Description

The invention relates to a process for the preparation of a silver-containing catalyst suitable for the preparation of ethylene oxide and to the use of the catalyst for the preparation of ethylene oxide.

It is generally known for a silver-containing catalyst to be employed in the preparation of ethylene oxide from ethylene. In order to obtain improved silver catalysts, efforts have been directed for many years towards modifying the silver catalysts with the aid of promoters. For example, in the British Patent Specification 1,413,251 is described a process for the preparation of a catalyst in which a silver compound is applied to a carrier, and the applied silver compound is reduced to silver and in which catalyst a promoter in the form of potassium oxide, rubidium oxide or caesium oxide or a mixture thereof is present on the carrier.

In our earlier patent application EP-A-0207550 is described a process for the preparation of a silver-containing catalyst suitable for the oxidation of ethylene to ethylene oxide, whereby a silver compound and, if desired, a promoter are applied to an alkali enriched carrier, after which the silver compound is reduced to metallic silver, and in which process the alkali enriched carrier has been prepared by mixing an aluminium compound with a salt of a metal of Group 1^A of the Periodic System and by calcining the mixture.

An alternative process has been found, wherein an alkali enriched carrier has been prepared by mixing a hydroxide of a metal of Group 1^A of the Periodic System, especially cesium hydroxide, an organic fluorine compound and an aluminium compound and by calcinating the obtained mixture. The carrier is then used in the preparation of silver catalysts which have an improved stability.

This is surprising since silver catalysts made from alkali enriched alumina carriers, prepared with alkali metal hydroxides without the addition of an organic fluorine compound, are much less stable silver catalysts.

The invention relates to a process for the preparation of a silver-containing catalyst suitable for the oxidation of ethylene to ethylene oxide, characterized in that a silver compound and, if desired, a promoter are applied to a carrier, after which the silver compound is reduced to metallic silver, and in which process the carrier has been prepared by mixing an aluminium compound with a hydroxide of a metal of Group 1^A of the Periodic System and with an organic fluorine compound and by calcining the obtained mixture.

The aluminium compounds can be a variety of modifications of aluminium oxide, which when calcined at between 1200 °C and 1700 °C produce alpha-aluminium oxide, such as gamma-aluminium oxide. Another possibility is to choose a hydrated aluminium oxide, such as boehmite, which via gamma-aluminium oxide produces alpha-aluminium oxide.

The hydroxides of the metals of Group 1^A of the Periodic System are lithium, sodium, potassium, rubidium or caesium. Preferably, potassium, rubidium or caesium hydroxide are used. Caesium hydroxide is particularly suitable.

The quantity of hydroxide of the alkali metal that is mixed with the aluminium compound is chosen such that the atom ratio of the metal of Group 1^A/Al is between 0.0001 and 0.1, preferably between 0.001 and 0.01.

For the preparation of the alkali enriched carrier, preferably an aluminium compound is mixed with water, hydroxide of a metal of Group 1^A of the Periodic System and an organic fluorine compound, the mixture thus obtained is extruded to shaped particles which are subsequently calcined. The calcination can take place in one or more steps, depending on the choice of starting material. In general, sufficient water is added to make the mixture extrudable. The extrudable applied paste obtained is then extruded in an extrusion press to form shaped pieces. These shaped pieces are heated, during which water still present is evaporated. The solid pieces are calcined. In order to prepare the alpha aluminium oxide modification, calcination up to a temperature of between 1200 °C and 1700 °C is necessary. Suitable starting materials are powders of gamma-aluminium oxide, alpha-aluminium oxide monohydrate, alpha-aluminium oxide trihydrate and beta-aluminium oxide monohydrate, which are sintered during the calcination, with fusion of the powder particles taking place. The heating and calcination also changes the crystal structure: the cubic structure of gamma aluminium oxide changes into the hexagonal structure of alpha aluminium oxide.

The organic fluorine compound may be a fluorinated alkane, a fluorinated alkene polymer such as teflon, or a fluorinated alkane carboxylic acid, or its salt or ester. The acid may be a monocarboxylic, a dicarboxylic or a polycarboxylic acid. Preferably the acid contains from 2 to 10 carbon atoms. Especially referred are perfluorinated alkane monocarboxylic acids, having two to ten carbon atoms, such as trifluoro acetic acid and pentafluoro propionic acid. Generally the amount of organic fluorine compound applied is between 0.1 and 10% by weight of the mixture of alkali hydroxide and aluminium compound.

The effective catalyst surface area can vary from between 0.2 and 5 m^2/g. It has also been found that

for the alpha-aluminium oxide, the alkali metal (caesium) is present at the surface in a concentration higher than is to be expected on the basis of the weighed-out quantity of alkali metal.

In order to prepare a catalyst, the alkali enriched carrier is then impregnated with a solution of a silver compound, sufficient to apply, as wished, 1 to 25 weight per cent of silver, calculated on the weight of the total catalyst, to the carrier. The impregnated carrier is separated from the solution and the precipitated silver compound is reduced to silver.

Preferably, a promoter is added, for example one or more of the alkali metals: potassium, rubidium or caesium. The promoters can be applied to the carrier before, during or after the impregnation with silver compound takes place. The promoter can also be applied to the carrier after the silver compound has been reduced to metallic silver.

In general, the carrier is mixed with an aqueous solution of a silver salt or silver complex, so that the carrier is impregnated with this solution, after which the carrier is separated from the solution and subsequently dryed. The impregnated carrier is then heated to a temperature of between 100 °C and 400 °C for a period necessary for the silver salt (or complex) to decompose and form a finely distributed layer of metallic silver which adheres to the surfaces. A reducing or inert gas can be passed over the carrier during the heating.

Various methods are known for adding the silver. The carrier can be impregnated with an aqueous solution of silver nitrate, then dried, after which the silver nitrate is reduced with hydrogen or hydrazine. The carrier can also be impregnated with an ammoniacal solution of silver oxalate or silver carbonate, the deposition of silver metal being effected by thermally decomposing the salt. Special solutions of a silver salt with certain solubilizing and reducing agent, such as combinations of vicinal alkanolamines, alkyldiamines and ammonia also serve the purpose.

The quantity of added promoter is generally between 20 and 1000 parts by weight of an alkali metal, such as potassium, rubidium or caesium (as metal) per million parts by weight of total catalyst. 50 to 300 parts by weight of alkali metal is particularly suitable. Suitable compounds to serve as starting material for promoters are, for example, nitrates, oxalates, carboxylic acid salts or hydroxides. The most preferred promoter is caesium, the caesium being preferably employed as caesium hydroxide or caesium nitrate.

Some excellent methods are known for adding the alkali metal as promoter in which this metal can be applied at the same time as the silver. Suitable alkali metal salts are generally salts which are soluble in the silver-depositing liquid phase. Besides the above-mentioned salts, it is also worth mentioning nitrates, chlorides, iodides, bromides, bicarbonates, acetates, tartrates, lactates and isopropoxides. The use of alkali metal salts which react with the silver present in the solution and thus cause silver salts to be prematurely precipitated from an impregnating solution should, however, be avoided. For example, potassium chloride should not be used for impregnating techniques in which an aqueous silver nitrate solution is used, but potassium nitrate can be used instead. Potassium chloride can be suitably used in a process in which an aqueous solution of silver amine complexes, from which no silver chloride will precipitate, is used.

In addition, the amount of alkali metal deposited on the carrier can be adjusted within certain limits by washing out a part of the alkali metal with, preferably, anhydrous methanol or ethanol. This method is employed subsequently if the concentration of the applied alkali metal is found to be too high. The temperatures, contact times and the drying with gases can be adjusted. Care should be taken to ensure that no traces of alcohol remain in the carrier.

A preferably employed process consists of the carrier being impregnated with an aqueous solution containing both alkali metal salt and silver salt, the impregnating solution being composed of a silver salt of a carboxylic acid, an organic amine, a salt of potassium, rubidium or caesium and an aqueous solvent. For example, a potassium-containing silver oxalate solution can be prepared in two ways. Silver oxide can be reacted with a mixture of ethylene diamine and oxalic acid, giving a solution containing a silver oxalate ethylene diamine complex, to which a certain amount of potassium and possibly other amines such as ethanolamine is added. Silver oxalate can also be precipitated from a solution of potassium oxalate and silver nitrate, the silver oxalate thus obtained then being repeatedly washed in order to remove the attached potassium salts until the desired potassium content is obtained. The potassium-containing silver oxalate is then solubilized with ammonia and/or amine. Solutions containing rubidium and caesium can also be prepared in this way. The thus impregnated carriers are then heated to a temperature of between 100 °C and 400 °C, preferably between 125 °C and 325 °C.

It should be noted that, irrespective of the nature of the silver in the solution before the precipitation onto the carrier, reference is always made to reduction to (metallic) silver, whereas it could also be referred to as decomposition on heating. It is preferred to think in terms of reduction, since positively charge Ag ions are converted into metallic Ag. The reduction times can be simply adapted to the starting materials employed.

As mentioned above, a promoter is preferably added to the silver. Caesium is the most preferred promoter in view of the fact that its selectivity for ethylene oxide has been found to be the highest in comparison with the use of potassium or rubidium as promoter.

The silver catalysts prepared by the process according to the present invention appear to be particularly stable catalysts for the direct catalytic oxidation of ethylene to ethylene oxide with the aid of molecular oxygen. The conditions for carrying out the oxidation reaction in the presence of the silver catalysts according to the invention are fairly similar to those already described in the literature. This applies to, for example, suitable temperatures, pressures, residence times, diluents such as nitrogen, carbon dioxide, steam, argon, methane or other saturated hydrocarbons, the presence or absence of moderating agents to control the catalytic action, for example 1,2-dichloroethane, vinyl chloride or chlorinated polyphenyl compounds, the desirability of employing either recirculating treatments of successive conversion in different reactors to enhance the yield of ethylene oxide, as well as any other special conditions which may be chosen for processes for the preparation of ethylene oxide. Usually, the pressures employed vary from about atmospheric pressure to about 35 bar. Higher pressures are, however, by no means excluded. The molecular oxygen employed as reactant can be obtained from conventional sources. The oxygen feed can consist substantially of relatively pure oxygen, a concentrated oxygen stream consisting of a large amount of oxygen with smaller amounts of one or more diluents, such as oxygen, argon, etc., or another oxygen-containing stream, such as air.

In a preferably employed application of the silver catalysts according to the present invention, ethylene oxide is prepared by contacting an oxygen-containing gas that has been separated from air and that contains not less than 95% oxygen with ethylene in the presence of the catalysts in question at a temperature within the range of 210 °C to 285 °C and preferably between 225 °C and 270 °C.

In the reaction of ethylene with oxygen to ethylene oxide, the ethylene is present in at least a double molecular quantity, but the quantity of ethylene employed is generally much higher. The conversion is therefore calculated according to the quantity of converted oxygen in the reaction and we therefore speak of oxygen conversion. This oxygen conversion is dependent on the temperature of the reaction and is a measure of the activity of the catalyst. The values T_{30}, T_{40} and T_{50} refer to the temperatures at 30 mol%, 40 mol% and 50 mol% conversion respectively of the oxygen in the reactor. The temperatures are generally higher for a higher conversion and are highly dependent on the catalyst employed and the reaction conditions. In addition to these T-values, selectively values are important, which indicate the molar percentage of ethylene oxide in the reaction mixture obtained. The selectivity is indicated as S_{30}, S_{40} or S_{50}, which refers to the selectivity at 30%, 40% or 50% oxygen conversion respectively.

The expression "stability" of a catalyst cannot be expressed directly. Stability measurements require trials of long duration. For measuring the stability, the applicant has a number of tests which are carried out under extreme conditions with space velocities of 30,000 litre.(litre catalyst)$^{-1}$.h^{-1}, where litres of throughput gas are understood to be litres STP (standard temperature and pressure). This space velocity is many times higher than the space velocity in commercial processes. The test is carried out for at least 1 month. The above-mentioned T- and S-values are measured during the entire period of the test. After the test has been broken off, the total quantity of ethylene oxide produced per ml catalyst is determined. The difference in selectivity and activity is calculated for a catalyst which would have produced 1000 gram ethylene oxide per ml catalyst. A new catalyst is considered to be more stable than a known catalyst if the differences in the T- and S-values of the new catalyst are smaller than those of the standard catalyst which is present during each test. The stability tests are carried out at 35% oxygen conversion.

Example 1

0.44 g caesium hydroxide dissolved in 110 ml water was mixed with 27 g Kaiser aluminium oxide ($Al_2O_3.H_2O$) by adding the aqueous caesium hydroxide solution to the aluminium oxide, and the mixture was kneaded for 5 minutes in a masticator. To this mixture was added 5 g penta fluoropropionic acid in 50 ml water and the resulting mixture was kneaded for 15 minutes. Then 108 g Kaiser aluminium oxide (Al_2O_3 . H_2O) was added and the mixture was further kneaded for 15 minutes. The paste obtained was left to stand for three hours and then extruded. The resulting shaped pieces were dried for 1 hour at 120 °C and subsequently calcined at progressively higher temperatures. Calcination was started with the temperature rising at a rate of 200 °C/h to 700 °C. Calcination was then continued for 1 hour at 700 °C, after which the temperature was raised in 2 hours to 1600 °C. Finally, calcination was continued for 1 hour at 1600 °C. The pore volume of the shaped aluminium oxide pieces was 0.50 ml.g^{-1} and the average pore diameter was 0.75 µm. The resulting shaped pieces were impregnated with an aqueous solution of silver oxalate, to which caesium hydroxide was added. The impregnation was carried out for 10 minutes under vacuum, after

which the shaped pieces were separated from the solution and placed in a hot air stream at a temperature of 250-270 °C for 10 minutes in order to convert the silver salt to silver. The aqueous solution of silver oxalate was a 28 wt% Ag-containing aqueous solution in which the silver oxalate was complexed with ethylene diamine and to which solution caesium hydroxide was added. After the hot air treatment the thus impregnated shaped pieces contained 16.7 wt% Ag (calculated on total catalyst) and 490 parts by weight of caesium per million parts by weight of total catalyst.

The catalyst obtained was then tested. A cylindrical steel reactor with a length of 15 cm and a cross-section of 3 mm was filled entirely with catalyst particles of about 0.3 mm in size. The reactor was placed in a bath in which silicon/aluminium particles were present in a fluidized state. A gas mixture with the following composition was passed through the reactor: 30 mol% ethylene, 8.5 mol% oxygen, 7 mol% carbon dioxide and 54.5 mol% nitrogen and 7 parts per million parts of gas of vinyl chloride as moderator. The space velocity was 30,000 $1.1^{-1}.h^{-1}$. The pressure was 15 bar and the temperature was dependent on the set oxygen conversion. The measuring equipment was connected to the reactor and to a computer such that the conversion and the temperature could be accurately controlled. The concentrations of the reaction components were determined with the aid of gas chromatography and mass spectrometry. The stability test was carried out at an oxygen conversion of 35%.

The reaction temperature at 35% oxygen conversion was determined during the entire duration of the test. The selectivity in respect of ethylene oxide was also determined. After at least 30 days the test was broken off and the total quantity of ethylene oxide produced per ml catalyst was determined. From the measured reaction temperatures the temperature increase in °C was calculated for the moment at which 1000 g ethylene oxide per ml catalyst would have been produced

$$(\Delta T_{35}^{1000}).$$

From the measured selectivities, the selectivity decrease in %mol was calculated for the moment at which 1000 g ethylene oxide per ml catalyst would have been produced

$$(\Delta S_{35}^{1000}).$$

The same measurements and calculations were carried out for a standard catalyst in the test.

The table shows the values

$$\Delta S_{35}^{1000}$$

and

$$\Delta T_{35}^{1000}$$

in comparison with the values of a standard catalyst.

Example	Catalyst		ΔS_{35}^{1000} (%m)	ΔT_{35}^{1000} (°C)
	wt.% Ag	ppm Cs		
1	16.7	490	1.6	18
COMP.	S839		2.3	11

Claims

1. A process for the preparation of a silver-containing catalyst suitable for the oxidation of ethylene to ethylene oxide, characterized in that a silver compound and, if desired, a promoter are applied to a carrier, after which the silver compound is reduced to metallic silver, and in which process the carrier has been prepared by mixing an aluminium compound with a hydroxide of a metal of Group 1^A of the Periodic System and with an organic fluorine compound and by calcining the obtained mixture.

2. A process according to claim 1, characterized in that the aluminium compound is an aluminium oxide or a hydrate of aluminium oxide.

3. A process according to claim 1 or 2, characterized in that the organic fluorine compound is a fluorinated alkane, a fluorinated alkene polymer or a fluorinated alkane carboxylic acid, its salt or ester.

4. A process according to claim 3, characterized in that the organic fluorine compound is a perfluorinated alkane monocarboxylic acid, having from 2 to 10 carbon atoms.

5. A process according to one or more of claims 1-4, characterized in that the aluminium compound is mixed with caesium hydroxide.

6. A process according to one or more of claims 1-5, characterized in that the aluminium compound is mixed with a quantity of hydroxide such that the atom ratio of metal of Group I^A/Al is between 0.0001 and 0.1, preferably between 0.001 and 0.01.

7. A process according to one or more of the claims 1-6, characterized in that the amount of organic fluorine compound applied is between 0.1 and 10 percent by weight of the mixture of alkali hydroxide and aluminium compound.

8. A process according to one or more of claims 1-7, characterized in that the aluminium compound is mixed with water, the hydroxide of a metal of Group 1^A of the Periodic System and the organic fluorine compound, the resulting mixture being extruded to shaped carrier particles which are then calcined.

9. A process according to one or more of claims 1-8, characterized in that the carrier is impregnated with a solution of a silver compound sufficient to apply 1 to 25 weight per cent of silver, calculated on the weight of the total catalyst on the carrier, the impregnated carrier being separated from the solution and the precipitated silver compound being reduced to silver.

10. A process according to claim 9, characterized in that besided the silver compound applied to the carrier, a sufficient quantity of one or more compounds of the alkali metals potassium, rubidium or caesium is applied as promotor, either simultaneously or not, to the carrier to deposit between 20 and 1000 parts by weight of alkali metal (measured as metal) per million parts by weight of total catalyst.

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3. A process according to claim 1 or 2, characterized in that the organic fluorine compound is a fluorinated alkane, a fluorinated alkene polymer or a fluorinated alkane carboxylic acid, its salt or ester.

4. A process according to claim 3, characterized in that the organic fluorine compound is a perfluorinated alkane monocarboxylic acid, having from 2 to 10 carbon atoms.

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11. A process for the preparation of ethylene oxide by oxidation of ethylene in the presence of a silver-containing catalyst, characterized in that the process is carried out in the presence of a silver-containing catalyst prepared by means of the process according to one or more of claims 1-10.

Revendications

1. Procédé de préparation d'un catalyseur contenant de l'argent, approprié pour l'oxydation de l'éthylène en oxyde d'éthylène,, caractérisé en ce qu'on applique un composé dérivé de l'argent et, si on le souhaite, un promoteur, sur un support, après quoi le composé dérivé de l'argent est réduit en argent métallique, et selon lequel le support est préparé en mélangeant un composé dérivé de l'aluminium avec un hydroxyde de métal du groupe 1^A du Tableau périodique, et avec un composé organique fluoré, et en calcinant le mélange obtenu.

2. Procédé selon la revendication 1, caractérisé en ce que le composé dérivé de l'aluminium, est un oxyde d'aluminium ou un hydrate d'oxyde d'aluminium.

3. Procédé selon la revendication 1 ou 2, caractérisé en ce que le composé organique fluoré, est un alcane fluoré, un polyalcène fluoré ou un acide alcane carboxylique fluoré, un sel ou un ester de celui-ci.

4. Procédé selon la revendication 3, caractérisé en ce que le composé organique fluoré, est un acide alcane monocarboxylique perfluoré, comportant de 2 à 10 atomes de carbone.

5. Procédé selon au moins une des revendications 1 à 4, caractérisé en ce que le composé dérivé de l'aluminium, est mélangé avec de l'hydroxyde de césium.

6. Procédé selon au moins une des revendications 1 à 5, caractérisé en ce que le composé dérivé de l'aluminium, est mélangé avec une quantité d'hydroxyde telle que le rapport atomique du métal du groupe 1^A à l'aluminium, est de 0,0001 à 0,1, de préférence de 0,001 à 0,01.

7. Procédé selon au moins une des revendications 1 à 6, caractérisé en ce que la quantité de composé organique fluoré appliquée, est de 0,1 à 10 % en poids par rapport au mélange d'hydroxyde alcalin et du composé dérivé de l'aluminium.

8. Procédé selon au moins une des revendications 1 à 7, caractérisé en ce que le composé dérivé de l'aluminium, est mélangé avec de l'eau, l'hydroxyde de métal du groupe 1^A du Tableau périodique, et le composé organique fluoré, le mélange résultant étant extrudé pour façonner des particules de support qui sont ensuite calcinées.

9. Procédé selon au moins une des revendications 1 à 8, caractérisé en ce que le support est imprégné avec une solution d'un composé dérivé de l'argent, selon une quantité suffisante pour appliquer de 1 à 25 pour cent en poids d'argent, par rapport au poids du catalyseur total sur le support, le support imprégné étant séparé de la solution, et le composé dérivé de l'argent précipité étant réduit en argent.

10. Procédé selon la revendication 9, caractérisé en ce qu'outre le composé dérivé de l'argent appliqué sur le support, on applique, comme promoteur, en même temps ou non sur le support, une quantité suffisante d'au moins un composé dérivé d'un métal alcalin choisi parmi le potassium, le rubidium ou le césium, afin de déposer de 20 à 1 000 parties en poids de métal alcalin (en calculant par rapport au métal) par million de parties en poids de catalyseur total.

11. Procédé de préparation d'oxyde d'éthylène, par oxydation de l'éthylène en présence d'un catalyseur contenant de l'argent, caractérisé en ce que le procédé est mis en oeuvre en présence d'un catalyseur contenant de l'argent, préparé en mettant en oeuvre le procédé selon au moins une des revendications 1 à 10.

Patentansprüche

1. Verfahren zur Herstellung eines zur Oxidation von Ethylen zu Ethylenoxid geeigneten, Silber enthalten-

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den Katalysators, dadurch gekennzeichnet, daß eine Silberverbindung und gewünschtenfalls ein Promotor auf einen Träger aufgebracht werden, wonach die Silberverbindung zu metallischem Silber reduziert wird, und in welchem Verfahren der Träger durch Vermischen einer Aluminiumverbindung mit einem Hydroxid eines Metalles der Gruppe 1^A des Periodensystems der Elemente und mit einer organischen Fluorverbindung und durch Kalzinieren des erhaltenen Gemisches hergestellt worden ist.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß die Aluminiumverbindung ein Aluminiumoxid oder ein Aluminiumoxidhydrat ist.

3. Verfahren nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die organische Fluorverbindung ein fluoriertes Alkan, ein fluoriertes Alkenpolymer oder eine fluorierte Alkankarbonsäure, deren Salz oder deren Ester ist.

4. Verfahren nach Anspruch 3, dadurch gekennzeichnet, daß die organische Fluorverbindung eine perfluorierte Alkanmonokarbonsaüre mit 2 bis 10 Kohlenstoffatomen ist.

5. Verfahren nach einem oder mehreren der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß die Aluminiumverbindung mit Cäsiumhydroxid vermischt wird.

6. Verfahren nach einem oder mehreren der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß die Aluminiumverbindung mit einer solchen Menge an Hydroxid vermischt wird, daß das Atomverhältnis von Metall der Gruppe 1^A zu Aluminium von 0,0001 bis 0,1, vorzugsweise von 0,001 bis 0,01 beträgt.

7. Verfahren nach einem oder mehreren der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß die Menge an angewendeter organischer Fluorverbindung von 0,1 bis 10 Gew.-% des Gemisches aus Alkalihydroxid und Aluminiumverbindung beträgt.

8. Verfahren nach einem oder mehreren der Ansprüche 1 bis 7, dadurch gekennzeichnet, daß die Aluminiumverbindung mit Wasser, dem Hydroxid eines Metalles der Gruppe 1^A des Periodensystems der Elemente und der organischen Fluorverbindung vermischt wird, und das erhaltene Gemisch zu geformten Trägerteilchen extrudiert wird, die dann kalziniert werden.

9. Verfahren nach einem oder mehreren der Ansprüche 1 bis 8, dadurch gekennzeichnet, daß der Träger mir einer Lösung einer Silberverbindung imprägniert wird, die zum Aufbringen von 1 bis 25 Gew.-% Silber, berechnet auf das Gewicht des Gesamtkatalysators, auf den Träger ausreicht, der imprägnierte Träger von der Lösung abgetrennt wird und die ausgefällte Silberverbindung zu Silber reduziert wird.

10. Verfahren nach Anspruch 9, dadurch gekennzeichnet, daß zusätzlich zu der auf den Träger aufgebrachten Silberverbindung eine ausreichende Menge einer oder mehrerer Verbindung der Alkalimetalle Kalium, Rubidium oder Cäsium, entweder gleichzeitig oder auch nicht, als Promotor auf den Träger aufgebracht wird, um 20 bis 1000 Gewichtsteile Alkalimetall (gemessen als Metall) je Million Gewichtsteile Gesamtkatalysator abzulagern.

11. Verfahren zur Herstellung von Ethylenoxid durch Oxidation von Ethylen in Gegenwart eines Silber enthaltenden Katalysators, dadurch gekennzeichnet, daß das Verfahren in Anwesenheit eines Silber enthaltend Katalysators, der mittels des Verfahrens nach eine oder mehreren der Ansprüche 1 bis 10 hergestellt worden ist, ausgeführt wird.

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