)
ZSM-4	0.5 (316°C)
ZSM-20	0.5 (371°C)
Mordenite	0.5 (316°C)
Dealuminized Y (Deal Y)	0.5 (510°C)
Zeolite Beta	0.6-2 (316°-399°C)

Constraint Index seems to vary somewhat with severity of operation (conversion) and the presence or absence of binders. Likewise, other variables, such as crystal size of the zeolite, the presence of occluded contaminants, etc., may affect the Constraint Index. Therefore, it will be appreciated that it may be possible to so select test conditions, e.g., temperatures, as to establish more than one value for the Constraint Index of a particular zeolite. This explains the range of Constraint Indices for Zeolite Beta.

Preferred zeolites for use in the present process are Zeolite ZSM-4 (described in U. S. Patent No. 3,923,639), Zeolite ZSM-20 (described in U. S. Patent No. 3,972,983), Zeolite Beta (described in U. S. Patent No. 3,308,069 and Re. 28,341), Zeolite Y (described in U. S. Patent No. 3,130,007) and modified forms of zeolite Y such as Ultrastable Y zeolite (described in U. S. Patent Nos. 3,293,192 and 3,449,070), dealuminized Y zeolite (U. S. Patent No. 3,442,795), and Zeolite UHP-Y (described in U. S. Patent No. 4,401,556). The most preferred zeolite is a zeolite Y which may be treated by known methods, by steaming and/or acid dealumination, to raise its silica/alumina ratio to at least 50:1.

In practicing the process of the present invention, it may be useful to incorporate the above-described crystalline zeolites with a matrix comprising another material resistant to the temperature and other conditions employed in the process. Such matrix material is useful as a binder.

Useful matrix materials include both synthetic and naturally-occurring substances, as well as inorganic materials such

as clay, silica and/or metal oxides. The latter may be either naturally-occurring or in the form of gelatinous precipitates or gels including mixtures of silica and metal oxides. Naturally-occurring clays which can be composited with the zeolite include those of the montmorillonite and kaolin families, which families include the sub-bentonites and the kaolins commonly known as Dixie, McNamee-Georgia and Florida clays or others in which the main mineral constituent is haloysite, kaolinite, dickite, nacrite or anauxite. Such clays can be used in the raw state as originally mined or initially subjected to calcination, acid treatment or chemical modification.

In addition to the foregoing materials, the zeolites employed herein may be composited with a porous matrix material, such as alumina, silica, silica-alumina, silica-magnesia, silica-zirconia, silica-thoria, silica-beryllia, and silica-titania, as well as ternary compositions, such as silica-alumina-thoria, silica-alumina-zirconia, silica-alumina-magnesia and silica-magnesia-zirconia. The matrix may be in the form of a cogel. The relative proportions of zeolite component and inorganic oxide gel matrix, on an anhydrous basis, may vary widely with the zeolite content ranging from between 1 to 99 wt %, and more usually in the range of 5 to 80 wt % of the dry composite.

The original cations associated with each of the crystalline zeolites utilized herein may be replaced by a wide variety of other cations, according to techniques well known in the art. Typical replacing cations including hydrogen, ammonium, alkyl ammonium and metal cations, including mixtures of the same.

The crystalline zeolite utilized in the process of this invention is employed in intimate combination with a noble metal, such as platinum or platinum in combination with other Group VIII metals, e.g., platinum-rhenium or platinum-iridium, in an amount between 0.1 and 25 wt %, normally 0.1 to 5 wt %, and preferably 0.3 to 3 wt %. Such component can be exchanged into the composition,

impregnated thereon, or physically intimately admixed therewith. Such component can be impregnated into or onto the zeolite, such as, for example, in the case of platinum, by treating the zeolite with a platinum metal-containing ion. Thus, suitable platinum compounds include chloroplatinic acid, platinous chloride and various compounds containing the platinum amine complex.

Process Conditions

The present process is essentially a reforming process, in that the reactions which take place are reforming reactions. However, the process cannot be called a reforming process per se since it passes an olefinic-containing feed at a high temperature over the catalyst and directly cyclizes the olefins to aromatics. Additionally, the process increases the octane value and reduces the sulfur content of the olefinic-containing feedstock. Thus, unlike conventional reforming processes, the process of the present invention (1) accepts olefinic-containing feedstocks, (2) accepts sulfur-containing feedstocks, and (3) accepts feedstocks with a high boiling point, i.e., in excess of 350°F (177°C).

The feedstock is contacted with the catalyst in the presence of hydrogen under conditions of temperature, pressure, space velocity and hydrogen ratio similar to those used in conventional reforming processes. Typical conditions include temperatures of 600° to 1200°F (300°-650°C), more commonly 700° to 1000°F (370°-540°C), pressures from mildly superatmospheric up to 1435 psig (10000 kPa), more commonly 100 to 500 psig (790 to 3550 kPa), space velocities from 0.1 to 20 LHSV, more commonly 2-16 LHSV, and hydrogen circulation rate of about 1125 to 5620 SCF/bbl (200 to 1000 Nm^3/m^3).

The process may be conveniently operated in conventional equipment, i.e., in a series of reactors with inter-stage heating to maintain the desired reactions and heat balance. As noted previously, a particular advantage of the use of the high siliceous zeolite supports is that the need for acidity maintenance by

chlorination, use of water co-feed and the like is substantially reduced and may, in favorable circumstances, be eliminated. Nonetheless, if experience demonstrates that the use of these conventional expedients is necessary or desirable, resort may be made to them. Thus, water may be fed in with the feedstock in conventional amounts, typically of 1 to 100 ppm, or halogenation may be used to maintain activity, for example, by incorporation of the halogen in the form of an acid or a salt or by addition of the halogen or halide compound during the reforming process itself, in a conventional manner. Chlorine is the preferred halogen. Details of the halogen activity maintenance methods may be found in U. S. Patent Nos. 4,261,810; 4,049,539; 3,835,063; 6,661,768; and 3,649,524.

The invention is illustrated by the following examples, in which all parts, proportions and percentages are by weight, unless stated to the contrary.

Example 1

The catalyst used was prepared by steaming and acid dealumination of a Linde Ultrastable Y, followed by impregnation with platinum as the tetraamine.

The resultant dealuminized Y zeolite was analyzed and found to have a bulk SiO_2/Al_2O_3 ratio of 45, with an approximate framework, i.e., tetrahedral alumina, SiO_2/Al_2O_3 of 2600 by MAS NMR. The activity represented by the alpha value of this material was determined to be 1.5, in good agreement with the approximate framework aluminum content. The platinum loading was determined to be 0.48% and had a substantially uniform dispersion of 96%, as determined by hydrogen chemisorption.

An olefinic gasoline sample from FCC of Arab Light VGO, with a RON+0 of 91 and 2950 ppm sulfur, was distilled into three fractions and analyzed for octane number (RON) and sulfur. The analyses indicated that sulfur increased significantly with increasing boiling point, while the octane number decreased, as shown below.

TABLE 1

FCC Gasoline Properties

Boiling Range, °F (°C)	Full-Range	C_5-180 (C_5-82)	180-300 (82-149)	300-420 (149-216)
Yield, Wt %	100.0	41.0	34.3	24.3
RON+O[1]	91.0	93.8	89.3	89.0
Sulfur, ppmw	2950	480	1850	7800
Hydrogen, Wt %	12.6	14.0	12.7	11.4

[1] Research Octane Number

The intermediate boiling range fraction (180°-300°F) was used as the feed for the process of this Example. Additional analyses indicated that this fraction was composed of 17% paraffins, 44% olefins, and 27% aromatics by weight. Process conditions of 900°F (482°C), 250 psig (1825kPa), 4.0 LHSV and about 4000 SCF/bbl (712Nm^3/m^3) hydrogen flow were used to simultaneously desulfurize and increase the octane rating of the olefinic FCC gasoline. For eighteen days prior to charging the FCC gasoline fraction, the dealuminized Y zeolite catalyst of the invention was used for reforming a number of conventional feeds.

Initial results showed that about 83 wt % yield of 99 RON+O gasoline was obtained when processing the intermediate fraction at the above conditions. Analysis showed the product to be composed of 25% paraffins, 0% olefins, 2% naphthenes, and 73% aromatics. At this reaction severity, it was estimated that there was a net hydrogen production of about 150 SCF/bbl (27Nm^3/m^3). The product compositions and properties can be found in Table 2.

TABLE 2

Product Compositions and Properties

	Feed	Product
Octane, RON + 0	89.3	98.6
Sulfur, ppmw	1850	1
Paraffins, Wt %	17	25
Olefins	44	0
Naphthenes	12	2
Aromatics	27	73

Essentially no catalyst aging was observed during six days of additional processing of the sulfur-containing, olefinic FCC gasoline feed.

Comparing the yield and octane data suggests that similar overall results can be achieved directly by processing with the novel dealuminized Y zeolite catalyst of this invention, as can be obtained by conventional hydrotreating (HDT) followed by conventional reforming. In addition, the relatively low hydrogen content of the olefinic FCC gasolines suggest that the net endotherm encountered in conventional reforming could be reduced.

Example 2

The catalyst utilized in Example 2 was the same catalyst as in Example 1. The feedstock for Example 2 was FCC gasoline which was distilled and cut at 180°F (82°C) and 300°F (149°C). A complete analysis of the full range FCC gasoline and of the cuts is given in Table 3.

TABLE 3

Analysis of FCC Gasoline

Fraction (As Cut)	Full-Range	Cut 1 180°F (82°C)	Cut 2 180°-300°F 82-149°C)	Cut 3 300°F+ (149°C+)
Yield, Vol. %	100.0	39.0	40.2	20.8
API Gravity	54.7	77.8	50.6	31.0
Hydrogen, Wt %	13.14	15.08	12.99	11.21
Sulfur, ppmw	3000	400	2100	8400
Nitrogen, ppmw	60	12	37	160
Paraffins, Wt %	31.9	43.5	30.6	19.3
Olefins	22.8	29.2	16.3	8.4
Naphthenes	14.7	16.1	15.8	10.6
Aromatics	30.5	11.3	37.3	61.4
RON+O	89.9	92.5	88.0	90.0
MON+O[1]	79.7	80.5	--	--
RVP[2]	5.15	11.22	--	--
TBP, °F				
5%	76	77	150	315
50%	247	136	261	393
95%	446	236	362	488

[1] Motor Octane Number
[2] Reid Vapor Pressure

It is worth noting that cut 2 and cut 3 contain significant amounts of olefins (16% and 8%, respectively) and aromatics (37% and 61%, respectively). As a result, their octane is already high (88 and 90 RON+O). However, upon hydrotreating to remove the sulfur and nitrogen, the octane would drop considerably. Thus, the purpose of the present example is to find a way to maintain or even increase the level of octane while removing the sulfur and nitrogen.

At the beginning of the run, the catalyst was heated to 300°F (149°C) under hydrogen atmosphere, kept at that temperature for 2 hours, and then slowly heated to 660°F (349°C) at a rate of 90°F (50°C) per hour. The feed was started after the catalyst had been at 660°F (349°C) for 2 hours. The temperature was then increased to the desired reaction temperature. The FCC gasoline heart cut (cut 2) was then added and maintained on-stream for 3 weeks at a temperature of 900°F (482°C). The feed was then changed to the heavy FCC gasoline fraction (cut 3) for a period of 2 weeks. Although the fractions were processed separately, it is believed that the fractions may be co processed. The light olefinic fraction, which already had a high octane rating (92.5 RON) and a relatively low sulfur content (0.04 wt %), did not appear to need further upgrading, although it may be treated by conventional means to reduce mercaptans. The runs were compared with runs using a standard chlorided platinum on alumina reforming catalyst.

The results of processing the heart cut (cut 2) are illustrated in Table 4 below.

TABLE 4

Upgrading of FCC Gasoline 180°-300°F Fraction

		HDT[1]/REF	0.5% Pt-USDY
Catalyst/Process	Feed	Pt-Al	ZEOLITE[2]
Net H_2 Consumption, SCF/B	--	108[3]	-146
(Nm^3/m^3)		(19.2)	(-26)
Yields and Properties, Wt %			
H	--	+0.6	+0.3
$H_2S + NH_3$	--	0.2	0.2
C_1	--	2.1	0.1
C_2	--	3.2	1.0
C_3	--	8.1	6.3
IC4[4], Vol %	--	3.3	7.0
NC4[5], Vol %	--	6.4	7.2
C_5+ Gasoline, Vol %	100.0	77.5	80.1
RON + 0	88	98.2	98.5
MON + 0	--	90.0	90.4
RVP	--	(3.6)	3.6
Sulfur, ppmw	2100	0.5	1.2
Nitrogen, ppmw	37	0.2	0.6
Aromatics, Wt %	37.3	47.5	50.3
Olefins	16.3	0.0	0.0
Density at 60°F (16°C)	0.7770	0.795	0.794

1 Hydrotreating
2 Process Conditions: 900°F (482°C), 250 psig (1825 kPa), 4.0 LHSV, 4000 SCF/B ($712 Nm^3/m^3$)H_2
3 Includes HDT Consumption 400 SCF/B($71.2 Nm^3/m^3$)H_2
4 Iso-butane
5 Normal Butane

Yields comparable to those achieved by conventional hydrotreating and reforming were obtained when processing the intermediate boiling range fraction, as illustrated in Table 4. It is worthy to note that the yield of iso-butane was considerably greater over the zeolite catalyst, mainly due to a reduction in light gas make, and was a potential source of additional alkylate. This reduction in light gas make could result in increased hydrogen purity in the recycle gas.

As illustrated in Table 5 below, processing the heavy FCC gasoline fraction appears particularly attractive.

TABLE 5

Upgrading of FCC Gasoline 300°F$^+$ (149°C) Fraction

Catalyst/Process	Feed	0.5% Pt-USDY[1] Zeolite
Yields and Properties, Wt. %		
H_2	--	- 0.8
$H_2S + NH_3$	--	0.89
C_1	--	0.2
C_2	--	1.8
C_3	--	4.4
IC4, Vol %	--	3.1
NC4, Vol %	--	5.4
C_5+ Gasoline, Vol %	100.0	88.4
RON + 0	90.0	103.3
MON + 0	--	93.7
RVP	--	2.6
Sulfur, ppmw	8400	3.5
Nitrogen, ppmw	160	1.3
Aromatics, Wt %	61.4	72.6
Olefins	3.4	0.0
Density at 60°F (16°C)	0.8706	0.858

[1] Process Conditions: 900°F (482°C), 250 psig (1825kpa), 2.0 LHSV, 4000 SCF/B (712Nm^3/m^{3}H$_2$

The heavy FCC gasoline fraction is presently hydrotreated in a number of refineries to remove sulfur. Both the high sulfur level of about 8000 ppm and high end point of about 450°F (232°C) preclude conventional hydrotreating/reforming. The results here indicate that net gasoline yields on this fraction, approaching 97 vol %, could be achieved with an octane gain of about 13 RON and a reduction of sulfur in the product to less than 10 ppm.

Combining the processed fractions with the untreated olefinic light gasoline results in a significant gain in overall FCC gasoline octane, with minimal loss of yield. As disclosed in Table 6 below, it is estimated that about 90 vol % yield of C_5+ gasoline could be obtained with an octane gain of 7 RON and a reduction of sulfur from 0.30 wt % to less than 0.02 wt %. The olefin content of the gasoline is substantially reduced, with an increase in aromatics.

TABLE 6

Overall Estimated Yields and Gasoline Properties

	Joliet FCC Gasoline	Net Product[1]	Δ
H_2, Wt %	--	-0.07	
H_2S, Wt %	--	0.305	
NH_3, Wt %	--	-0.007	
C_1, Wt %	--	0.05	
C_2, Wt %	--	0.84	
C_3, Wt %	--	3.65	
IC4, Vol %	--	3.48	+3.5
NC4, Vol %	--	4.02	+4.0
C_5+ Gasoline, Vol %	100	89.9	-9.1
C_5+ Properties			
RON+O	89.9	97.0	+7.1
MON+O	79.7	86.6	+9.9
RVP+O	5.15	6.70	

Sulfur, Wt %	0.300	0.016[2]
Nitrogen, ppmw	60	6
Aromatics	30.5	49.4
Olefins	22.8	11.3

[1] Linear blending of untreated light FCC gasoline and processed intermediate and heavy fractions

[2] Lower if olefinic light gasoline Merox treated

Thus, the present process offers the potential for both increasing the overall FCC gasoline pool octane and reducing the level of sulfur. Direct processing of the intermediate and heavy FCC gasoline fractions using a process of this type could be an attractive alternative to conventional hydrotreating/reforming or hydrodesulfurization of FCC feeds.

Further, by the process of the present invention, the catalyst can operate in the presence of a higher level of sulfur without any significant aging of the catalyst. The conventional reforming processes can tolerate olefins in the feed which generally tend to coke very rapidly over conventional catalysts at reforming conditions. The net result of this process is a high octane gasoline that is low in sulfur with a minimal loss of yield.

Claims

1. A process for simultaneously reducing the sulfur content and increasing the octane number of an olefinic containing feedstock comprising contacting said olefinic containing feedstock in a single stage process with a noble metal-containing crystalline zeolite having a Constraint Index less than 2 and a framework SiO_2/Al_2O_3 molar ratio no less than 50, under conditions sufficient to yield a product of increased octane number with respect to the octane number of said olefinic-containing feedstock.

2. The process of Claim 1, wherein said sulfur is present in said feedstock at a concentration of greater than 100 ppm.

3. The process of Claim 1 or Claim 2, wherein said olefinic-containing feedstock is derived from a catalytic cracking process.

4. The process of any preceding Claim, wherein said contacting is conducted at a temperature of 700°-1000°F (370-540°C), a pressure of about 100-500 psig (790 to 3550 kPa), a LHSV of 2 to 16 in the presence of hydrogen.

5. The process of preceding Claim 2, wherein said zeolite has a framework SiO_2/Al_2O_3 ratio of greater than 500:1.

6. The process of any preceding Claim, wherein said crystalline zeolite is selected from Zeolite Beta, Zeolite L, Zeolite Y, Mordenite, ZSM-3, ZSM-4, ZSM-18, ZSM-20.

7. The process of Claim 6 wherein the zeolite is Zeolite Y.

8. The process of any preceding Claim, wherein said noble metal is platinum or platinum in combination with another Group VIII metal.

European Patent Office

EUROPEAN SEARCH REPORT

Application number

DOCUMENTS CONSIDERED TO BE RELEVANT

EP 87310493.9

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	US - A - 4 604 189 (DERBYSHIRE) * Claims 1,4,5,8,9,12,15,16,19; column 5, lines 3-12 * --	1,2,4, 6,7,8	C 10 G 35/095 C 10 G 45/12 C 10 G 49/08 B 01 J 29/06 B 01 J 29/22 B 01 J 29/32
X	US - A - 4 440 630 (OLECK) * Claim 1; column 5, lines 3-29; example 1; column 4, lines 15-22 * --	1,2,4, 5,8	
X	EP - A2/A3 - 0 186 479 (MOBIL OIL) * Claims 1-4,6,7,9-12; page 2, lines 3-12; page 8, lines 26-29; example 6 * --	1,4,5, 8	
X	EP - A1 - 0 014 291 (MOBIL OIL) * Claims 1,2,5,6,11-15; page 7, line 16 - page 8, line 6 * ----	1,4,6	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)
C 10 G
B 01 J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	25-03-1988	BÖHM

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