CLAIMS

1. A process for preparing a functionalized lower hydrocarbon, comprising:

(a) feeding to a reactor a reactor feed comprising ethanol at a concentration of at least 14 mol %; and

(b) contacting the ethanol with a mixed oxide catalyst in the reactor, the mixed oxide catalyst having the formula $Zn_xZr_yA_vQ_sMn_wO_z$, whereby the ethanol is converted to at least one functionalized lower hydrocarbon at a yield of at least about 30% of the maximum theoretical molar yield,

wherein X is 1 to 10,

wherein Y is 1 to 100,

wherein A is Al, Si, Mg, or Cu, and V is 0 to 100,

wherein Q is Al, Si, Mg, or Cu, and S is 0 to 100,

wherein W is 0 to 30, and

wherein Z is 5 to 250.

2. The process of claim 1, further comprising step (c) of recovering at least one of the functionalized lower hydrocarbons.

3. The process of claim 2, wherein the functionalized lower hydrocarbon recovered in step (c) is propylene.

4. The process of claim 1, wherein the ethanol is bio-based ethanol.

5. The process of claim 1, wherein ethanol is contacted with the $Zn_xZr_yA_vQ_sMn_wO_z$ mixed oxide catalyst at a temperature falling within the range of about 300°C to about 600°C.

6. The process of claim 1, wherein the $Zn_xZr_yA_vQ_sMn_wO_z$ mixed oxide catalyst is prepared using a hard-template method, a co-precipitation method, or an impregnated method.

7. The process of claim 6, wherein V is 0, S is 0, and W is 0, and, wherein the ratio of Zn/Zr (x:y) in the $Zn_xZr_yO_z$ mixed oxide catalyst is about 1:12 and is prepared using the hard-template method, and wherein the molar concentration of the ethanol in the reactor feed is about 14.8%, and wherein the functionalized lower hydrocarbon includes isobutylene, propylene, and acetone.

8. A process for preparing a functionalized lower hydrocarbon, comprising:

(a) feeding to a reactor a reactor feed comprising ethanol at a concentration of at least about 14 mol %; and

(b) contacting the ethanol with a mixed oxide catalyst in the reactor, the mixed oxide catalyst having the formula $Zn_xZr_yA_vQ_sMn_wO_z$, whereby the ethanol is converted to at least one functionalized lower hydrocarbon at a yield of at least about 30% of the maximum theoretical molar yield,

wherein X is 1 to 10,

wherein Y is 1 to 100,

wherein A is Al, and V is 1 to 100,

wherein Q is Al, Si, Mg, or Cu, and S is 0,

wherein W is 0, and

wherein Z is 5 to 250.

9. The process of claim 8, wherein the ratio of Zn/Zr/Al (x:y:v) in the $Zn_xZr_yAl_vO_z$ mixed oxide catalyst is from about 1:8:8 to about 1:20:20.

10. The process of claim 8, wherein the ratio of Zn/Zr/Al (x:y:v) in the $Zn_xZr_yAl_vO_z$ mixed oxide catalyst is about 1:12:1.

11. The process of claims 10, wherein the $Zn_xZr_yAl_vO_z$ mixed oxide catalyst is prepared using a co-precipitation method.

12. The process of claim 11, wherein the functionalized lower hydrocarbon is propylene.

13. The process of claim 12, wherein the yield of the propylene is at least about 59% of the maximum theoretical molar yield.

14. The process of claim 10, wherein the molar concentration of the ethanol in the reactor feed is about 37%.

15. A process for preparing a functionalized lower hydrocarbon, comprising:

(a) feeding to a reactor a reactor feed comprising ethanol at a concentration of at least about 14 mol %; and

(b) contacting the ethanol with a mixed oxide catalyst in the reactor, the mixed oxide catalyst having the formula $Zn_xZr_yA_vQ_sMn_wO_z$, whereby the ethanol is converted to at least one functionalized lower hydrocarbon at a yield of at least about 30% of the maximum theoretical molar yield,

wherein X is 1 to 10,

wherein Y is 1 to 100,

wherein A is Al and V is 1 to 100,

wherein Q is Si and S is 1 to 100,

wherein W is 0, and

wherein Z is 5 to 250.

16. The process of claim 15, wherein the ratio of Zn/Zr/Al/Si (x:y:v:s) in the $Zn_xZr_yAl_vSi_sO_z$ mixed oxide catalyst is from about 1:8:8:8 to about 1:20:20:20.

17. The process of claim 15, wherein the ratio of Zn/Zr/Al/Si (x:y:v:s) in the $Zn_xZr_yAl_vSi_sO_z$ mixed oxide catalyst is about 1:12:2:2.

18. The process of claim 17, wherein the $Zn_xZr_yAl_vSi_sO_z$ mixed oxide catalyst is prepared using a co-precipitation method.

19. The process of claim 18, wherein the functionalized lower hydrocarbon is propylene.

20. The process of claim 19, wherein the yield of the propylene is at least about 70% of the maximum theoretical molar yield.

21. The process of claim 19, wherein the molar concentration of the ethanol in the reactor feed is about 37%.

22. The process claim 1, wherein the $Zn_xZr_yA_vQ_sMn_wO_z$ mixed oxide catalyst is regenerated *in situ*.

23. The process of claim 22, wherein the $Zn_xZr_yA_vQ_sMn_wO_z$ mixed oxide catalyst is regenerated *in situ* by switching the process feed to an oxygen-rich stream while maintaining catalyst reaction temperatures.