~~**WHAT IS CLAIMED IS:**~~

CLAIMS

1. ~~——~~ A hydrogenolysis catalyst comprising:

a catalytic component comprising copper oxide, manganese oxide, and aluminum oxide; and

a binder comprising a zirconium component,

wherein:

the catalyst comprises ~~at least about 30.0 wt%~~ copper oxide~~, and~~ in an amount from 45 wt% to 55 wt%,

the catalyst ~~is substantially free~~comprises less than 1.5 wt.% of silicon or an oxide thereof~~.~~

~~2. The hydrogenolysis catalyst of claim 1, wherein~~, based on the ~~copper oxide is~~ total weight of the hydrogenolysis catalyst, and

wherein the zirconium component is present in an amount from ~~about 35~~4 wt% to ~~about 75~~15 wt% by weight of the hydrogenolysis catalyst.

~~3. ——~~2. The hydrogenolysis catalyst of ~~claim 1 or 2, wherein the copper oxide is present in an amount from about 45 wt% to about 55 wt%.~~

~~4. The hydrogenolysis catalyst of any one of claims 1-3, wherein the manganese oxide is present in an amount from about 0 wt% to about 10 wt% by weight of the hydrogenolysis catalyst.~~

~~5. The hydrogenolysis catalyst of any one of~~ claims 1-4, wherein the manganese oxide is present in an amount from ~~about~~ 5 wt% to ~~about~~ 12 wt% by weight of the hydrogenolysis catalyst.

~~6.~~ 3. The hydrogenolysis catalyst of any one of claims ~~1-5~~1or 2, wherein the aluminum oxide is present in an amount from ~~about~~ 15 wt% to ~~about~~ 40 wt% by weight of the hydrogenolysis catalyst.

~~7.~~ ~~4.~~ The hydrogenolysis catalyst of any one of claims 1-~~6, wherein the aluminum oxide is present in an amount from about 20 wt% to about 35 wt% by weight of the hydrogenolysis catalyst.~~

~~8. The hydrogenolysis catalyst of any one of claims 1-7~~3, wherein zirconium component is zirconium oxide.

~~9.~~ ~~5.~~ The hydrogenolysis catalyst of ~~any one of claims~~claim 1-~~8, wherein the zirconium component is present in an amount from about 4 wt% to about 15 wt% by weight of the hydrogenolysis catalyst.~~

~~10. The hydrogenolysis catalyst of any one of claims 1-9~~, wherein the zirconium component is present in an amount from about 5 wt% to about 12 wt% by weight of the hydrogenolysis catalyst.

~~11.~~ ~~6.~~ The hydrogenolysis catalyst of any one of claims 1-~~10~~5, wherein the binder further comprises alumina.

~~12.~~ ~~7.~~ The hydrogenolysis catalyst of any one of claims 1-~~11~~6, wherein the hydrogenolysis catalyst further comprises an alkali metal component.

~~13. The hydrogenolysis catalyst of claim 12, wherein alkali metal component comprises sodium.~~

~~14.~~ ~~8.~~ The hydrogenolysis catalyst of any one of claims 1-~~13, wherein the alkali metal is present in an amount from about 0 wt% to about 1 wt%.~~

~~15. The hydrogenolysis catalyst of any one of claims 1-14~~7, wherein the hydrogenolysis catalyst is in an unreduced form and exhibits an X-ray powder diffraction profile with 2θ peaks at 31.1°, 36.0°, 36.8°, 38.8°, 44.6°, 48.8°, 61.7°, 64.9°, 68.1° is in an unreduced form and exhibits an X-ray powder diffraction profile with 2θ peaks.

~~16.~~ ~~9.~~ The hydrogenolysis catalyst of any one of claims 1-~~15~~8, wherein the hydrogenolysis catalyst is a calcined and extruded hydrogenolysis catalyst.

~~17.~~ ~~10.~~ The hydrogenolysis catalyst of any one of claims 1-~~16~~9, wherein the hydrogenolysis catalyst exhibits a pore volume of greater than 0.25 cm^3/g~~.~~

~~18. The hydrogenolysis catalyst of any one of claims 1-17, wherein the hydrogenolysis catalyst exhibits,~~ a packed bulk density of ~~about~~ 0.8 g/cm^3 to ~~about~~ 1.5 g/cm^3~~.~~

~~19. The hydrogenolysis catalyst of any one of claims 1-18, wherein the hydrogenolysis catalyst has~~ a Brunauer-Emmett-Teller ~~(“("BET”)")~~ surface area from ~~about~~ 15 m^2/g to ~~about~~ 70 m^2/g.

~~20. The hydrogenolysis catalyst of any one of claims 1-19, wherein the hydrogenolysis catalyst is in the form of a solid extrudate or tablet.~~

~~21. The hydrogenolysis catalyst of claim 15, wherein the hydrogenolysis catalyst is in an unreduced form and exhibits an X-ray powder diffraction profile with 2θ peaks at 18.9°, 31.1°, 32.5°, 36.0°, 36.8°, 38.8°, 44.6°, 48.8°, 53.6°, 58.3°, 59.1°, 61.7°, 64.9°, 66.8°, 68.1°, 72.2°, 75.1°, and 77.0°.~~

~~22.~~ 11. A method of preparing a calcined ~~hydrogenation~~hydrogenolysis catalyst according to any of the claims 1 to 10, the method comprising:

mixing a catalytic component with a binder system and water to obtain a material mixture;

forming the material mixture to obtain a formed material mixture;

calcining the formed material mixture at a temperature, and for a time, sufficient to cure form the calcined hydrogenolysis catalyst;

wherein:

the catalytic component comprises copper oxide, manganese oxide, and aluminum oxide;

the binder system comprises a zirconium component;

the calcined hydrogenolysis catalyst comprises ~~at least 30 wt%~~ copper oxide~~; and~~ in an amount from 45 wt% to 55 wt%;

the calcined hydrogenolysis catalyst ~~is substantially free~~comprises less than 1.5 wt.% of silicon or an oxide thereof~~.~~, based on the total weight of the hydrogenolysis catalyst, and

~~23.~~ wherein the zirconium component is present in an amount from 4 wt% to 15 wt% by weight of the hydrogenolysis catalyst.

12. The method of claim ~~22~~11, wherein the catalytic component comprises pre-calcined powder comprising copper oxide, manganese oxide, and aluminum oxide.

~~24.~~ 13. The method of claim ~~23~~12, wherein the pre-calcined powder was calcined at a temperature from ~~about~~ 400°C to ~~about~~ 800°C.

~~25. The method of any one of claims 22-24, wherein the zirconium component is zirconium acetate.~~

~~26. The method of any one of claims 22-25, wherein the binder system further comprises alumina.~~

~~27. The method of any one of claims 22-26, further comprising mixing an extrusion aid selected from polymeric polysaccharide, hydroxypropyl methyl cellulose, hydroxyethyl methyl cellulose, or a mixture of two or more thereof.~~

~~28. The method of any one of claims 22-27, further comprising removing at least some of the water from the wet material mixture prior to calcining.~~

~~29. The method of any one of claims 22-28, wherein the calcining is conducted at a temperature from about 200°C to about 1000°C.~~

~~30. The method of claim 29, wherein the temperature is from about 450°C to about 550°C.~~

~~31. A hydrogenolysis catalyst prepared by the method of any one of claims 22-30.~~

~~32.~~ 14. A method of conducting hydrogenolysis of a fatty acid ester, the method comprising contacting the fatty acid ester with a hydrogenolysis catalyst ~~comprising:~~according to any of the claims 1-10.

~~a catalytic component comprising copper oxide, manganese oxide, and aluminum oxide; and~~

~~a binder comprising a zirconium component;~~

~~wherein:~~

~~the hydrogenolysis catalyst comprises at least 30% copper oxide; and~~

~~the hydrogenolysis catalyst is substantially free of silicon or an oxide thereof.~~

~~33.~~ 15. The method of claim ~~32~~14, wherein the fatty acid ester is represented by Formula I:

$$R^1\text{-}CO\text{-}OR^2 \text{ (I)},$$

wherein

R^1 and R^2 are each independently a branched or unbranched C_1 to C_{24} alkyl or a branched or unbranched C_2 to C_{24} alkenyl.

~~34. The method of claim 33, wherein R^1 and R^2 are each independently a C_{10} to C_{14} branched or unbranched alkyl or a C_{10} to C_{14} branched or unbranched alkenyl.~~

~~35. The method of claim 33, wherein R^1 and R^2 are each independently a C_{12} to C_{14} branched or unbranched alkyl.~~

~~36. The method of claim 33, wherein when R^1 is a C_{10} to C_{18} branched or unbranched alkyl or a C_{10} to C_{18} branched or unbranched alkenyl, R^2 is a C_1 to C_6 alkyl.~~

~~37. The method of claim 36, wherein R^2 is methyl.~~

~~38. The method of any one of claims 33-37, wherein the copper oxide is present in an amount from about 35 wt% to about 75 wt% by weight of the hydrogenolysis catalyst.~~

~~39. The method of any one of claims 33-38, wherein the manganese oxide is present in an amount from about 1 wt% to about 20 wt% by weight of the hydrogenolysis catalyst~~

~~40. The method of any one of claims 33-39, wherein the aluminum oxide is present in an amount from about 15 wt% to about 40 wt% by weight of the hydrogenolysis catalyst.~~

~~41. The method of any one of claims 33-40, wherein zirconium component is zirconium oxide.~~

42. The method of any one of claims 33-41, wherein the zirconium component is present in an amount from about 1 wt% to about 20 wt% by weight of the hydrogenolysis catalyst.

43. The method of any one of claims 33-42, wherein the binder further comprises alumina.

44. The method of any one of claims 33-43, wherein the hydrogenolysis catalyst further comprises an alkali metal component.

45. The method of claim 44, wherein alkali metal component comprises sodium.

46. The method of any one of claims 44 or 45, wherein the alkali metal is present in an amount from about 0 wt% to about 1 wt%.

47. The method of any one of claims 33-46, wherein the hydrogenolysis catalyst is in an unreduced form and exhibits an X-ray powder diffraction profile with 2θ peaks 31.1°, 36.0°, 36.8°, 38.8°, 44.6°, 48.8°, 61.7°, 64.9°, 68.1°.

48. The method of any one of claims 33-47, wherein the hydrogenolysis catalyst is a calcined and extruded hydrogenolysis catalyst.

49. The method of any one of claims 33-48, wherein the hydrogenolysis catalyst exhibits a pore volume of greater than 0.25 cm^3/g.

50. The method of any one of claims 33-49, wherein the hydrogenolysis catalyst exhibits a packed bulk density of about 0.8 g/cm^3 to about 1.5 g/cm^3.

51. The method of any one of claims 33-50, wherein the hydrogenolysis catalyst has a Brunauer-Emmett-Teller ("BET") surface area from about 15 m^2/g to about 70 m^2/g.

52. The method of claim 47, wherein the hydrogenolysis catalyst is in an unreduced form and exhibits an X-ray powder diffraction profile with 2θ peaks at 18.9°, 31.1°, 32.5°, 36.0°, 36.8°, 38.8°, 44.6°, 48.8°, 53.6°, 58.3°, 59.1°, 61.7°, 64.9°, 66.8°, 68.1°, 72.2°, 75.1°, and 77.0°.

53. The method of any one of claims 33-52, wherein the method is conducted at a temperature of at least about 170°C.

54. The method of claim 53, wherein the temperature is from about 170°C to about 220°C.

55. The hydrogenolysis catalyst of any one of claims 1-21, wherein the hydrogenolysis catalyst is free of silicon or an oxide thereof.

56. The method of any one of claims 22-30, wherein the calcined hydrogenolysis catalyst is free of silicon or an oxide.

57. The method of any one of claims 32-54, wherein the hydrogenolysis catalyst is free of silicon or an oxide.

58. The method of any one of claims 22-30, wherein forming the material mixture comprises extrusion, tableting, or spherization.