CLAIMS

1. A process for producing propylene, the process comprising:

metathesizing at least a portion of butene in a feed stream in a metathesizing reaction zone comprising a metathesis catalyst to form a metathesis reaction product, the metathesis catalyst comprising a mesoporous silica-alumina catalyst support impregnated with at least one metal oxide, where the mesoporous silica-alumina catalyst support comprises from 5 weight percent to 50 weight percent alumina based on the weight of the mesoporous silica-alumina catalyst support;

passing the entire metathesis reaction product to a cracking reaction zone comprising a cracking catalyst, the cracking catalyst comprising an MFI structured silica-containing catalyst; and

subjecting the metathesis reaction product to cracking in the cracking reaction zone to form a cracking reaction product, wherein at least a portion of the metathesis reaction product is cracked by the cracking catalyst and the cracking reaction product comprises propylene.

2. The process of claim 1 further comprising introducing the feed stream comprising the butene to the metathesizing reaction zone.

3. The process of claim 2 where the feed stream is a raffinate-2 stream from a fluidized catalytic cracking (FCC) reactor or an ethylene cracking reactor.

4. The process of claim 2 where the feed stream comprises:

from 20 wt. % to 60 wt. % of cis- or trans-2-butene, or both;

from 10 wt. % to 20 wt. % of 1-butene; and

from 5 wt. % to 20 wt. % n-butane.

5. The process of claim 1 where the mesoporous silica-alumina catalyst support comprises from 10 weight percent to 40 weight percent alumina based on the weight of the mesoporous silica-alumina catalyst support.

6. The process of claim 1 where the at least one metal oxide comprises one or more oxides of molybdenum, rhenium, tungsten, or mixtures thereof.

7. The process of claim 1 where the at least one metal oxide comprises tungsten oxide.

8. The process of claim 7 where the metathesis catalyst comprises from 1 weight percent to 30 weight percent tungsten oxide based on the total weight of the metathesis catalyst.

9. The process of claim 7 where the metathesis catalyst comprises from 5 weight percent to 20 weight percent tungsten oxide based on the total weight of the metathesis catalyst.

10. The process of claim 1 where the mesoporous silica-alumina catalyst support impregnated with the at least one metal oxide includes a pore size distribution from 2.5 nm to 40 nm.

11. The process of claim 1 where the mesoporous silica-alumina catalyst support impregnated with the at least one metal oxide comprises a total pore volume of at least 0.600 cm^3/g.

12. The process of claim 1 where the MFI structured silica-containing catalyst comprises alumina.

13. The process of claim 1 where the MFI structured silica-containing catalyst comprises less than 0.01 wt. % alumina.

14. The process of claim 1 where the MFI structured silica-containing catalyst comprises a total acidity from 0.001 mmol/g to 0.1 mmol/g.

15. The process of claim 1 where the cracking reaction zone is downstream of the metathesizing reaction zone.

16. The process of claim 1 where the metathesizing reaction zone and the cracking reaction zone are disposed within a single reactor.

17. The process of claim 1 where the butene comprises 2-butene.

18. The process of claim 17 where at least a portion of the 2-butene isomerizes to 1-butene in the metathesizing reaction zone.

19. The process of claim 1 where the metathesis reaction product comprises propylene and pentene.

20. The process of claim 1 where a volume ratio of the metathesis catalyst to the cracking catalyst is from 1:1 to 1:2.

21. The process of claim 1 where an acidity of the metathesis catalyst is from 0.001 mmol/g to 5 mmol/g.

22. A process for producing propylene, the process comprising:

metathesizing at least a portion of butene in a feed stream in a metathesizing reaction zone comprising a metathesis catalyst to form a metathesis reaction product, the metathesis catalyst comprising a mesoporous silica-alumina catalyst support impregnated with tungsten oxide, where the mesoporous silica-alumina catalyst support comprises from 5 weight percent to 50 weight percent alumina based on the weight of the mesoporous silica-alumina catalyst support and the metathesis catalyst comprises a relative pore volume of at least 0.600 cm^3/g;

cracking at least a portion of the metathesis reaction product in a cracking reaction zone comprising a cracking catalyst to form a cracking reaction product, where the cracking catalyst comprises a MFI structured silica-containing catalyst and the cracking reaction product comprises propylene.