Claims

[Claim 1]

An oxide catalyst for use in an oxidation reaction of an olefin and/or an alcohol, the oxide catalyst comprising:

the oxide catalyst contains molybdenum, bismuth, iron, cobalt, and cerium; an atomic ratio a of bismuth to 12 atoms of molybdenum is $2 \leq a \leq 6$, an atomic ratio b of iron to 12 atoms of molybdenum is $2.5 < b \leq 5$, an atomic ratio c of cobalt to 12 atoms of molybdenum is $2 \leq c \leq 8$, an atomic ratio d of cerium to 12 atoms of molybdenum is $0.5 \leq d \leq 6$, and an atomic ratio of iron/cobalt is $0.4 \leq b/c \leq 2.5$;

wherein when a spacing d of a complex oxide of cerium and molybdenum showing a peak at 33.50° in a X-ray diffraction is taken as a reference, a change rate of d is 5000 to 9000 ppm.

[Claim 2]

The oxide catalyst according to claim 1, wherein the oxide catalyst has a composition represented by the following composition formula (1):

$$Mo_{12}Bi_aFe_bCo_cCe_dA_eB_fO_g \quad (1),$$

wherein Mo represents molybdenum; Bi represents bismuth; Fe represents iron; Co represents cobalt; Ce represents cerium; A represents at least one element selected from the group consisting of cesium and rubidium; B represents at least one element selected from the group consisting of copper, nickel, magnesium, and lead; a to f represents an atomic ratio of each element to 12 atoms of Mo; $2 \leq a \leq 6$, $2.5 < b \leq 5$, $2 \leq c \leq 8$, $0.4 \leq b/c \leq 2.5$, $0.5 \leq d \leq 6$, $0.01 \leq e \leq 2$, and $0 \leq f < 2$ are satisfied; and g represents number of oxygen atoms determined by a valence of a constituent element other than oxygen.

[Claim 3]

A method for producing the oxide catalyst according to claim 1 or 2, the method comprising the steps of:

aging a starting material slurry comprising molybdenum, bismuth, iron, cobalt, and cerium at a temperature of 30°C or more and 80°C or less;

drying the aged starting material slurry;

preliminarilly calcining the dried product at 120°C or more and 350°C or less; and

subsequently finally calcining the preliminarilly calcined product at a temperature of 400°C or more and 700°C or less.

[Claim 4]

A method for producing an unsaturated aldehyde comprising the step of oxidizing at least one olefin selected from the group consisting of propylene and isobutylene and/or t-butyl alcohol using the oxide catalyst according to claim 1 or 2.

Claims

[Claim 1]

An oxide catalyst for use in an oxidation reaction of an olefin and/or an alcohol, the oxide catalyst comprising:

the oxide catalyst contains molybdenum, bismuth, iron, cobalt, and cerium; an atomic ratio a of bismuth to 12 atoms of molybdenum is $2 \leq a \leq 6$, an atomic ratio b of iron to 12 atoms of molybdenum is $2.5 < b \leq 5$, an atomic ratio c of cobalt to 12 atoms of molybdenum is $2 \leq c \leq 8$, an atomic ratio d of cerium to 12 atoms of molybdenum is $0.5 \leq d \leq 6$, and an atomic ratio of iron/cobalt is $0.4 \leq b/c \leq 2.5$;

wherein when a spacing d of a complex oxide of cerium and molybdenum showing a peak at 33.50° in a X-ray diffraction is taken as a reference, a change rate of d is 5000 to 9000 ppm.

[Claim 2]

The oxide catalyst according to claim 1, wherein the oxide catalyst has a composition represented by the following composition formula (1):

$$Mo_{12}Bi_aFe_bCo_cCe_dA_eB_fO_g \quad (1),$$

wherein Mo represents molybdenum; Bi represents bismuth; Fe represents iron; Co represents cobalt; Ce represents cerium; A represents at least one element selected from ~~the group consisting of cesium and rubidium; B represents~~

at least one element selected from the group consisting of copper, nickel, magnesium, and lead; a to f represents an atomic ratios of each element to 12 atoms of Mo; $2 \leq a \leq 6$, $2.5 < b \leq 5$, $2 \leq c \leq 8$, $0.4 \leq b/c \leq 2.5$, $0.5 \leq d \leq 6$, $0.01 \leq e \leq 2$, and $0 \leq f < 2$ are satisfied; and g represents number of oxygen atoms determined by a valence of a constituent element other than oxygen.

[Claim 3]

A method for producing the oxide catalyst according to claim 1 or 2, the method comprising the steps of:

aging a starting material slurry comprising molybdenum, bismuth, iron, cobalt, and cerium at a temperature higher than room temperature;

drying the aged starting material slurry;

preliminarilly calcining the dried product at 120°C or more and 350°C or less; and

subsequently finally calcining the preliminarilly calcined product at a temperature of 400°C or more and 700°C or less.

[Claim 4]

A method for producing an unsaturated aldehyde comprising the step of oxidizing at least one olefin selected from the group consisting of propylene and isobutylene and/or t-butyl alcohol using the oxide catalyst according to claim 1 or 2.