CLAIMS

[Claim 1]

A methacrylic acid production catalyst for use in producing methacrylic acid by a gas-phase catalytic oxidation of methacrolein with molecular oxygen, the catalyst having a composition represented by the following Formula (1),

$$P_aMo_bV_cNb_dCu_eA_fE_gG_h(NH_4)_iO_j \quad (1)$$

wherein P, Mo, V, Nb, Cu, NH_4 and O represent phosphorus, molybdenum, vanadium, niobium, copper, ammonium radical and oxygen, respectively; A represents at least one element selected from the group consisting of silicon, germanium, arsenic and antimony; E represents at least one element selected from the group consisting of bismuth, zirconium, tellurium, silver, selenium, tungsten, boron, iron, zinc, chromium, magnesium, calcium, strontium, tantalum, cobalt, nickel, manganese, barium, titanium, tin, lead, indium, sulfur, palladium, gallium, cerium and lanthanum; G represents at least one element selected from the group consisting of lithium, sodium, potassium, rubidium, cesium and thallium; and a to j represent mole ratios of the components, and when $b = 12$, $1.3 \leq a + f \leq 2.1$, $0.01 \leq c + d \leq 3$, $0.35 \leq d / (c + d) \leq 1$, $0.5 \leq a$, $0 \leq c$, $0.01 \leq d \leq 3$, $0.005 \leq e \leq 3$, $0 \leq f$, $0 \leq g \leq 3$, $0.01 \leq h \leq 3$ and $0 \leq i \leq 5$ are satisfied, and j is a mole ratio of oxygen necessary to satisfy valences of the components.

[Claim 2]

A methacrylic acid production catalyst precursor that is a precursor of a catalyst for use in producing methacrylic acid by a gas-phase catalytic oxidation of methacrolein with molecular oxygen, the methacrylic acid production catalyst precursor having a Keggin-type structure and having a composition represented by the following Formula (2),

$$P_aMo_bV_cNb_dCu_eA_fE_gG_h(NH_4)_iO_j \quad (2)$$

wherein P, Mo, V, Nb, Cu, NH_4 and O represent phosphorus, molybdenum, vanadium, niobium, copper, ammonium radical and oxygen, respectively; A represents at least one element selected from the group consisting of silicon, germanium, arsenic and antimony; E represents at least one element selected from the group consisting of bismuth, zirconium, tellurium, silver, selenium, tungsten, boron, iron, zinc, chromium, magnesium, calcium, strontium, tantalum, cobalt, nickel, manganese, barium, titanium, tin, lead, indium, sulfur, palladium, gallium, cerium and lanthanum; G represents at least one element selected from the group consisting of lithium, sodium, potassium, rubidium, cesium and thallium; and a to j represent mole ratios of the components, and when $b = 12$, $1.3 \leq a + f \leq 2.4$, $0.01 \leq c + d \leq 3$, $0.35 \leq d / (c + d) \leq 1$, $0.5 \leq a$, $0 \leq c$, $0.01 \leq d \leq 3$, $0.005 \leq e \leq 3$, $0 \leq f$, $0 \leq g \leq 3$, $0.01 \leq h \leq 3$ and $0.1 \leq i \leq 20$ are

satisfied, and j is a mole ratio of oxygen necessary to satisfy valences of the components.

[Claim 3]

A method for producing the methacrylic acid production catalyst precursor according to claim 2, the method comprising:

(i) a step of preparing a slurry (I) or a solution (I) containing at least a source material of molybdenum;

(ii) a step of adding an ammonium compound to the slurry (I) or the solution (I) to prepare a slurry (II) containing an ammonium salt; and

(iii) a step of drying the slurry (II) to obtain the methacrylic acid production catalyst precursor having the Keggin-type structure, wherein

in steps (i) and (ii), each pH of the slurry (I), the solution (I) and the slurry (II) is maintained in a range of 0.1 to 6.5.

[Claim 4]

A method for producing a methacrylic acid production catalyst, comprising a step of firing the methacrylic acid production catalyst precursor produced by the method according to claim 3.

[Claim 5]

A method for producing methacrylic acid, wherein methacrylic acid is produced by a gas-phase catalytic oxidation of methacrolein with molecular oxygen using the methacrylic acid production catalyst according to claim 1.

[Claim 6]

A method for producing methacrylic acid, comprising a step of firing the methacrylic acid production catalyst precursor produced by the method according to claim 3 to produce a methacrylic acid production catalyst, and producing methacrylic acid by a gas-phase catalytic oxidation of methacrolein with molecular oxygen using the methacrylic acid production catalyst.

[Claim 7]

A method for producing a methacrylic acid ester, wherein the methacrylic acid produced by the method according to claim 5 or 6 is esterified.

[Claim 8]

A method for producing a methacrylic acid ester, wherein methacrylic acid is produced by the method according to claim 5 or 6, and the methacrylic acid is esterified.