



# JOURNAL OF MOLECULAR CATALYSIS A: CHEMICAL

## *PatentsALERT*

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## CATALYST PREPARATION AND REGENERATION

### 5915951

#### Process for catalytic combustion of a fuel in the presence of a non-selective oxidation catalyst

Euzen Patrick; Tocque Eric; Rebours Stephane; Mabilon Gil; Rueil Malmaison, Chatou, Rueil Malmaison, Carrieres Sur Seine, France, Institut Francais du Petrole

Processes for the catalytic combustion of hydrocarbons, carbon monoxide, hydrogen, or mixtures thereof (processes with one or more catalytic stages) and processes of abating the pollution produced by the exhaust gases of vehicles that run on natural gas using a non-selective oxidation catalyst. The non-selective oxidation catalyst comprises a monolithic substrate, a porous support with a refractory inorganic oxide base and an active phase that consists of cerium, zirconium, iron, and at least one metal that is selected from the group that is formed by palladium and platinum is described; with the porous support content being between 200 and 400 g/l of catalyst; with the cerium content being between 0.3% and 20% by weight relative to the porous support; with the zirconium content being between 0.3% and 20% by weight relative to the porous support; with the iron content being between 0.01% and 3.5% of iron by weight relative to the porous support; and with the palladium and/or platinum content being higher than 3 g/l of catalyst.

### 5916686

#### Siloxane organic hybrid polymer catalyst

Lin Chia-Cheng, Gibsonia, PA, United States, PPG Industries

Siloxane organic hybrid polymers and a method of making them by condensation polymerization reaction of organoalkoxysilane with an alkali metal carboxylic acid catalyst in the presence of organic film-forming polymers are disclosed.

### 5916835

#### Heterogeneous catalyst regeneration

Carroll Kevin M; Morales Edrick; Han Yuan-Zhang, Havertown, West Chester, PA, United States, Arco Chemical Technology

The catalytic activity of a titanium-containing heterogeneous catalyst such as titania-on-silica which has been used to catalyze olefin epoxidation is effectively restored by washing the catalyst with water, alcohol, ether, nitrile, ester, aromatic hydrocarbon, or ketone.

### 5919566

#### Inorganic support materials containing sulphonate and mercapto groups, process for the production thereof and use as catalyst

Lansink-Rotgerink Hans; Wieland Stefan; Auer Emmanuel, Glattbach, Offenbach, Frankfurt, Germany, Degussa Aktiengesellschaft

Inorganic support materials containing sulphonate and mercapto groups, and a process for the modification of these materials with the corresponding difunctional organosilicon compounds and use thereof as catalysts in acid-catalyzed reactions.

### 5919722

#### Zeolite L catalysis

Verduijn Johannes Petrus; Gellings Pieter Ernst, Spijkenisse, Oostvoorne, Netherlands, Exxon Chemical Patents

Binderless zeolite L particles are prepared by a method in which particles are formed from silica and from 0 to 95 wt.% preformed zeolite L crystallites, and the particles are thereafter reacted with an alkaline solution comprising a source of alumina to convert the silica binder to zeolite L. These particles may comprise cylindrical zeolite L crystallites with a mean diameter of at least 0.05  $\mu\text{m}$  in a zeolite L matrix and may be used as catalyst. Also acyclic hydrocarbons are dehydrocyclized and/or isomerized by contacting them at a temperature of 370°C to 600°C with this catalyst incorporating at least one Group VIII metal having dehydrogenating activity to convert at least part of the acyclic hydrocarbons into aromatic hydrocarbons.

### 5922633

#### Thermal latent acid catalyst

Nakane Yoshinori; Mizutani Hiroki; Ishibashi Hayato; Ishidoya Masahiro, Kanagawa-ken, Chigasaki, Yokohama, Chigasaki, Japan, NOF

A thermal latent acid catalyst which comprises (i) a compound having an epoxy group, (ii) a compound

having a sulfur atom of the following formula:  $R^5-S-R^6$ , wherein  $R^5$  and  $R^6$  are the same or different from each other and are a hydrogen atom or an organic group of 1–40 carbon atoms,  $R^5$  and  $R^6$  optionally are bonded with each other to form a cyclic structure; and (iii) a Lewis acid of the following formula:  $(X^1)_{n1}-M^1-(R^7)_{n2}$ , wherein  $M^1$  is a boron atom, an aluminium atom, a tin atom, a lead atom or a transition element,  $X^1$  is one or more halogen atoms,  $R^7$  is one or more organic groups of 1–40 carbon atoms,  $R^7$  optionally forms a chelate ring by coordinating to the  $M^1$  atom,  $n1$  and  $n2$  are each an integer of 0 through 6, and  $n1$  plus  $n2$  equals an integer of 1–6. The ratio of the epoxy group of the epoxy compound (i) to the  $M^1$  atom of the Lewis acid is 0.2:10 and the ratio of the sulfur atom of the compound (ii) to the  $M^1$  atom of the Lewis acid is 0.2:10.

#### 5922635

#### Nanoscale solid superacid catalysts with pendant fluoroalkylsulfonic acid or fluoro, perfluoroalkylsulfonic acid groups

Olah George A; Prakash, GK Surya, Beverly Hills, Hacienda Heights, CA, United States

A solid superacid catalyst composition of a carrier material having a particle size between 0.5 and 5000 nm and at least one pendant fluoroalkylsulfonic acid or fluoro, perfluoroalkylsulfonic acid group attached thereto. Also, methods for making this catalysts by attaching pendant fluoroalkylsulfonic acid or fluoro, perfluoroalkylsulfonic acid groups to the carrier material by various procedures to form the catalyst composition.

#### 5922895

#### Amine borane complexes and phosphineborane complexes as catalyst for hydrosilation

Tzou Ming-Shin; Sugiura Yasushi, Midland Chiba Prefecture, MI, Japan, Dow Corning

A hydrosilation method comprising contacting a silicon hydride with an unsaturated reactant in the presence of a catalysts selected from the group consisting of amine borane complexes and phosphineborane complexes. The catalysts are especially useful for selectively hydrosilating unsaturated organic compounds with an internal unsaturated bond to increase the desired hydrosilation product yield.

#### 5925330

#### Method of m41s functionalization of potentially catalytic heteroatom centers into as-synthesized m41s with concomitant surfactant extraction

Roth Wieslaw J, Sewell, NJ, United States, Mobil Oil

A method for modifying a crystalline molecular sieve material is provided. The crystalline molecular sieve material is modified by functionalizing it and concurrently removing its templating surfactant. The method is accomplished by contacting the crystalline molecular sieve material with a treatment composition including a functionalizing agent, an exchanging moiety and a solvent.

#### 5925586

#### Phosphorus modified small pore molecular sieve catalysts, and their use in the production of light olefins

Sun, Hsiang-ning, Houston, TX, United States, Exxon Chemical Patents

A process for the modification of a small pore molecular sieve catalyst to increase its selectivity to ethylene in the production of light olefins from oxygenated compounds, particularly methanol. The catalyst is modified with phosphorus by incorporating a phosphonitrilic oligomer with the catalyst, and then calcining the catalyst at temperature sufficient to decompose the phosphonitrilic oligomer, and deposit from about 0.001 to about 50 wt.% phosphorus on the catalyst. This modification provides a novel composition in that it increases the ethylene selectivity of the catalyst in the production of light olefins from oxygenates as contrasted with a small pore molecular sieve catalyst otherwise similar except that it has not been so treated and modified with the phosphonitrilic oligomer.

#### 5925798

#### Thoria catalyst

Gambell James William; Liu Paul Ho; Ebner Jerry Rudolph, Ballwin, Shanghai, St. Peters, MO, People's Republic of China, Solutia

A more reactive thoria catalyst for the production of diaryl ethers from aromatic compounds, a process for making the catalyst and the use of the catalyst is taught. The thoria catalyst has a specified surface area, density and average crystal size.

**5928382****Bleaching composition comprising polyoxometallates as bleaching catalyst**

Reinhardt Gerd; Friderichs Vera; Scharbert Bernd; Schulz Rolf Peter; Krebs Bernt; Bohner Rainer; Thulig Christian, Kelkheim, Kesten, Frankfurt, Munster, Norden, Ahlen, Germany, Clariant

Bleach composition comprising one or more bleaching agents and one or more polyoxometallates of the formula  $O_{b,c}H_2O$  as bleaching catalyst; the symbols Q, A, X, M, Z, q, a, x, m, y, z, b and c are defined in the description.

**5928980****Attrition resistant catalysts and sorbents based on heavy metal poisoned FCC catalysts**

Gangwal Santosh; Jothimurugesan Kandaswamy, Cary, Hampton, VA, United States, Research Triangle Institute

A heavy metal poisoned, spent FCC catalyst is treated by chemically impregnating the poisoned catalyst with a new catalytic metal or metal salt to provide an attrition resistant catalyst or sorbent for a different catalytic or absorption processes, such as catalysts for Fischer–Tropsch Synthesis, and sorbents for removal of sulfur gases from fuel gases and flue-gases. The heavy metal contaminated FCC catalyst is directly used as a support for preparing catalysts having new catalytic properties and sorbents having new sorbent properties, without removing or “passivating” the heavy metals on the spent FCC catalyst as an intermediate step.

**5928985****Copper catalysts**

Williams Brian Peter, Darlington, United Kingdom, Imperial Chemical Industries

Stabilization of a reduced copper catalyst by (a) passivating the catalyst by passing a gas stream that is free of reducing gases and which contains 0.05–0.5% by volume of oxygen and an amount of carbon dioxide at least twice the amount of oxygen through a bed of the catalyst until the catalyst is passivated, the proportion of oxygen in said gas stream and the temperature at which it is fed to the bed being such that the temperature of the catalyst does not rise to above 100°C during said passivation step, and then (b) increasing the oxygen content of the gas passing through the bed until the

oxygen partial pressure corresponds to that of air at atmospheric pressure. The process may be applied to the stabilization of fresh reduced catalysts or to the stabilization of used, e.g., spent catalysts, before discharge thereof from a reactor.

**5929256****Production of maleic anhydride using molybdenum-modified vanadium–phosphorus oxide catalysts**

Felthouse Timothy R; Keppel Robert A; Schaefer Carl J, St. Louis, Chesterfield, Crestwood, MO, United States, Huntsman Petrochemical

An active catalyst having a crystal structure corresponding to that of a catalyst that has been prepared and activated by the following process. A substantially pentavalent vanadium-containing compound is reacted with a pentavalent phosphorus-containing compound in an alcohol medium capable of reducing the vanadium to an oxidation state of less than +5. Molybdenum is incorporated into the product of the reaction, thereby forming a solid molybdenum-modified precursor composition. The alcohol is removed to produce a dried solid molybdenum-modified precursor composition. Shaped bodies comprising said dried solid molybdenum-modified precursor composition are formed. The dried-formed molybdenum-modified catalyst precursor composition is activated to transform it into the active catalyst.

**ENVIRONMENTAL CATALYSIS****5916839****Catalyst for purifying automobile exhausts**

Pak Chan-ho; Park Sang-cheol, Seoul, South Korea, Samsung Electro-Mechanics

A catalyst useful in purifying exhaust gases is disclosed which includes: (a) a carrier including a composite of  $SiO_2$ ,  $\gamma$ -alumina and an alkali earth metal oxide selected from the group consisting of MgO and BaO; (b) an oxygen absorbing material; and (c) at least one noble metal.

**5918555****Catalytic method for  $NO_x$  reduction**

Winegar Phillip, New York, NY, United States

An apparatus and method for reducing  $NO_x$  pollution in flue gas produced by a power plant uses heat

exchanger elements having extended surfaces which contain a SCR catalyst, with the heat exchanger elements located in the flue gas stream. Coolant is passed through the heat exchanger elements to cool the catalyst, with a temperature control system used to maintain the catalyst at its optimum temperature such that the maximum conversion of  $\text{NO}_x$  is achieved. Utilizing the present invention, temperature cycling of the catalyst is avoided, prolonging the life of the catalyst, while at the same time optimizing the efficiency of conversion regardless of variations in the flue gas flow or temperature.

#### 5919422

##### **Titanium dioxide photo-catalyzer**

Yamanaka Osamu; Iwasa Tadanobu; Tamaki Makoto; Sakai Kazuhiro; Yamaguchi Hisao; Nishikasugai-gun, Ichinomiya, Iwakura, Yoro-gun, Japan, Toyoda Gosei

A photo-catalyzer for deodorizing, cleaning, sterilizing, and water purifying operations includes a substrate, a titanium dioxide film disposed on the substrate and functioning as a photo-catalyst, and a light-emitting diode disposed adjacent to the titanium dioxide film and producing ultraviolet light having a wavelength from 360 to 400 nm onto the titanium dioxide film. The photo-catalyzer can be used in places where there is no sunlight because it is optionally provided with a light-emitting diode. The light-emitting diode does not require a large installation space because it is an extremely small light-emitting device. Hence, the photo-catalyzer has a compact structure and can be used easily anywhere, including small places. The substrate can be fabricated into a variety of useful appliances to take advantage of the strong oxidizing properties of the photo-catalyzer. Devices comprising a photo-catalyzer may be used for deodorizing, destroying or repelling micro-organisms, and including undertaking air or water purification.

#### 5919994

##### **Catalytic halogenated hydrocarbon processing and ruthenium catalysts for use therein**

Rao Velliyur Nott Mallikarjuna, Wilmington, DE, United States, E.I. du Pont de Nemours and Company

Processes for decreasing the chlorine/carbon ratio for halogenated hydrocarbons containing chlorine and

from 1 to 6 carbon atoms in the presence of a catalyst are disclosed. The processes are each characterized by employing a catalyst comprising ruthenium on a support of (i) fluorided alumina, (ii) aluminum fluoride, or (iii) fluorides of Zn, Mg, Ca, Ba, Y, Sm, Eu, and/or Dy. Also disclosed are multiphase catalyst compositions of ruthenium supported on fluorides of Zn, Mg, Ca, Ba, Y, Sm, Eu and/or Dy.

#### 5922294

##### **High surface area, thermally stabilized titania automotive catalyst support**

Chattha Mohinder S; Montreuil Clifford Norman, Northville, Inkster, MI, United States, Ford Global Technologies

This invention is a sulfur-resistant, high surface area and temperature stabilized anatase crystal form of a mixed-oxide of titania and alumina comprising at least 40% molar amount titania. The mixed-oxide is made by co-hydrolysis of a mixture of the alkoxides of titanium and aluminum. The mixed oxide is useful as a catalyst support for treating exhaust gases generated by a diesel or gasoline internal combustion engine of automotive vehicles. The catalyst support may contain catalytic materials like precious metals.

#### 5925590

##### **Catalysts utilizing oxygen-deficient metal oxide compound for removal of exhaust gas constituents**

White James H; Schwartz Michael, Boulder, CO, United States, Eltron Research

The invention provides various solid catalysts for decomposition of exhaust gases. Catalysts include, among others, those of formula  $\text{Ce}_{0.5}\text{La}_{0.4}\text{Sr}_{0.1}\text{Pd}_{0.025}\text{O}_{3.x}$  and  $\text{BiCompa}_{0.8}\text{Cu}_{0.2}\text{O}_{3.x}$ . The invention also relates to catalytic reactors for decomposition of exhaust gases utilizing solid catalysts of the invention. The invention further provides methods for synthesis of various mixed metal oxide catalysts for decomposition of exhaust gas pollutants.

#### 5928981

##### **Diesel catalytic converter**

Leyrer Jurgen; Lindner Dieter; Lox Egbert; Kreuzer Thomas; Muller Wilfried; Domesle Rainer, Kahl,

Hauau, Karben, Offenbach, Alzenau, Germany, Degussa-Huls Aktiengesellschaft

A catalyst for purifying the exhaust gases from diesel engines. The catalyst contains a zeolite mixture of several zeolites with different moduli and platinum group metals as well as further metal oxides from the group aluminum silicate, aluminum oxide and titanium oxide, wherein the aluminum silicate has a ratio by weight of silicon dioxide to aluminum oxide of 0.005:1 and the platinum group metals are deposited only on further metal oxides.

## CHEMICALS AND FINE CHEMICALS

### 5914011

#### Catalytic reaction and mass transfer structure

Yeoman Neil; Pinaire Ronald; Ulowetz Michael A; Berven Jeffrey O; Nace Timothy P; Furse David A, Merrick, Wichita, KS, United States, Koch-Glitsch

A reaction with distillation column is provided with a plurality of discrete catalytic reaction containers. The containers contain a plurality of solid catalyst particles that form a catalytic reaction zone. The containers also include a liquid collection tray cover, which defines a liquid accumulation zone immediately overlying the catalytic reaction zone. Overflow weirs are provided on the tray cover to allow for overflow of liquid on the tray cover. A member may be provided within the containers to create an open area within the catalytic reaction zone to facilitate entry of the liquid into the catalytic reaction zone. The containers can be individually positioned within the reactor to suit particular process requirements.

### 5916838

#### Catalysts for the amination of alkylene oxides, alcohols, aldehydes and ketones

Wulff-Doring Joachim; Melder Johann-Peter; Schulz Gerhard; Voit Guido; Frank Gutshoven; Harder Wolfgang, Frankenthal, Neuhofen, Ludwigshafen, Schriesheim, Gent, Weinheim, Germany, BASF Aktiengesellschaft

A catalyst comprises, based on the total weight of the catalyst, 0.1–6% by weight of cobalt, nickel or a mixture thereof, 0.001–25% by weight of ruthenium, 0–10% by weight of copper, and 0–5% by weight of promoters on a porous metal oxide carrier. Preferably, it comprises 0.1–3% by weight of cobalt and 0.1–3%

by weight of nickel. It can be used in hydrogenation reactions, dehydrogenation reactions or hydrogenation/dehydrogenation reactions, in particular in the amination of alkylene oxides, alcohols, aldehydes or ketones with ammonia or primary or secondary amines.

### 5916840

#### Process for preparing carboxylic acid salts and catalysts useful in such process

Ebner Jerry R; Franczyk Thaddeus S, St. Peters, Maryland Heights, MO, United States, Monsanto

Carboxylic acid salts are prepared by the dehydrogenation of a primary alcohol in the presence of a catalyst comprising a finely divided anchor metal partially embedded on a support and having at least some of the nonembedded surface coated with an electroless plating of a catalytically active metal. The anchor metal is selected from a group consisting of osmium, iridium, rhodium and mixtures thereof.

### 5917023

#### Reductive coupling of nitrobenzene or nitrobenzenes substituted on the nucleus to give the corresponding azobenzenes and azoxybenzenes by means of redox catalysts

Hagemeyer Alfred; Heineke Daniel; Voit Guido; Witzel Tom, Rheine, Ludwigshafen, Schriesheim, Germany, BASF Aktiengesellschaft

Nitrobenzene or a nitrobenzene substituted on the nucleus is subjected to reductive coupling to give the corresponding azobenzene and azoxybenzene under heterogeneous catalysis with substantial avoidance of overreduction to aniline derivatives by means of a redox catalyst in its reduced or partly reduced form, the redox catalyst containing at least one active metal component capable of a change of oxidation state.

### 5917071

#### Synthesis of ruthenium or osmium metathesis catalysts

Grubbs Robert H; Belderrain Tomas R; Brown Seth N; Wilhelm Thomas E, South Pasadena, Seville, South Bend, Pasadena, CA, United States, California Institute of Technology

The present invention relates to the synthesis of highly active ruthenium and osmium vinyl alkylidene

catalysts. In one embodiment, the invention may be summarized by the following reaction scheme wherein  $n$  is 1 or 2; X and  $X^1$  are each anionic ligands; L and  $L^1$  are each neutral electron donors and  $R^{17}$  which is hydrogen, aryl or  $C_1$ – $C_{18}$  alkyl; and,  $R^{12}$  and  $R^{13}$  are each hydrogen or one of the following substituent groups:  $C_1$ – $C_{18}$  alkyl,  $C_2$ – $C_{18}$  alkenyl,  $C_2$ – $C_{18}$  alkynyl, aryl,  $C_1$ – $C_{18}$  carboxylate,  $C_1$ – $C_{18}$  alkoxy,  $C_2$ – $C_{18}$  alkenyloxy,  $C_2$ – $C_{18}$  alkynyloxy, aryloxy,  $C_2$ – $C_{18}$  alkoxy carbonyl,  $C_1$ – $C_{18}$  alkylthio,  $C_1$ – $C_{18}$  alkylsulfonyl and  $C_1$ – $C_{18}$  alkylsulfanyl. In addition to the ease of synthesis (typically a one-step synthesis), the reactions generally may be run at or above room temperature and the resulting products usually may be used without extensive post synthesis purification.

### 5917092

#### Metal exchanged zeolite catalysts for alcohol amination

Vedage Gamini Ananda; Emig Lenore Ann; Li Hong-Xin; Armor John Nelson, Bethlehem, Whitehall, Allentown, Orefield, PA, United States, Air Products and Chemicals

A process for the production of predominantly primary and secondary amines and little or no tertiary amines by the reductive amination of aliphatic alcohols using a metal exchanged crystalline aluminosilicate catalyst. The catalyst has a silica/alumina ratio ranging from about 10:1 to 40:1, contains about 1% to 10% by weight of cobalt or nickel and about 0.05% to 5% by weight of at least one other metal. High conversion rates are achieved at moderate temperatures and pressures.

### 5919728

#### Catalyst for the fluorination of halogenated hydrocarbons

Rinaldi Francesco; Cuzzato Paolo; Bragante Letanzio, Padova, Treviso, Albignasego, Italy, Ausimont

A fluorination catalyst based on of an amorphous Cr(III) compound and on a compound of another metal selected from Mg, Ca, Sr, Ba, Sc, Ti and Zr, wherein the atomic ratio of Cr/other metal is between 50:1 and 1:1, said compounds are supported on a  $AlF_3$  support and being prepared by impregnating the support with a concentrated aqueous solution containing a soluble

Cr(III) salt and a soluble salt of the other metal. The catalyst can be used in gaseous phase reactions.

### 5919988

#### Foam test for double metal cyanide-catalyzed polyols

Pazos Jose F; Jividen Veril C, Havertown, Scott Depot, WV, United States, Arco Chemical Technology

Double metal cyanide-catalyzed polyols are made by an improved process in which a starter is continuously added during polymerization of the epoxide. The process includes a continuously added starter ( $S_c$ ), and optionally, an initially charged starter ( $S_i$ ). The continuously added starter comprises at least about 2 equivalent percent of the total starter used. The process enables the use of water and low molecular weight polyol starters in DMC-catalyzed polyol synthesis. In addition, the process gives polyether polyols having reduced levels of high molecular weight polyol tail, which can adversely affect polyurethane foam processing.

### 5922900

#### Process for producing carboxylic acid esters and catalysts therefore

Wieland Stefan; Panster Peter, Offenbach, Rodenbach, Germany, Degussa Aktiengesellschaft

A process for producing carboxylic acid esters by the following steps: (a) preparation of a reaction mixture containing an alcohol and a carboxylic acid and/or a carboxylic anhydride and/or a carboxylic acid ester and or a partially esterified carboxylic acid; (b) heating of this mixture to the suitable reaction temperature in the presence of a solid polysiloxane insoluble in the reaction medium and having sulphonic acid groups with intensive thorough mixing accompanied by continuous separation of the reaction water which forms, wherein the polysiloxane used as the catalyst is modified by treatment with a soluble aluminum, titanium or zirconium compound, and the spherical particles thereof have a diameter of 0.01–3 mm, a specific surface of 0.1–1200  $m^2/g$ , a specific pore volume of 0.01–6.0 ml/g and a bulk density of 50–1000 g/l.

### 5922920

#### Catalytic production of aryl alkyl hydroperoxides by polynuclear transition metal aggregates

Bond Jeffrey Evans; Gorun Sergiu Mircea; Schriver George William; Stibrany Robert Timothy; Vanderspurt

Thomas Henry; Via Grayson Hall; Zhang Baoshan; Dakka Jihad Mohammed, Flemington, Providence, Somerville, Long Valley, Stockton, Westfield, Upton, Kessel-lo, NY, Belgium, Exxon Chemical Patents

A method is provided for preparing organic hydroperoxides by oxidizing aryl alkyl hydrocarbons having a benzylic hydrogen with an oxygen containing gas using as a catalyst an oxo (hydroxo) bridged tetranuclear metal complex having a mixed metal core, one metal of the core being a divalent metal selected from Zn, Cu, Fe, Co, Ni, Mn or mixtures thereof and another metal being a trivalent metal selected from In, Fe, Mn, Ga, and Al. A method is also provided for the manufacture of the catalyst.

#### 5925685

##### Method for carrying out heterogeneous catalysis

Adams John R; Hickey Thomas P, Houston, TX, United States, Catalytic Distillation Technologies

Catalytic distillation reactions are improved by having an inert condensing component present in the reaction which is boiling and condensing within the reaction that washes the catalyst in the system and, in the case of gaseous reactants, occludes a portion of the reactants to facilitate the reaction without unduly high pressures. The inert condensing component is boiling at the conditions within the reactor and is taken overhead for condensation and return as reflux. The inert condensing component may occlude the gaseous reactants allowing for better contact with the catalyst and provides the benefits of concurrent reaction and distillation, for example, the reaction of CO and H<sub>2</sub> over a copper catalyst to produce methanol using propane as the inert condensing component.

#### 5929259

##### Preparation of ethylene oxide and catalyst

Lockemeyer John Robert, Sugar Land, TX, United States, Shell Oil

This invention relates to a process for preparing an ethylene oxide catalyst by depositing silver and one or more alkali metal promoters on an alpha alumina carrier in which a fired carrier body is impregnated with a source of titania in a liquid medium that upon heating yields titania and is then calcined to generate titania uniformly dispersed in the carrier in an amount of up to

about 10% by weight, basis the total weight of the carrier, and subsequently drying the carrier having said silver and alkali metal supported thereon.

#### 5929260

##### Hydrogenation using magnetic catalysts

Kormann Claudius; Wettling Thomas; Schwab Ekkehard; Henkelmann Jochem, Schifferstadt, Limburgerhof, Neustadt, Mannheim, Germany, BASF Aktiengesellschaft

Catalysts are composed of (a) a magnetizable core, (b) which may be coated with a binder and (c) which carries catalytically active metals or metal compounds on its surface.

#### 5929261

##### Process for the selective hydration of vinyloxirane to 1,2-butylene oxide of heterogeneous catalysts

Sigwart Christoph; Heineke Daniel; Flick Klemens, Schriesheim, Ludwigshafen, Herxheim, Germany, BASF Aktiengesellschaft

A process for preparing 1,2-butylene oxide by catalytic hydrogenation of vinyloxirane over a heterogeneous catalyst comprises using a catalyst prepared by applying at least one element of groups VII–XI of the Periodic Table in the form of a sol to an inert support.

#### 5929264

##### Process for the preparation of substituted indenenes and their use as ligand systems for metallocene catalysts

Rohrmann Jurgen; Kuber Frank, Kelkheim, Oberursel, Germany, Targor

The invention relates to a process for the preparation of a compound of the formula IV or IVA in which R<sup>1</sup>–R<sup>5</sup> are preferably hydrogen or alkyl, which comprises reacting a compound I with a compound II in which X<sup>1</sup> and X<sup>2</sup> are preferably halogen, to give the corresponding indenones, which are converted into the compounds IV and IVA by reduction and dehydration. The compounds IV and IVA are important intermediate products for the preparation of chiral metallocene complexes that are suitable catalyst components for olefin polymerization.



**5929275****Catalyst and process for producing unsaturated aldehyde and unsaturated acid**

Wada Koichi; Iwamoto Akira; Seo Yoshimasa; Sudo Atsusi; Sakai Fumio; Shiraiishi Kazuo; Miki Hideaki, Kanagawa-ken, Yamaguchi-ken, Gunma-ken, Yamaguchi-ken, Japan, Nippon Kayaku

A catalyst for the production of unsaturated aldehyde and unsaturated acid, obtained by loading a catalytically active component on a carrier and calcining the loaded catalyst, characterized by an average particle diameter of the catalyst of 4–16  $\mu\text{m}$ , an average particle diameter of the carrier of 3–12  $\mu\text{m}$ , a calcining temperature of 520–600°C and an amount of the catalytically active component loaded on the carrier of 5–80% by weight [(weight of the catalytically active component)/(weight of the catalytically active component + weight of the carrier + weight of a strength improver)], and a process for producing unsaturated aldehyde and unsaturated acid with the catalyst.

**POLYMERISATION CATALYSIS****5914289****Supported metallocene-alumoxane catalysts for the preparation of polyethylene having a broad monomodal molecular weight distribution**

Razavi Abbas, Mons, Belgium, Fina Research

The present invention relates to the production of high density polyethylene homopolymers or copolymers having a broad and monomodal molecular weight distribution wherein the polymerization process is conducted in the presence of supported metallocene-alumoxane catalysts wherein the metallocene is bridged, comprises at least a hydrogenated indenyl or fluorenyl and a metal M which may be Ti, Zr or Hf, wherein a plurality of conformers of the metallocene are formed and isolated on the support by reaction of the metallocene with the alumoxane and depositing the product formed on the support at a temperature in the range of 85°C to 110°C.

**5914291****Porous inorganic catalyst support**

Marsden Christine E; Regan John M, Chester, Warrington, United Kingdom

Olefin polymerisation catalyst on a porous inorganic support comprising (i) 99.5–83.3 parts by weight of

$\text{SiO}_2$ , (ii) 0.5–10 parts by weight of titanium, and 0.85–1.15 parts by weight of chromium, this catalyst having a pore volume of 0.9–1.15  $\text{cm}^3/\text{g}$ , a surface area of 440–540  $\text{m}^2/\text{g}$  and a mean pore diameter between 70 and 100 Å.

**5914375****Catalyst composition for preparing high-syndiotactic polystyrene from styrene or other aryl ethylene monomers and processes using the same**

Tsai Jing-Cheng Cheng; Wang Shian-Jy; Peng Shu-Ling; Sue Mickey, Hsinchu, Taipei, Taiwan, Industrial Technology Research Institute

A catalyst composition for preparing high-syndiotactic polystyrene polymers which comprises: (a) a titanium complex represented by the following formula of  $\text{TiR}'_1\text{R}'_2\text{R}'_3\text{R}'_4$  or  $\text{TiR}'_1\text{R}'_2\text{R}'_3$ , wherein  $\text{R}'_1$ ,  $\text{R}'_2$ ,  $\text{R}'_3$ , and  $\text{R}'_4$  are, independently, an alkyl group, an aryl group, an alkoxy group, an aryloxy group, an amino group, a hydrogen atom, or a halogen atom; (b) a cyclopentadienyl complex of silicon (Si), germanium (Ge), or tin (Sn) represented by the following formula wherein  $\text{R}_1$ ,  $\text{R}_2$ ,  $\text{R}_3$ ,  $\text{R}_4$ , and  $\text{R}_5$  can be, independently, alkyl group, aryl group, silyl group, germanyl group, stannyl group, hydrogen atom, or halogen atom; R is an alkyl group, aryl group, hydrogen atom, or halogen atom; and X can be one of the Group IVA elements of silicon (Si), germanium (Ge), or tin (Sn); and (c) an activated transitional metal co-catalyst, which can be methyl aluminoxane, or a mixture containing a non-coordinated Lewis acid (a Lewis acid is an electron-pair donor) and a trialkyl aluminum, such as triethyl aluminum or tetraisobutyl aluminum.  $\text{R}_1$  and  $\text{R}_2$ , and  $\text{R}_3$  and  $\text{R}_4$ , respectively, can also be part of a benzene ring.

**5914376****Catalyst for the polymerization of olefins, process for the preparation thereof, and use thereof**

Herrmann Hans-Friedrich; Bachmann Bernd; Dolle Volker; Spaleck Walter, Darmstadt, Eppstein/Taunus, Kelkheim, Liederbach, Germany, Targor

Catalyst for the polymerization of olefins, process for the preparation thereof, and the use thereof. The present invention relates to a heterogeneous catalyst for the polymerization of olefins, comprising the product of the reaction of an aluminoxane, which is insoluble in

aliphatic and aromatic hydrocarbons, with at least one metallocene.

#### 5914408

##### Olefin polymerization catalysts containing benzo-thiazole

Krishnamurti Ramesh; Nagy Sandor; Tyrell John; Etherton Bradley P, Williamsville, Grand Island, Williamsville, Houston, TX, United States, Equistar Chemicals

A novel metallocene catalyst for the polymerization of olefin (co)polymers is of the general formula where M is a transition metal of Groups III–X of the Periodic Table; E is sulfur or oxygen; E is the bond to the transition metal and to the carbon atom between sulfur and nitrogen of the benzothiazole moiety; L is a polymerization-stable anionic ancillary ligand; X is a halogen, alkoxy from C<sub>1</sub> to C<sub>20</sub>, siloxy from C<sub>1</sub> to C<sub>20</sub>, N(R<sub>1</sub>)<sub>2</sub>, a hydrocarbyl group containing up to about 12 carbon atoms or hydrogen or mixtures thereof; preferably X is halogen, methoxy, ethoxy or siloxy (R<sub>1</sub>)<sub>3</sub>SiO–, where R<sub>1</sub> is alkyl from C<sub>1</sub> to C<sub>20</sub>; and *m* + *n* equals the valency of the M minus 1.

#### 5916990

##### Propylene-based polymer, method of its production, composition thereof, catalyst component for polymerization, and method for its production

Yanagihara Hisayoshi; Watanabe Kazuyuki; Iwamoto Satoshi; Takahashi Hirotooshi; Itoh Kazuharu, Oita, Japan, Showa Denko

A propylene-based polymer is characterized in that (1) the xylene-extraction insoluble portion (XI) is 99.0 wt.% or greater, (2) the isotactic pentad ratio (IP) is 98.0% or greater as measured by <sup>13</sup>C nuclear magnetic resonance spectroscopy, (3) the isotactic average chain length (*N*) is 500 or greater, and (4) the total amount of each of the fractions obtained by column separation of the xylene insolubles whose average chain length (*N<sub>f</sub>*) is 800 or greater accounts for 10 wt.% or more of the entirety, and a method for its production, as well as a propylene-based polymer composition prepared by combining with this propylene-based polymer at least a nucleating agent in the range of 0.05–15 wt.% is provided. In addition, a polymerization catalyst component allowing the production of such a propylene-based polymer, and a method for its production are likewise provided.

#### 5917072

##### Catalysts for the polymerization of alpha-olefins

Banzi Viviano; Biagini Paolo; Santi Roberto; Borsotti Giampiero; Lugli Gabriele, Vigarano Mainarda, Tre-cate, Novara, S. Donato Milanese, Italy, Enichem

A description of catalysts of the metallocene type which can be used in the (co)polymerization of alpha-olefins, particularly in the preparation of elastomeric copolymers of ethylene.

#### 5917073

##### Organic aluminoxy compound and catalyst for producing polymer

Kondoh Tsuyoshi; Naganuma Shoji; Tomotsu Norio, Ichihara, Japan, Idemitsu Petrochemical

An organic aluminoxy compound which shows <sup>27</sup>Al nuclear magnetic resonance spectrum (<sup>27</sup>Al NMR spectrum) having an A<sub>1</sub>/A<sub>2</sub> ratio of almost 0.1, wherein A<sub>1</sub> is the area of a region encompassed by a segment of a line which connects a local minimum point existing between a continuous curve “a” containing a peak, appearing at around 150 ppm, and a continuous curve “b” containing a peak, appearing at around 60 ppm, to the point where the above curve “b” comes into contact with the base line and also by the above curve “b” and A<sub>2</sub> is area of a region encompassed by the above curves “a” and “b” and also by the base line; an organic aluminoxy compound containing at least 5%, expressed in terms of aluminum atom, of a portion insoluble in a mixed solvent of toluene and hexane in a ratio by volume of 2:5 at 30°C or lower; and a catalyst for producing a polymer comprising any of the above organic aluminoxy compounds and a transition metal compound. The above catalyst is a homogeneous catalyst having high and stable activity and used for polymerization of olefins and styrenes.

#### 5919723

##### Supported metallocene catalyst for the (co)polymerization of alpha-olefins

Milani Federico; Labianco Antonio; Pivotto Bruno, Occhiobello, Stienta, Ferrara, Italy, Enichem

A supported catalyst for the (co)polymerization of alpha-olefins is obtained by putting the following prod-

ucts in contact with each other: (a) a metallocene derivative of a metal selected from the group consisting of transition metals and lanthanides, which is in itself capable of promoting the polymerization of alpha-olefins in the presence of or also without suitable activators; (b) an active support containing magnesium, halogen, titanium and smaller quantities of tin; (c) an organometal derivative of aluminium of which at least 50% of the aluminium atoms are bound to at least one alkyl carbon atom. Components (a) and (b) are preferably interacted first to obtain a supported metallocene derivative, which is then put in contact with (c) to obtain the desired catalyst. Alternatively, (b) and (c) are interacted and subsequently put in contact with (a).

**5919875**

**Method of preparing syndiotactic 1,2-polybutadiene with a chromium-based catalyst system**

Luo Steven; Hayes Michael W; Brumbaugh Dennis R, Akron, Canton, North Canton, OH, United States, Bridgestone

A process for polymerizing 1,3-butadiene into syndiotactic 1,2-polybutadiene is described using a catalyst system comprising (a) a chromium-containing compound, (b) an organoaluminum hydride, and (c) a hydrogen phosphite. The use of the catalyst system avoids the use of environmentally detrimental components such as carbon disulfide and halogenated solvents. The syndiotactic 1,2-polybutadiene can be used as a plastic or as an additive for rubber compositions wherein it can crosslink with conventional rubbers using conventional crosslinking agents.

**5919983**

**Highly soluble olefin polymerization catalyst activator**

Rosen Robert K; VanderLende Daniel D, Sugar Land, TX, United States, The Dow Chemical

A catalyst activator, comprising a cation which is a Bronsted acid capable of donating a proton, and an inert, compatible, noncoordinating, anion, characterized by a solubility constant at 25°C in hexane, cyclohexane or methylcyclohexane of at least 5 wt.%.

**5922631**

**Liquid clathrate aluminosilicate compositions as cocatalysts with transition metal catalyst compounds**

Sangkoyya Samuel A, Baton Rouge, LA, United States, Albemarle

Described are olefin polymerization catalysts that comprise the reaction product of (a) a metallocene and/or a Ziegler–Natta catalyst compound (TiCl<sub>4</sub>, etc.) and (b) a liquid clathrate composition formed from (i) an aluminosilicate, (ii) an organic, inorganic or organometallic compound, and (iii) an aromatic solvent. These liquid clathrates are obtained by the reaction, in aromatic solvents, of aluminosilicates such as, methylaluminosilicate, with organic, inorganic or organometallic compounds that form stable clathrates with the aluminosilicate and the solvent.

**5922632**

**Vanadium based components and catalysts for the polymerization of olefins and polymerization processes using the same**

Zucchini Umberto (deceased); Dall'Occo Tiziano; Angelini Antonella, Late of Ferrara, Italy, Montell Technology

Catalysts component of the (co)polymerization of alpha-olefins CH<sub>2</sub>=CHR, wherein R is hydrogen or an alkyl radical having 1 to 8 carbon atoms, comprising a product of the composition wherein (b) represents an organic compound selected from alkyl, aryl and acyl halides, *y* is a number higher than 2 and lower than 4, and preferably comprised between 2.5 and 3.5 and *z* is a number higher than zero and lower than or equal to 2, and preferably between 0.002 and 1. Components can be obtained as products of the reaction, carried out at temperatures higher than 10°C, between VCl<sub>4</sub> and the compound (b). Particularly preferred among compounds (b) are benzoyl chloride, *p*-methoxybenzoyl chloride and *p*-chloro benzoyl chloride. From the components of the invention, either supported or not, catalysts having high activity particularly useful for the production of ethylene polymers showing broad molecular weight distribution can be prepared.

**5922819**

**Process for producing polymers of vinyl aromatic compounds using polymer-containing catalyst systems**

Wunsch Josef; Lux Martin; Fischer David, Schifferstadt, Dannstadt-Schauernheim, Gonnheim, Germany, BASF Aktiengesellschaft

Polymers of vinylaromatic compounds are prepared at 0°C to 150°C in the presence of catalyst systems

which comprise as active constituents (a) compounds of the formula I  $XM(Z^1)_{z_1}(Z^2)_{z_2}(Z^3)_{z_3}(I)$  where the substituents and indices have the following meanings: X is  $C_1$ – $C_{10}$  alkyl, five- to seven-membered cycloalkyl,  $C_1$ – $C_{10}$  alkoxy,  $C_6$ – $C_{15}$  aryl or a cyclopentadienyl group, M is a metal of transition groups II to VIII of the Periodic Table of the Elements,  $Z^1$  to  $Z^3$  are polymers of vinylaromatic compounds, dienes, acrylates or mixtures thereof and  $Z^1$  to  $Z^3$  are 0, 1, 2 or 3, where  $1 \leq Z_1 + Z_2 + Z_3 \leq 3$ , and (b) linear or cyclic aluminoxane compound or compounds which form metalocenium ions and are selected from the group consisting of strong, uncharged Lewis acids, ionic compounds having a Lewis-acid cation and ionic compounds having a Bronsted acid as cation.

#### 5922828

##### Process for producing polyethylene terephthalate using a specific catalyst stabilizer system

Schiraldi David Anthony, Charlotte, NC, United States, Hoechst Celanese

A novel process to produce polyethylene terephthalate (PET) using a specific catalyst stabilizer system is described. The catalyst stabilizer system is specific for producing PET, wherein the polycondensation catalyst is titanium and the stabilizer possesses an irreversible oxidation potential of at least +2.0 V vs. SCE. The novel process results in PET having acceptable color and low acetaldehyde content.

#### 5925587

##### Supported polymerization catalyst component and system, polymerization process using same for the production of ultra-fine particle size resins with improved crystallization rates

Lee Chun D; Fries Richard W, Cincinnati, Joliet, IL, United States, Equistar Chemicals LP

A supported polymerization catalyst component and a catalyst system useful in the production of polyolefin resins that have a narrow particle size distribution and enhanced crystallization rates is provided. The supported polymerization component comprises talc, an organomagnesium compound or complex, wherein the weight ratio of talc/magnesium in the organomagnesium compound or complex is from about 1000:1 to about 5:1, at least one transition metal containing compound and/or a metallocene effective in alpha-olefin

polymerization reactions, and, optionally, an alcohol or a silane. The catalyst system of the instant invention includes the aforementioned alpha-olefin polymerization catalyst component and at least one aluminum-containing cocatalyst compound. A process for polymerizing or copolymerizing alpha-olefins, conducted under olefin polymerization conditions utilizing the inventive catalyst system of this invention is also described.

#### 5925589

##### Process for the manufacture of a support for olefin polymerization catalysts and process for the polymerization of olefins

Koch Benoit; Rulmont Andre; Wijzen Fabienne, Hannut, Liege, Ayeneux, Belgium, Solvay (Societe Anonyme)

Process for the manufacture of a support for olefin polymerization catalysts comprising silica, aluminium phosphate and, optionally, alumina, according to which, in the first step, a source of silica, chosen from alkaline aqueous silica sols and alkaline aqueous solutions of inorganic silicate is added to an aqueous solution of a source of phosphate ions that has a pH of less than 5. In the second step, the pH of the medium being maintained below 5 throughout the first step, an aluminium compound is added to the medium obtained from the first step. In the third step, a precipitate is formed by adding a precipitation agent to the medium obtained from the second step, with the pH of the precipitation medium maintained above or equal to 5.

#### 925717

##### Process for hydrogenation of conjugated diene polymers and catalyst compositions suitable for use therein

De Boer Eric Johannes Maria; Hessen Bart; Van Der Huizen Adriaan Albert; De Jong Wouter; Van Der Linden Adrianus Johannes; Ruisch Bart Johan; Schoon Lodewijk; De Smet Heleen Johanna Augusta; Van Der Steen Frederik Hendrik; Van Strien Hubertus Cornelis Thomas Lucianes; Villena Alan; Walhof Judith Johanna Berendina, CM Amsterdam, Netherlands, Shell Oil

The invention provides a catalyst composition for hydrogenation of polymers containing ethylenical unsaturation which comprises at least: (a) a titanium compound of the formula (I) wherein  $A_1$  represents an optionally substituted indenyl group of the formula

wherein substituents  $R_1$  and  $R_2$  may be the same or different and each may be selected from halogen, phenyl which optionally may bear one or more the same or different substituents, lower alkyl, alkoxy, phenoxy, phenylalkoxy, benzyl, and a bulky substituent containing one or more hetero atoms such as tri(loweralkyl)silyl,  $-NPh_2$ ,  $-NHPh$ ,  $-BPh_2$ , and  $-B(OPh)_2$ , wherein  $n$  may be an integer from 0 to 4, and  $m$  may be an integer from 0 to 3, (II) wherein  $A_2$  has the same meaning as  $A_1$ , or alternatively represents an optionally substituted cyclopentadienyl group, and wherein  $L_1$  and  $L_2$  may be the same or different and each may be selected from hydrogen, halogen and preferred chlorine, lower alkyl, phenyl, aralkyl having from 7 to 10 carbons, a lower alkoxy group, phenyloxy, phenylalkoxy group having from 7 to 10 carbon atoms, carboxyl, carbonyl, a B-diketone coordination, a  $-CH_2P(\text{phenyl})_2$ ,  $-CH_2Si(\text{lower alkyl})_3$  or  $-P(\text{phenyl})_2$  group; and (b) an alkali metal hydride, added as such or prepared in situ in the polymer solution from the alkali metal terminated living polymer and/or from additionally added alkali metal alkyl. The invention also concerns a process for hydrogenation of polymers containing ethylenical unsaturation using this catalyst.

**5928982****Catalyst for polymerizing an olefin and method for polymerizing the olefin**

Suga Yoshinori; Uehara Yumito; Maruyama Yasuo; Isobe Eiji; Ishihama Yoshiyuki; Sagae Takehiro, Yokohama, Yokkaichi, Japan, Mitsubishi Chemical

A catalyst for polymerizing an olefin, which comprises (a) a metallocene transition metal compound, (b) (1) an ion-exchanging layered compound other than a silicate or (2) an inorganic silicate prepared by treating a starting ion-exchanging layer compound other than a silicate or a starting silicate with a salt, an acid, or a combination thereof, said component (b) having a water content not higher than 1% by weight which is obtained by heat-dehydrating component (b) under an inert gas atmosphere or under reduced pressure, and (c) an organoaluminum compound.

**5929181****Method for preparation of copolymers of ethylene/norbornene-type monomers with nickel catalysts**

Makovetsky Kiryll Lvovich; Finkelshtein Eugeny Shmerovich; Bykov Viktor Ivanovich; Bagdasaryan

Andrey Khristoforovich; Goodall Brian Leslie; Rhodes Larry Funderburk, Moscow, Akron, Silver Lake, OH, Russia, The B.F. Goodrich, A.V. Topchiev Institute of Petrochemical Synthesis

A method of preparing amorphous copolymers of ethylene and at least one norbornene (NB)-type comonomer is disclosed. These polymers may be random or alternating depending on the choice of catalyst and/or the relative ratio of the monomers used. This method comprises polymerizing said monomers in a diluent or in bulk in the presence of a neutral nickel catalyst which may be represented by the formula wherein Y may be a saturated or unsaturated hydrocarbon chain, X may be oxygen or sulfur, E may be phosphorus, arsenic, antimony, oxygen or nitrogen, R and R' independently is hydrogen or a hydrocarbon group, L is a ligand containing a heteroatom P, N, O or L, and R together with L may form part of a chelating structure in which case L is an ethylenic double bond.

**REFINERY CATALYSIS****5914028****Reforming process with catalyst pretreatment**

Wilson Charles R; Holtermann Dennis L, San Francisco, Crockett, CA, United States, Chevron Chemical

A catalytic reforming process using a halided zeolite catalyst containing platinum in a metal-coated reactor system where, prior to catalyst loading and reforming, halide acid is removed from the catalyst. The process comprises providing a reforming reactor system having a metal coating; providing a halided zeolite catalyst containing platinum prepared by a method which includes removing volatile halide acid; loading said catalyst into said reactor system; and catalytically reforming hydrocarbons to aromatics, wherein metal from the metal-coated reactor system does not deactivate the catalyst. The coating metal preferably comprises tin and the zeolite catalyst is preferably a platinum L-zeolite catalyst. The invention is also a method for reducing catalyst contamination from a metal which was used to coat a reactor system. The method comprises pretreating a halided catalyst with hydrogen to remove volatile halide acid. The resulting catalyst is then loaded into a metal-coated reactor system and hydrocarbons are converted.

**5914290****Distillate hydrofining catalyst and a process for the preparation of the same**

Shi Yahua; Li Dadong; Liu Xuefen; Nie Hong; Gao Xiaodong; Ying Yibing, Beijing, People's Republic of China, China Petrochemical, Research Institute of Petroleum

The present invention discloses a hydrofining catalyst. The catalyst has the following composition based on the total weight of the entire catalyst composition: 1–5 wt.% nickel oxide, 12–35 wt.% tungsten oxide, 1–9 wt.% fluorine, and the balancing amount of composite alumina. Said composite alumina is composed of one or several kinds of micropore alumina and one or several kinds of macropore alumina, wherein the weight ratio of micropore alumina/macropore alumina is 75:25 to 50:50. The term “micropore alumina” in the context means the alumina in which the volume of the pore of diameter less than 80 Å occupies more than 95% of its total pore volume, while the term “macropore alumina” in the context means the alumina in which the volume of the pore of diameter 60–600 Å occupies more than 70% of its total pore volume. The pore distribution mentioned above is determined by BET method of nitrogen adsorption at low temperature. This catalyst is especially suitable for the hydrofining of inferior distillates with high sulfur content and boiling range of 80–550°C.

**5916433****Catalyst for the hydroisomerization of contaminated hydrocarbon feedstock**

Tejada Jorge Alejandro; Romero Yilda Margot; Reyes Edito Jose, San Antonio de Los Altos, Eolo, Aragua, Los Teques, Venezuela, Intevep

A catalyst system for treating sulfur and nitrogen contaminated hydrocarbon feedstock includes a matrix, at least one support medium substantially uniformly distributed through said matrix and comprising a silica alumina molecular sieve material having a composition  $x\text{SiO}_2:\text{Al}_2\text{O}_3:y\text{P}_2\text{O}_5$ , wherein  $x$  is at least about 0.1, a first catalytically active metal phase supported on said support medium, said first catalytically active metal phase comprising a first metal and a second metal each selected from group VIII of the Periodic Table of Elements, said first metal being different from said

second metal, a second catalytically active metal phase supported on said matrix, said second catalytically active metal phase comprising a third metal and a fourth metal each selected from group VIII of the Periodic Table of Elements and a fifth metal selected from group VIb of the Periodic Table of Elements, said third metal being different from said fourth metal.

**5916529****Multistage moving-bed hydroprocessing reactor with separate catalyst addition and withdrawal systems for each stage, and method for hydroprocessing a hydrocarbon feed stream**

Scheuerman; Georgianna L, Moraga, CA, United States, Chevron United States

A method, and a reactor, for hydroprocessing a hydrocarbon feed stream through multistage moving catalyst beds contained within a single onstream reactor vessel, with separate catalyst addition and withdrawal systems for each of the multistages of moving catalyst beds. The reactor contains two or more different and distinct moving catalyst beds for any hydroprocessing application. The method includes serially passing, without leaving the reactor vessel, at least a partially treated hydrocarbon stream from one hydroconversion reaction zone containing a moving catalyst bed with a first set of catalytic characteristics to another hydroconversion reaction zone containing a moving catalyst bed with a second set of catalytic characteristics that differ in catalytic abilities from the first set of catalytic characteristics.

**5919995****Use of composite catalyst for the dismutation and/or transalkylation of alkylaromatic hydrocarbons**

Alario Fabio; Benazzi Eric, Neuilly sur Seine, Montesson, France, Institut Français du Pétrole

The invention concerns the use of a catalyst for the dismutation of alkylaromatic hydrocarbons, preferably for the dismutation of toluene to produce benzene and xylenes, and/or for the transalkylation of alkylaromatic hydrocarbons, preferably for the transalkylation of toluene and trimethylbenzenes to produce xylenes. The catalyst is a composite comprising at least one zeolite with structure type mazzite, at least partially in its acid form, at least one zeolite with structure type mordenite,

at least partially in its acid form, at least one matrix and, optionally, at least one element selected from the group formed by groups IB and VIII of the periodic classification of the elements.

#### 5922630

##### **Hydrotreating catalyst composition and processes therefore and therewith**

Wu An-Hsiang; Drake Charles A, Bartlesville, Nowata, OK, United States, Phillips Petroleum

A catalyst composition and a process for converting a hydrocarbon stream such as, for example, a  $C_9$  + aromatic compound to  $C_6$  to  $C_8$  aromatic hydrocarbons such as xylenes are disclosed. The catalyst composition comprises an aluminosilicate, and a metal wherein the weight ratio of aluminum/silicon is in the range of about 0.002:1 to about 0.6:1. The process comprises contacting a hydrocarbon stream with the catalyst composition under a condition sufficient to effect the conversion of a hydrocarbon to a  $C_6$  to  $C_8$  aromatic hydrocarbon. Also disclosed is a process for producing the catalyst composition which comprises: (1) contacting a zeolite with steam to produce a steamed zeolite; (2) optional contacting the steamed zeolite with an effective amount of an acid under a condition sufficient to effect a reduction in aluminum content of the zeolite to produce an acid-leached zeolite; and (3) impregnating the steamed or acid-leached zeolite with an effective amount of a metal compound under a condition sufficient to effect the production of a metal-promoted zeolite.

#### 5922636

##### **Catalyst for oligomerization of alpha-olefins**

Sarin Rakesh; Ray Sabyasachi Sinha; Tuli Deepak Kumar; Rai Madan Mohan; Ghosh Sobhan; Bhatnagar Akhilesh Kumar, Faridabad, New Delhi, Faridabad, India

A catalyst composition for use in oligomerization of olefins contained in refinery distillate streams including paraffins, naphthenes, and aromatics therein, the catalyst consisting of a first constituent which is at least one aluminum halide; and a second constituent which is at least one alkoxide of a transition metal of Group IVB of the Periodic Table and which has a general formula where M is selected from the group consisting of metals

of Group IVB of the Periodic Table and R is one of (a) an alkyl group having from 1 to 12 carbon atoms or (b) an alkylaryl group having an alkyl chain having from 1 to 12 carbon atoms.

#### 5922638

##### **Process for presulfurizing hydrotreatment catalysts**

Dufresne Pierre; Brahma Nilanjan, Valence, La Voulte Sur Rhone, France, Europeene de Retraitement de Catalyseurs Eurecat

The invention relates to a process for ex-situ presulfurization of porous particles of a hydrocarbon hydroconversion catalyst that contains at least one metal or metal oxide, comprising bringing catalytic particles into contact with a presulfurizing agent that contains elementary sulfur and at least one organic liquid. It is characterized in that the process comprises preparing the presulfurizing agent in the form of an essentially homogeneous liquid and impregnating the catalyst particles with said liquid, with said elementary sulfur consequently being incorporated for the most part into the pores of the catalyst.

#### 5922639

##### **Catalysts for use in hydrocarbon conversion reactions and containing one doping metal chosen from the group consisting of titanium, zirconium, hafnium, cobalt, nickel, zinc, the lanthanides and alkali and alkaline-earth metals**

Alario Fabio; Deves Jean-Marie; Euzen Patrick, Neuilly-S/Seine, Vernouillet, Paris, France, Institut Francais du Petrole

The present invention relates to a catalyst comprising a matrix consisting of a mixture of  $\eta$  transition alumina,  $\gamma$  transition alumina, and at least one doping metal chosen from the group made up of titanium, zirconium, hafnium, cobalt, nickel, zinc, the lanthanides, the alkali metals and alkaline-earth metals, at least one halogen chosen from the group made up of fluorine, chlorine, bromine and iodine, at least one noble metal from the platinum group, and at least one promoter metal chosen from the group made up of tin, germanium, indium, gallium, thallium, antimony, lead, rhenium, manganese, chromium, molybdenum and tungsten.

**5925237****Method for inhibiting the rate of coke formation during the zeolite catalyzed aromatization of hydrocarbons**

Drake Charles A; Wu An-Hsiang, Nowata, Bartlesville, OK, United States, Phillips Petroleum

The rate of coke formation during the aromatization of gasoline boiling range hydrocarbons in which the hydrocarbons are contacted with a zeolite catalyst is significantly reduced by providing a concentration of a silylating agent in the hydrocarbon feed.

**5925238****Catalytic multi-stage hydrodesulfurization of metals-containing petroleum residua with cascading of rejuvenated catalyst**

Duddy John E; Abrams Lawrence M; Hildebrandt Steven J, Bensalem, Cherry Hill, Kendall Park, NJ, United States, IFP North America

A process for catalytic two-stage hydrodesulfurization of metal-containing petroleum residua feedstocks to achieve at least about 75% desulfurization of the liquid product while also providing at least about 40% reduction in catalyst consumption. In the process, used catalyst having a catalyst equilibrium age of 0.3–5.0 bbl oil feed/lb catalyst is withdrawn from the second stage reactor, rejuvenated so as to remove 10–50 wt.% of the contaminant metals and at least 80 wt.% of carbon deposited on the catalyst, and then cascaded forward and added to the first stage reactor. Sufficient fresh make-up catalyst is added to the second stage reactor to replace the used catalyst withdrawn there, and only sufficient fresh catalyst is added to the first stage reactor to replace any catalyst transfer losses. Used catalyst having a catalyst equilibrium age of 0.6–10.0 bbl oil/lb catalyst is withdrawn from the first stage reactor for discard.

**5925799****Catalytic distillation and hydrogenation of heavy unsaturates in an olefins plant**

Stanley Stephen J; Sumner Charles, Matawan, Livingston, NJ, United States, ABB Lummus Global

In an olefins plant for the production and recovery of ethylene and propylene, the hydrogenation of the C<sub>2</sub>

acetylenes, the C<sub>3</sub> acetylenes and dienes, and the C<sub>4</sub> and heavier acetylenes, dienes and olefins and the selective separation of the resulting products are carried out by the use of various arrangements of one or more reaction distillation columns. These columns contain a hydrogenation catalyst in enriching and stripping sections and concurrently perform a catalytic hydrogenation reaction and a distillation function.

**5925800****Conversion of oxygenates to hydrocarbons with monolith supported non-zeolitic molecular sieve catalysts**

Sun Hsiang-ning; Lai Wenyih Frank, Houston, Bridgewater, NJ, United States, Exxon Chemical Patents

The present invention provides a method for the conversion of oxygenates to olefins comprising exposing said oxygenates to a catalytic coating comprising a non-zeolitic molecular sieve catalyst coated on a support comprising inorganic materials, wherein said catalyst comprises in the range of at least about 5 wt.% of said support, under conditions effective to convert said oxygenates to olefins.

**5925801****Process for preparing high-octane gasoline components, and a catalyst**

Duplyakin Valery Kuzmich; Finevich Valentina Petrovna; Urzhuntsev Gleb Alexandrovich; Lugovskoi Alexandr Ivanovich, Omsk, Russia, Institut Kataliza Imeni G.K. Borskova Sibirskogo Otdelenia Rossiiskoi, Akademii Nauk

A process for preparing high-octane gasoline components consists in that a feed stock, composed of isobutane and olefins, preferably butylenes, in a molar ratio between 1 and 40, is contacted at temperatures from about 50°C to about 160°C and at pressures from about 1 to about 40 atm with a heterogeneous acid catalyst, whose active component is a metal-complex or metaloxopolymeric compound of the general formula H<sub>k</sub>(Me<sup>1</sup>); (Me<sup>2</sup>)<sub>m</sub>O<sub>n</sub>X<sub>p</sub> wherein k = 1–6; j = 1–3; m = 1–5; n = 1–10, p = 2–10, dispersed in a porous organic or inorganic matrix, followed by the extraction regeneration of the deactivated catalyst with an organic or inorganic solvent.



**5928499****Hydroconversion process employing catalyst with specified pore size distribution, median pore diameter by surface area, and pore mode by volume**

Sherwood Jr. David Edward; Dai Pei-Shing Eugene, Beaumont, Port Arthur, TX, United States, Texaco

A process for hydrotreating a hydrocarbon feed containing components boiling above 1000°F and sulfur, metals and carbon residue utilizing a heterogeneous catalyst having a specified pore size distribution, median pore diameter by surface area and pore mode by volume, to give a product containing a decreased content of components boiling above 1000°F and decreased sulfur, metals and carbon residue is disclosed. The process includes contacting the hydrocarbon feed with hydrogen in the presence of the catalyst at isothermal hydroconversion conditions. The catalyst includes an porous alumina support containing less than or equal to 2.5 wt.% silica on the finished catalyst basis, and bearing 2.2–6 wt.% of a Group VIII metal oxide, 7–24 wt.% of a Group VIB metal oxide and preferably less than 0.2 wt.% of a phosphorous oxide. The catalyst may be characterized as having a Total Surface Area of 215–245 m<sup>2</sup>/g, a Total Pore Volume of 0.82–0.98 cm<sup>3</sup>/g, a Median Pore Diameter by Surface Area of 91–104 Å, and a Pore Diameter Distribution in which 22.0–33.0% of the total Pore Volume is present as macropores of a diameter greater than 250 Å, 67.0–78.0% of the Total Pore Volume is present as micropores of a diameter less than 250 Å. Greater than or equal to 65% of the micropore volume is present as micropores having a diameter  $\pm 25$  Å about a Pore Mode by volume of 86–99 Å. Less than 0.08 cm<sup>3</sup>/g of the micropore volume is present in micropores with diameters less than 80 Å.

**5928983****Process for the preparation of high activity carbon monoxide hydrogenation catalysts and the catalyst compositions**

Culross Claude C, Baton Rouge, LA, United States, Exxon Research and Engineering

A process for the preparation of a novel highly active, highly selective catalyst useful for conducting carbon monoxide hydrogenation reactions, particularly Fischer–Tropsch reactions, the catalyst per se, and process for use of such catalyst in conducting carbon

monoxide hydrogenation reactions, particularly Fischer–Tropsch Synthesis reactions. The catalyst is prepared by contacting together, preferably by dispersing in a liquid, a preformed, particulate refractory inorganic oxide support, preferably a fumed silica support, compound or salt of a catalytic metal, or metals, i.e., a metal selected from Groups IB, IIB, VIIB or VIII of the Periodic Table, preferably cobalt, an oxidizable alcohol, oxidizable aldehyde, or oxidizable ketone promoter, suitably glyoxal, and an oxidant sufficient to react with the promoter and convert the metal, or metals, to an insoluble highly dispersed metal carboxylate which is deposited and supported on the support. The solids are recovered, and heated at an elevated temperature to reduce the catalytic metal, or metals, to the zero-valent state and form the catalyst composite. This catalyst in its reduced form is very active, and selective, in conducting carbon monoxide hydrogenation reactions, particularly in converting a mixture of hydrogen and carbon monoxide to C<sub>5</sub> + hydrocarbons, on contact of the gaseous mixture with the catalyst at reaction conditions.

**5929296****Catalyst based on dealuminated mordenite and its use for dismutation and/or transalkylation of aromatic hydrocarbons**

Merlen Elisabeth; Alario Fabio, Rueil Malmaison, Neuilly Sur Seine, France, Institut Francais du Petrole

A catalyst for transforming aromatic hydrocarbons, preferably for dismutation of toluene to produce benzene and xylenes and transalkylation of toluene and aromatic compounds containing at least 9 carbon atoms per molecule, preferably trimethylbenzenes, to produce xylenes, contains a mordenite in its acid form in a proportion of 40–90% by weight and a binder, which is preferably alumina, and which is generally present in a proportion of 10–60% by weight. The mordenite contains less than 0.1% by weight of sodium and has a SiO<sub>2</sub>/Al<sub>2</sub>O<sub>3</sub> molar ratio of over 40:60.

**ORGANOMETALLIC CATALYSIS****5916975****Process for epoxidising prochiral olefins and a catalyst therefor and intermediates for making the catalyst**

Bell David; Finney Frances; Attrill Robin Patrick; Miller David; Turner Gillian, Hertfordshire, Essex, United Kingdom, Smith Kline Beecham

A process for enantioselectively epoxidising a prochiral olefin, which comprises reacting a prochiral olefin with a source of oxygen in the presence of a salen catalyst and a source of an electron donating ligand, is characterized in that the donor ligand is isoquinoline N-oxide or a compound having donor ligand activity and having substantially the same solubility characteristics as isoquinoline N-oxide.

#### 5919948

##### **Asymmetric ligands useful for transition metal catalyzed bond forming reactions and epoxide reactions therewith**

Trost Barry M; Bunt Richard C, Los Altos Hills, Redwood City, CA, United States, The Board of Trustees of the Leland Stanford Junior University

A novel ligand having the Formula 1 structure has proved remarkably successful in the amination of butadiene monoepoxide, which is a potentially desirable substrate for an asymmetric synthesis providing access to each enantiomer of vinylglycinol. This and other ligands described are useful for chiral induction of bond forming reactions with an epoxide substrate.

#### 5919984

##### **Catalytic process for the selective oxidation of organic tertiary polyphosphines to phosphine monooxides**

Grushin Vladimir, Greenville, DE, United States

This invention concerns a process for the selective mono oxidation of organic tertiary polyphosphines to phosphine monooxides. These monooxides are useful as ligands for transition metals in the formation of transition metal catalysts.

#### 5922634

##### **Catalyst systems based on rhodium complexes containing diphosphine ligands and their use in the preparation of aldehydes**

Bahrman Helmut; Lappe Peter; Muller Thomas, Hamminkeln, Plano, Dinslaken, TX, Germany, Hoechst Aktiengesellschaft

A water-soluble catalyst composition comprising rhodium complexes containing diphosphine ligands,

wherein the diphosphine ligands present are compounds of the formula where  $R^1$  is selected from the group consisting of carboxylate ( $\text{COO}^-$ ), sulfonate ( $\text{SO}_3^-$ ), phosphonate ( $\text{PO}_3^{2-}$ ) and 2-amino ethanebisphosphonate  $\text{NH}-\text{CH}_2-\text{CH}(\text{PO}_3^{2-})_2$ ,  $R^2$  is selected from the group consisting of a straight-chain alkylene of 1 to 8 carbon atoms, an oxygen-containing alkylene of 2–6 carbon atoms, cycloalkylene of 3–10 carbon atoms and a member of the formulae II, III, IV or V, a, b, c, d, e, f, g, h, k and l are individually 0 to 1, where at least one of a, b, c, d, e, f, g, h, k or l has to be equal to 1, x(s) are individually 0 or 1, y is an integer of 1–24,  $R^3$  and  $R^4$  are individually selected from the group consisting of alkyl of 4–26 carbon atoms, substituted or unsubstituted aryl of 6–10 carbon atoms, cycloalkyl of 6–10 carbon atoms and benzyl and  $R^3$  can also be hydrogen and the use thereof in hydroformylations.

#### 5929265

##### **Binuclear iridium(I) phosphine complexes and their use as catalyst in the asymmetric hydroamination of olefins**

Dorta Romano; Egli Patrick; Bieler Nikolaus H; Togni Antonio; Eyer Martin, Chur, Alpnach, Glis, Oberwil, Glis, Switzerland, Lonza

Binuclear iridium(I) phosphine complexes of the general formula in which X is fluorine, chlorine, bromine or iodine, and is in each case a chiral bidentate diphosphine ligand. The complexes are particularly suitable as catalysts for the inter- or intramolecular asymmetric hydroamination of prochiral olefins.

#### 5929273

##### **Process for preparing diphosphines ligands and catalysts containing the same**

Kohlpaintner Christian W; Hanson Brian E; Ding Hao, Corpus Christi, Blacksburg, VA, United States, Celanese International

The present invention provides novel water-soluble diphosphines having the formula wherein X, Y,  $R_{1-18}$  and n are defined herein, and which can be complexed with a transition metal to form a novel catalyst useful in such applications as hydroformylation.