CLAIMS

What is claimed is:

1. A molecular sieve membrane for separating hydrocarbons of a lube feed stock into a permeate and a retentate based on molecular shape comprising:

one or more layers of size-selective catalyst, each layer of size-selective catalyst having a plurality of perpendicular membrane channels and a plurality of opening pores, wherein the plurality of perpendicular membrane channels is in fluidic communication with the plurality of opening pores; and

a porous support comprising a plurality of diffusing gaps, wherein the porous support is in fluidic communication with the plurality of opening pores providing a fluidic pathway between the perpendicular membrane channels and the diffusing gaps, and the molecular sieve membrane is configured for cross-flow of the lube feed stock over the molecular sieve membrane causing a continuous flow of the permeate into the perpendicular membrane channels through the plurality of opening pores into and out of the diffusing gaps of the porous support.

2. The molecular sieve membrane of claim 1, wherein the size-selective catalyst comprises zeolite or mordenite.

3. The molecular sieve membrane of any preceding claim, wherein the porous support comprises graphite, clays and/or two-dimensional ionic conductors.

4. The molecular sieve membrane of any preceding claim, wherein the porous support is a single layer.

5. The molecular sieve membrane of any preceding claim, wherein the porous support is a coating.

6. The molecular sieve membrane of any preceding claim, wherein the size-selective catalyst comprises a crystal structure of ZSM48 and/or mordenite.

7. The molecular sieve membrane of any preceding claim, wherein each of the perpendicular membrane channels is between about 4 Angstroms to about 10 Angstroms.

8. The molecular sieve membrane of any preceding claim, wherein each of the perpendicular membrane channels is between about 4 Angstroms to about 8 Angstroms.

9. The molecular sieve membrane of any preceding claim, wherein each of the perpendicular membrane channels is between about 4 Angstroms to about 6 Angstroms.

10. The molecular sieve membrane of any preceding claim, wherein the molecular sieve membrane is not acidic as determined by titration, ammonia adsorption, pyridine adsorption, or a combination thereof.

11. The molecular sieve membrane of any preceding claim, wherein the membrane is tubular.

12. The molecular sieve membrane of any preceding claim, wherein the molecular sieve membrane is configured to separate wax from lube oil.

13. The molecular sieve membrane of any preceding claim, wherein the membrane channels are two dimensional in shape.

14. The molecular sieve membrane of any preceding claim, wherein the hydrocarbons comprise a plurality of paraffins and a plurality of ring molecules and the plurality of paraffins are separated from the plurality of ring molecules.

15. A process for separating n-paraffins from other hydrocarbons comprising the steps of:

providing a feed stock comprising a plurality of n-paraffins and a plurality of ring molecules;

contacting the feed stock with the molecular sieve membrane of Claim 1; and

separating the permeate to produce a wax product without solvent, wherein the permeate comprises the plurality of n-paraffins and the retentate comprises the plurality of ring molecules.

16. The process of claim 15 where the feed stock is a waxy intermediate.

17. A process for separating paraffins in a hydrotreated hydrocarbon stream comprising the steps of:

providing a hydrotreated hydrocarbon stream comprising paraffins, aromatics and/or other multi-ring hydrocarbon compounds;

contacting the hydrotreated hydrocarbon stream with the molecular sieve membrane of Claim 1; and

separating the paraffins to provide a wax product feed stream for catalytic dewaxing, and a stream of fuel or lube by-products, wherein solvent is not used in the separation process.

18. The process of any one of the preceding claims, wherein the wax product stream comprises paraffins, 1-ring naphthenes, and ringed aromatics and the lube product stream comprises multi-ring naphthenes.

19. The process of any one of the preceding claims, wherein the lube feed stock comprises Group II+ base stock.

20. The process of any one of the preceding claims, wherein the permeate or retentate comprises a Group III+ base stock.

21. The process of any one of the preceding claims, wherein the process is carried out in blocked mode operation.

22. The process of any one of the preceding claims, wherein process is carried out at an operating temperature of about 100 °C to minimize isomerization activity.

23. The process of any one of the preceding claims, wherein process is carried out at an operating temperature of about 200 °C to minimize isomerization activity.

24. The process of any one of the preceding claims, wherein process is carried out at an operating temperature of about 300 °C to minimize isomerization activity.

25. The process of any one of the preceding claims, wherein the process further comprises the step of pretreating the molecular sieve membrane to minimize acidity of the molecular sieve membrane.

26. The process of any one of the preceding claims, wherein the permeate has a volume between about 65 vol% and about 75 vol% of a clean Group I, Group II, or Group III lube base stock and the retentate has a volume between about 25 vol% and about 35 vol% of the clean Group I, Group II, or

Group III lube base stock .

27. The process of any one of the preceding claims, wherein the permeate comprises paraffins in a volumetric amount of about 45 vol% of the clean Group I, Group II, or Group III lube base stock and comprises 1-ring naphthene in a volumetric amount of about 25 vol% of the clean Group I, Group II, or Group III lube base stock and the retentate comprises multi-ring naphthene and mono-aromatics in a volumetric amount of about 30 vol% of the clean Group I, Group II, or Group III lube base stock.

28. The process of any one of the preceding claims, wherein the permeate has good oxidative stability when blended with anti-oxidants and other additives, as determined by Sequence III-G automotive engine oil testing and the Turbine Oil Oxidation Stability Test.