The present disclosureprovides a process for preparing a propane oxidation catalyst, the process comprising: (a) preparing a catalyst precursor; (b) pre-calcining the catalyst precursor in a precalcining zone in an oxygen-containing gas at a temperature of less than 330°C to form a pre-calcined precursor; then (c) feeding an oxygen-free gas to the pre-calcined precursor in a purging zone until the gas exiting the purging zone is substantially free of oxygen, wherein the temperature of the purging zone is less than 330°C, and (d) calcining the pre-calcined precursor to obtain the catalyst.

In one aspect of the present disclosure, there is provided a process for preparing a propane oxidation catalyst, the process comprising: (a) preparing a catalyst precursor; (b) pre-calcining the catalyst precursor in a precalcining zone in an oxygen-containing gas at a temperature of less than 330°C to form a pre-calcined precursor; then (c) feeding an oxygen-free gas to the pre-calcined precursor in a purging zone until the gas exiting the purging zone is substantially free of oxygen and for at least an additional 8 hours, wherein the temperature of the purging zone is less than 330°C, and (d) calcining the pre-calcined precursor to obtain the catalyst, wherein the catalyst is represented by the formula $A_aV_bN_cX_dZ_eO_f$ wherein A is at least one element selected from the group consisting of Mo and W, N is at least one element selected from the group consisting of Te and Sb, X is at least one element selected from the group consisting of Nb, Ta, Ti, Al, Zr, Cr, Mn, Fe, Ru, Co, Rh, Ni, Pt, Sb, Bi, B, In, As, Ge, Sn, Hf, Pb, P, Pm, Eu, Gd, Dy, Ho, Er, Tm, Yb and Lu, and Z is at least one element selected from the group consisting of Zn, Ga, Ir, Sm, Pd, Au, Ag, Cu, Sc, Y, Pr, Nd and Tb; and wherein, when a = 1, b = 0.01 to 1.0, c = 0.01 to 1.0, d = 0.01 to 1.0, e = 0 to 0.1 and f is dependent on the oxidation state of the other elements.

In another aspect, there is provided a process for preparing a propane oxidation catalyst, the process comprising: (a) preparing a catalyst precursor represented by the formula $Mo_{0.70}V_{0.19}Te_{0.17}Nb_{0.12}$; (b) pre-calcining said catalyst precursor in a precalcining zone under a flow of air and at a temperature that is ramped from ambient to 275°C to form a pre-calcined precursor; then (c) feeding nitrogen to the pre-calcined precursor in a purging zone and maintaining the temperature at 275°C for an additional eight hours to purge oxygen, and (d) calcining the pre-calcined precursor to obtain the propane oxidation catalyst, wherein the propane oxidation catalyst is represented by the formula $Mo_{0.69}V_{0.19}Te_{0.17}Nb_{0.12}$.

It was unexpectedly found that precalcination at a temperature of less than 330°C, followed by an oxygen purging step, mitigates or prevents the formation of the undesirable M_5O_{14} phase.

DETAILED DESCRIPTION OF THE INVENTION

As used herein, "a," "an," "the," "at least one," and "one or more" are used interchangeably. The terms "comprises," "includes," and variations thereof do not have a limiting meaning where these terms appear in the description and claims. Thus, for example, an aqueous composition that includes particles of "a" hydrophobic polymer can be interpreted to mean that the composition includes particles of "one or more" hydrophobic polymers.

Also herein, the recitations of numerical ranges by endpoints include all numbers subsumed in that range (e.g., 1 to 5 includes 1, 1.5, 2, 2.75, 3, 3.80, 4, 5, etc.). For the purposes of the invention, it is to be understood, consistent with what one of ordinary skill in the art would understand, that a numerical range is intended to include and support all possible subranges that are included in that range. For example, the range from 1 to 100 is intended to convey from 1.01 to 100, from 1 to 99.99, from 1.01 to 99.99, from 40 to 60, from 1 to 55, etc.

Also herein, the recitations of numerical ranges and/or numerical values, including such recitations in the claims, can be read to include the term "about." In such instances the term "about" refers to numerical ranges and/or numerical values that are substantially the same as those recited herein

WHAT IS CLAIMED IS:

1. A process for preparing a propane oxidation catalyst, the process comprising: (a) preparing a catalyst precursor; (b) pre-calcining the catalyst precursor in a precalcining zone in an oxygen-containing gas at a temperature of less than 330°C to form a pre-calcined precursor; then (c) feeding an oxygen-free gas to the pre-calcined precursor in a purging zone until the gas exiting the purging zone is substantially free of oxygen and for at least an additional 8 hours, wherein the temperature of the purging zone is less than 330°C, and (d) calcining the pre-calcined precursor to obtain the catalyst, wherein the catalyst is represented by the formula $A_aV_bN_cX_dZ_eO_f$ wherein A is at least one element selected from the group consisting of Mo and W, N is at least one element selected from the group consisting of Te and Sb, X is at least one element selected from the group consisting of Nb, Ta, Ti, Al, Zr, Cr, Mn, Fe, Ru, Co, Rh, Ni, Pt, Sb, Bi, B, In, As, Ge, Sn, Hf, Pb, P, Pm, Eu, Gd, Dy, Ho, Er, Tm, Yb and Lu, and Z is at least one element selected from the group consisting of Zn, Ga, Ir, Sm, Pd, Au, Ag, Cu, Sc, Y, Pr, Nd and Tb; and wherein, when a = 1, b = 0.01 to 1.0, c = 0.01 to 1.0, d = 0.01 to 1.0, e = 0 to 0.1 and f is dependent on the oxidation state of the other elements.

2. The process of Claim 1 wherein the catalyst comprises less than 4% of M_5O_{14} phase.

3. The process of any of the preceding claims wherein the catalyst comprises less than 2% of M_5O_{14} phase.

4. The process of any of the preceding claims wherein the oxygen-free gas comprises primarily nitrogen.

5. The process of any of the preceding claims wherein the temperature of at least one of the precalcining zone or the purging zone is less than 310°C.

6. The process of any of the preceding claims wherein the temperature of at least one of the precalcining zone or the purging zone is less than 290°C.

7. The process of any of the preceding claims wherein the temperature of at least one of the precalcining zone or the purging zone is less than 280°C.

8. The process of any of the preceding claims wherein step (b) is continued until the weight of the precursor stabilizes to obtain a pre-calcined precursor.

9. The process of any of the preceding claims wherein A = Mo, N = Te, and X = Nb.

10. A process for preparing a propane oxidation catalyst, the process comprising: (a) preparing a catalyst precursor represented by the formula $Mo_{0.70}V_{0.19}Te_{0.17}Nb_{0.12}$; (b) pre-calcining said catalyst precursor in a precalcining zone under a flow of air and at a temperature that is ramped from ambient to 275°C to form a pre-calcined precursor; then (c) feeding nitrogen to the pre-calcined precursor in a purging zone and maintaining the temperature at 275°C for an additional eight hours to purge oxygen, and (d) calcining the pre-calcined precursor to obtain the propane oxidation catalyst, wherein the propane oxidation catalyst is represented by the formula $Mo_{0.69}V_{0.19}Te_{0.17}Nb_{0.12}$.