**[0012]** Hydrocracking catalysts are bifunctional: hydrotreating is facilitated by the hydrogenation function provided by the metal components, and the cracking reaction is facilitated by the solid acid components. Both reactions need the presence of high pressure hydrogen.

**[0013]** During hydrocracking, the heavy hydrocarbon feed molecules form a liquid film and covers the active sites of the catalyst. Due to the limitation of hydrogen solubility in hydrocarbons, the hydrogen availability in the hydrocracking catalyst extrudates has been an issue. In practice, the heavy hydrocarbon feed fills the pores first, and reactant hydrogen must then access the active sites in the pores via diffusion through the heavy hydrocarbon feed. Conventional hydrocracking catalysts exhibit limited hydrogen pore diffusivity with heavy, more refractive feedstocks. This has inhibited the hydrogenation function of the hydrocracking catalysts, which results in middle distillates and unconverted oil (UCO) products with poor quality. This issue becomes more significant when the hydrocracking feed become more disadvantaged, as these feeds consume greater amounts of hydrogen during hydroprocessing, making even less hydrogen available for diffusion into the pores.

**[0014]** Accordingly, there is a current need for a hydrocracking catalyst that exhibits a higher degree of hydrogen efficiency, and greater product yield and quality, as compared to conventional hydrocracking catalysts.

## SUMMARY OF THE INVENTION

**[0015]** The present invention is directed to an improved finished hydrocracking catalyst containing a HNPV ASA component in combination with a HNPV alumina support. The ASA base is characterized as having a low particle density. The HNPV ASA component employed in the catalyst of the present invention is characterized as having a narrower pore size distribution as compared to a conventional ASA, and the alumina support is characterized as having a broader pore size distribution as compared to an alumina base used in conventional hydrocracking catalysts.

**[0015a]** The present invention provides a hydrocracking catalyst, comprising:

a base extrudate comprising at least one molecular sieve, an alumina and an amorphous silica alumina support, wherein the base extrudate has a nanopore volume in the 6 nm to 11 nm range of 0.5 to 0.9 cc/g; and

at least one metal selected from the group consisting of elements from Group 6 and Groups 8 through 10 of the Periodic Table.

**[0015b]** The present invention provides a process for hydrocracking a hydrocarbonaceous feedstock, comprising contacting the feedstock with a hydrocracking catalyst under hydrocracking conditions to produce a hydrocracked effluent;

the hydrocracking catalyst comprising

a base extrudate comprising at least one molecular sieve, an alumina and an amorphous silica alumina support, wherein the base extrudate has a nanopore volume in the 6 nm to 11 nm range of 0.5 to 0.9 cc/g; and

at least one metal selected from the group consisting of elements from Group 6 and Groups 8 through 10 of the Periodic Table.

**[0015c]** The present invention provides a hydrocracking catalyst, comprising:

a base extrudate comprising at least one molecular sieve, an alumina and an amorphous silica alumina support, wherein the base extrudate has a total nanopore volume in the 2 to 50 nm of 0.7 to 1.2 cc/g; and

at least one metal selected from the group consisting of elements from Group 6 and Groups 8 through 10 of the Periodic Table.

**[0015d]** The present invention provides a process for hydrocracking a hydrocarbonaceous feedstock, comprising contacting the feedstock with a hydrocracking catalyst under hydrocracking conditions to produce a hydrocracked effluent;

the hydrocracking catalyst comprising

a base extrudate comprising at least one molecular sieve, an alumina and an amorphous silica alumina support, wherein the base extrudate has a total nanopore volume in the 2 to 50 nm of 0.7 to 1.2 cc/g; and

at least one metal selected from the group consisting of elements from Group 6 and Groups 8 through 10 of the Periodic Table.

**[0015e]** The present invention provides a hydrocracking catalyst, comprising:

a base extrudate comprising at least one molecular sieve, an alumina and an amorphous silica alumina support, the base extrudate having a particle density of 0.7 to 0.9 g/cc; and

at least one metal selected from the group consisting of elements from Group 6 and Groups 8 through 10 of the Periodic Table.

**[0015f]** The present invention provides a process for hydrocracking a hydrocarbonaceous feedstock, comprising contacting the feedstock with a hydrocracking catalyst under hydrocracking conditions to produce a hydrocracked effluent;

the hydrocracking catalyst comprising

a base extrudate comprising at least one molecular sieve, an alumina and an amorphous silica alumina support, the base extrudate having a particle density of 0.7 to 0.9 g/cc; and

at least one metal selected from the group consisting of elements from Group 6 and Groups 8 through 10 of the Periodic Table.

**[0015g]** The present invention provides a hydrocracking catalyst, comprising:

a base extrudate comprising at least one molecular sieve, an alumina and an amorphous silica alumina support, wherein the base extrudate is formed using an amorphous silica alumina support having a nanopore volume in the 6 nm to 11 nm range of 0.6 to 0.9 cc/g; and

at least one metal selected from the group consisting of elements from Group 6 and Groups 8 through 10 of the Periodic Table.

**[0015h]** The present invention provides a process for hydrocracking a hydrocarbonaceous feedstock, comprising contacting the feedstock with a hydrocracking catalyst under hydrocracking conditions to produce a hydrocracked effluent;

the hydrocracking catalyst comprising

a base extrudate comprising at least one molecular sieve, an alumina and an amorphous silica alumina support, wherein the base extrudate is formed using an amorphous silica alumina support having a nanopore volume in the 6 nm to 11 nm range of 0.6 to 0.9 cc/g; and

at least one metal selected from the group consisting of elements from Group 6 and Groups 8 through 10 of the Periodic Table.

**[0016]** It has been found that by employing ASA and alumina materials having a higher nanopore volume in the 6 to 11 nm range, the base extrudate exhibits a lower particle density. A lower base extrudate particle density allows for increased metals loading while maintaining a conventional particle density for the finished hydrocracking catalyst. The finished hydrocracking catalysts employing using the

(q) Particle density: Particle density is obtained by applying the formula D=M/V. M is the weight and V is the volume of the catalyst sample. The volume is determined by measuring volume displacement by submersing the sample into mercury under 28 mm Hg vacuum.

**Hydrocracking Catalyst Composition**

**[0034]** Catalysts used in carrying out the hydrocracking process includes an amorphous silica-alumina (ASA) component characterized as having a high nanopore volume (HNPV) and low particle density, a HNPV alumina support, one or more metals, one or more molecular sieves, and optionally one or more promoters. The composition of the finished catalyst, based on the bulk dry weight of the finished hydrocracking catalyst, is described in Table 1 below.

**TABLE 1**

| | |
|---|---|
| HNPV ASA component | 15 – 85 wt. % |
| HNPV alumina support | 5 – 55 wt. % |
| total molecular sieve content | 0.1 – 75 wt. % |
| total metal oxide content | 15 – 55 wt. % |
| total promoter content | 0 – 15 wt. % |

**[0035]** For each embodiment described herein, the HNPV ASA component is characterized as having a low particle density. In addition, the HNPV ASA component employed in the catalyst of the present invention is characterized as having a narrower pore size distribution as compared to conventional ASA materials. The alumina support is characterized as having a broader pore size distribution as compared to an alumina base used in conventional hydrocracking catalysts.

**[0036]** A HNPV ASA used in the manufacture the finished hydrocracking catalyst of the present invention will have a NPV (6 nm - 11 nm) of 0.6 to 0.9 cc/g.

**[0037]** A HNPV alumina extrudate used in the manufacture the finished hydrocracking catalyst of the present invention will have a NPV (6 nm - 11 nm) of 0.1 to 0.3 cc/g.

**[0038]** The HNPV ASA component and HNPV alumina support are combined to form a HNPV base extrudate suitable for increased metal loading on the finished improved hydrocracking catalyst of the present invention. As used herein, the term HNPV base extrudate means the base extrudate has a total nanopore volume that is greater than a conventional base containing conventional ASA and alumina

materials. A HNPV base extrudate used to manufacture the finished hydrocracking catalyst of the present invention will have a NPV (6 nm - 11 nm) of 0.1 to 1.0 cc/g.

**[0039]** It has been found that by employing ASA and alumina materials having a higher nanopore volume in the 6 to 11 nm range, the base extrudate exhibits a lower particle density. A lower base extrudate particle density allows for increased metals loading while maintaining a conventional particle density for the finished hydrocracking catalyst.

**[0040]** Finished hydrocracking catalysts manufactured using the HNPV base extrudate of the present invention exhibit improved hydrogen efficiency, and greater product yield and quality as compared to conventional hydrocracking catalysts containing conventional ASA and alumina components.

**[0041]** The HNPV ASA and HNPV alumina support components useful in the hydrocracking catalysts of the present invention, and base extrudates formed from these components, are characterized as having the properties described in Tables 2 and 3 below, respectively.

**TABLE 2**

| | **HNPV ASA** | **HNPV alumina** |
|---|---|---|
| d10 (nm) | 55 – 70 | 60 – 70 |
| d50 (nm) | 100 – 110 | 140 – 160 |
| d90 (nm) | 270 – 300 | 180 – 220 |
| Peak Pore Diameter (Å) | 80 – 100 | 160 – 200 |
| NPV – 6 nm – 11 nm (cc/g) | 0.6 – 0.9 | 0.1 – 0.3 |
| NPV – 11 nm – 20 nm (cc/g) | 0.4 – 0.7 | 0.4 – 0.7 |
| NPV – 20 nm – 50 nm (cc/g) | 0.2 – 0.4 | 0 – 0.3 |
| Total NPV (2 – 50 nm) (cc/g) | 1.5 – 2.0 | 0.7 – 1.2 |
| loose bulk density (g/mL) | 0.15 – 0.35 | 0.4 – 0.6 |
| BET surface area ($m^2$/g | 450 – 600 | 180 – 350 |

**TABLE 3**

| | HNPV Base Extrudate |
|---|---|
| d10 (nm) | 40 – 60 |
| d50 (nm) | 70 – 90 |
| d90 (nm) | 90 – 120 |
| Peak Pore Diameter (Å) | 70 – 100 |
| NPV – 6 nm – 11 nm (cc/g) | 0.5 – 0.9 |
| NPV – 11 nm – 20 nm (cc/g) | 0.05 – 0.25 |
| NPV – 20 nm – 50 nm (cc/g) | 0 – 0.1 |
| Total NPV (2 – 50 nm) (cc/g) | 0.7 – 1.2 |
| BET surface area ($m^2$/g) | 400 – 600 |
| WPV (water pore volume) (cc/g) | 0.85 – 1.25 |
| particle density (g/cc) | 0.7 – 0.9 |

**[0042]** For each embodiment described herein, the amount of HNPV ASA component in the finished hydrocracking catalyst is from 15 wt.% to 85 wt.% based on the bulk dry weight of the hydrocracking catalyst. In one subembodiment, the amount of HNPV ASA component in the hydrocracking catalyst is from 25 wt.% to 75 wt.% based on the bulk dry weight of the finished hydrocracking catalyst

**[0043]** For each embodiment described herein, the hydrocracking catalyst contains one or more molecular sieves selected from the group consisting of BEA-, ISV-, BEC-, IWR-, MTW-, *STO-, OFF-, MAZ-, MOR-, MOZ-, AFI-, *NRE, SSY-, FAU-, EMT-, ITQ-21-, ERT-, ITQ-33-, and ITQ-37-type molecular sieves, and mixtures thereof.

**[0044]** In one subembodiment, the one or more molecular sieves selected from the group consisting of molecular sieves having a FAU framework topology, molecular sieves having a BEA framework topology, and mixtures thereof.

**[0045]** The amount of molecular sieve material in the finished hydrocracking catalyst is from 0.1 wt.% to 75 wt.% based on the bulk dry weight of the hydrocracking catalyst. In one subembodiment, the amount of molecular sieve material in the finished hydrocracking catalyst is from 1 wt.% to 8 wt.%.

**[0046]** The finished catalyst may optionally contain a non-zeolitic molecular sieves which can be used include, for example, silicoaluminophosphates (SAPO),

**TABLE 7**

| Catalyst | ASA (wt.%) | Support (wt.%) | USY (wt.%) | Ni (wt.%) | W (wt.%) | Particle Density (g/cc) |
|---|---|---|---|---|---|---|
| A1 (conventional) | 53.2 | 11.3 | 6.3 | 3.8 | 25.3 | 1.35 |
| A2 (HNPV) | 49.2 | 10.5 | 5.9 | 4.8 | 29.6 | 1.34 |
| B1 (conventional) | 50.6 | 16.3 | 4.0 | 5.1 | 25.3 | 1.41 |
| B2 (HNPV) | 47.7 | 14.1 | 3.8 | 4.8 | 29.6 | 1.31 |

**TABLE 8**

| Base Extrudate | A1 (conventional) | A2 (HNPV) |
|---|---|---|
| d10 (nm) | 41 | 46 |
| d50 (nm) | 74 | 74 |
| d90 (nm) | 135 | 102 |
| Peak Pore Diameter (Å) | 69 | 75 |
| NPV - 6 nm - 11 nm (cc/g) | 0.35 | 0.6 |
| NPV - 11 nm - 20 nm (cc/g) | 0.08 | 0.05 |
| NPV - 20 nm - 50 nm (cc/g) | 0.03 | 0.01 |
| Total NPV (2-50 nm) (cc/g) | 0.67 | 0.88 |
| BET surface area ($m^2/g$) | 379 | 434 |
| WPV, (cc/g) | 0.81 | 0.87 |
| particle density (g/cc) | 0.93 | 0.87 |

**TABLE 9**

| Base Extrudate | B1 (conventional) | B2 (HNPV) |
|---|---|---|
| d10 (nm) | 37 | 46 |
| d50 (nm) | 68 | 75 |
| d90 (nm) | 121 | 107 |
| Peak Pore Diameter (Å) | 69 | 75 |
| NPV - 6 nm - 11 nm (cc/g) | 0.33 | 0.6 |
| NPV - 11 nm - 20 nm (cc/g) | 0.07 | 0.07 |
| NPV - 20 nm - 50 nm (cc/g) | 0.02 | 0.01 |

| | | |
|---|---|---|
| Total NPV (2-50 nm) (cc/g) | 0.67 | 0.9 |
| BET surface area ($m^2$/g) | 377 | 429 |
| WPV, (cc/g) | 0.84 | 0.93 |
| particle density (g/cc) | 1.01 | 0.85 |

**TABLE 10**

| | HNPV ASA | CONV. ASA | HNPV alumina | CONV. Alumina |
|---|---|---|---|---|
| d10 (nm) | 60 | 35 | 69 | 34 |
| d50 (nm) | 109 | 73 | 147 | 51 |
| d90 (nm) | 286 | 161 | 201 | 72 |
| Peak Pore Diameter (Å) | 89 | 57 | 167 | 51 |
| NPV - 6 nm - 11 nm (cc/g) | 0.7 | 0.41 | 0.18 | 0.012 |
| NPV - 11 nm - 20 nm (cc/g) | 0.5 | 0.16 | 0.54 | 0.01 |
| NPV - 20 nm - 50 nm (cc/g) | 0.34 | 0.06 | 0.09 | 0 |
| Total NPV (2-50 nm) (cc/g) | 1.71 | 0.98 | 0.87 | 0.5 |
| loose bulk density (g/mL) | 0.2 | 0.25-0.35 | 0.4-0.6 | 0.6-0.8 |
| BET surface area ($m^2$/g) | 528 | 540 | 226 | 297 |

## EXAMPLE 2

### Hydrocracking Performance:

**[0076]** Catalysts A1 through B2 were used to process a typical Middle Eastern VGO. The feed properties are listed in Table 11. The run was operated in pilot plant unit under 2300 psig total pressure and 1.0 - 2.2 LHSV. The feed was passed a catalyst bed filled with hydrotreating catalyst before flowing into the hydrocracking zone. Prior to introduction of feed, the catalysts were activated either with DMDS (gas phase sulphiding) or with a diesel feed spiked with DMDS (liquid phase sulphiding).

**[0077]** The results of the tests are noted below in Tables 12 and 13. As Tables 12 and 13 indicate, Catalysts A2 and B2 achieved a 60% conversion at lower reaction temperatures (CAT) relative to conventional catalysts A1 and B1. In other words, Catalysts A2 and B2 were more catalytically active than their conventional counterparts, Catalysts A1 and B1, respectively.

What is claimed is:

1. A hydrocracking catalyst, comprising:

a base extrudate comprising at least one molecular sieve, an alumina and an amorphous silica alumina support, wherein the base extrudate has a nanopore volume in the 6 nm to 11 nm range of 0.5 to 0.9 cc/g; and

at least one metal selected from the group consisting of elements from Group 6 and Groups 8 through 10 of the Periodic Table.

2. The hydrocracking catalyst of Claim 1, wherein the base extrudate is formed using an alumina having a nanopore volume in the 6 nm to 11 nm range of 0.1 to 0.3 cc/g.

3. The hydrocracking catalyst of Claim 2, wherein the base extrudate is formed using an amorphous silica alumina support having a nanopore volume in the 6 nm to 11 nm range of 0.6 to 0.9 cc/g.

4. The hydrocracking catalyst of Claim 1, wherein the base extrudate is formed using an amorphous silica alumina support having a nanopore volume in the 6 nm to 11 nm range of 0.6 to 0.9 cc/g.

5. The hydrocracking catalyst of Claim 1, wherein the base extrudate has a total nanopore volume in the 2 to 50 nm of 0.7 to 1.2 cc/g.

6. The hydrocracking catalyst of Claim 1, wherein the base extrudate has a particle density of 0.7 to 0.9 g/cc.

7. A process for hydrocracking a hydrocarbonaceous feedstock, comprising contacting the feedstock with a hydrocracking catalyst under hydrocracking conditions to produce a hydrocracked effluent;

the hydrocracking catalyst comprising

a base extrudate comprising at least one molecular sieve, an alumina and an amorphous silica alumina support, wherein the base extrudate has a nanopore volume in the 6 nm to 11 nm range of 0.5 to 0.9 cc/g; and

at least one metal selected from the group consisting of elements from Group 6 and Groups 8 through 10 of the Periodic Table.

8. The process of Claim 7, wherein the base extrudate is formed using an alumina having a nanopore volume in the 6 nm to 11 nm range of 0.1 to 0.3 cc/g.

9. The process of Claim 8, wherein the base extrudate is formed using an amorphous silica alumina support having a nanopore volume in the 6 nm to 11 nm range of 0.6 to 0.9 cc/g.

10. The process of Claim 7, wherein the base extrudate is formed using an amorphous silica alumina support having a nanopore volume in the 6 nm to 11 nm range of 0.6 to 0.9 cc/g.

11. The process of Claim 7, wherein the base extrudate has a total nanopore volume in the 2 to 50 nm of 0.7 to 1.2 cc/g.

12. The process of Claim 7, wherein the base extrudate has a particle density of 0.7 to 0.9 g/cc.

13. A hydrocracking catalyst, comprising:

a base extrudate comprising at least one molecular sieve, an alumina and an amorphous silica alumina support, wherein the base extrudate has a total nanopore volume in the 2 to 50 nm of 0.7 to 1.2 cc/g; and

at least one metal selected from the group consisting of elements from Group 6 and Groups 8 through 10 of the Periodic Table.

14. The hydrocracking catalyst of Claim 13, wherein the base extrudate is formed using an alumina having a nanopore volume in the 6 nm to 11 nm range of 0.1 to 0.3 cc/g.

15. The hydrocracking catalyst of Claim 14, wherein the base extrudate is formed using an amorphous silica alumina support having a nanopore volume in the 6 nm to 11 nm range of 0.6 to 0.9 cc/g.

16. The hydrocracking catalyst of Claim 13, wherein the base extrudate is formed using an amorphous silica alumina support having a nanopore volume in the 6 nm to 11 nm range of 0.6 to 0.9 cc/g.

17. The hydrocracking catalyst of Claim 13, wherein the base extrudate has a nanopore volume in the 6 nm to 11 nm range of 0.5 to 0.9 cc/g.

18. The hydrocracking catalyst of Claim 13, wherein the base extrudate has a particle density of 0.7 to 0.9 g/cc.

19. A process for hydrocracking a hydrocarbonaceous feedstock, comprising contacting the feedstock with a hydrocracking catalyst under hydrocracking conditions to produce a hydrocracked effluent;

the hydrocracking catalyst comprising

a base extrudate comprising at least one molecular sieve, an alumina and an amorphous silica alumina support, wherein the base extrudate has a total nanopore volume in the 2 to 50 nm of 0.7 to 1.2 cc/g; and

at least one metal selected from the group consisting of elements from Group 6 and Groups 8 through 10 of the Periodic Table.

20. The process of Claim 19, wherein the base extrudate is formed using an alumina having a nanopore volume in the 6 nm to 11 nm range of 0.1 to 0.3 cc/g 0.7 to 1.2 cc/g.

21. The process of Claim 20, wherein the base extrudate is formed using an amorphous silica alumina support having a nanopore volume in the 6 nm to 11 nm range of 0.6 to 0.9 cc/g.

22. The process of Claim 19, wherein the base extrudate is formed using an amorphous silica alumina support having a nanopore volume in the 6 nm to 11 nm range of 0.6 to 0.9 cc/g.

23. The process of Claim 19, wherein the base extrudate has a nanopore volume in the 6 nm to 11 nm range of 0.5 to 0.9 cc/g.

24. The process of Claim 19, wherein the base extrudate has a particle density of 0.7 to 0.9 g/cc.

25. A hydrocracking catalyst, comprising:

a base extrudate comprising at least one molecular sieve, an alumina and an amorphous silica alumina support, the base extrudate having a particle density of 0.7 to 0.9 g/cc; and

at least one metal selected from the group consisting of elements from Group 6 and Groups 8 through 10 of the Periodic Table.

26. The hydrocracking catalyst of Claim 25, wherein the base extrudate is formed using an alumina having a nanopore volume in the 6 nm to 11 nm range of 0.1 to 0.3 cc/g.

27. The hydrocracking catalyst of Claim 26, wherein the base extrudate is formed using an amorphous silica alumina support having a nanopore volume in the 6 nm to 11 nm range of 0.6 to 0.9 cc/g.

28. The hydrocracking catalyst of Claim 25, wherein the base extrudate is formed using an amorphous silica alumina support having a nanopore volume in the 6 nm to 11 nm range of 0.6 to 0.9 cc/g.

29. The hydrocracking catalyst of Claim 25, wherein the base extrudate has a nanopore volume in the 6 nm to 11 nm range of 0.5 to 0.9 cc/g.

30. The hydrocracking catalyst of Claim 29, wherein the base extrudate has a total nanopore volume in the 2 to 50 nm of 0.7 to 1.2 cc/g.

31. A process for hydrocracking a hydrocarbonaceous feedstock, comprising contacting the feedstock with a hydrocracking catalyst under hydrocracking conditions to produce a hydrocracked effluent;

the hydrocracking catalyst comprising

a base extrudate comprising at least one molecular sieve, an alumina and an amorphous silica alumina support, the base extrudate having a particle density of 0.7 to 0.9 g/cc; and

at least one metal selected from the group consisting of elements from Group 6 and Groups 8 through 10 of the Periodic Table.

32. The process of Claim 31 wherein the base extrudate is formed using an alumina having a nanopore volume in the 6 nm to 11 nm range of 0.1 to 0.3 cc/g.

33. The process of Claim 32, wherein the base extrudate is formed using an amorphous silica alumina support having a nanopore volume in the 6 nm to 11 nm range of 0.6 to 0.9 cc/g.

34. The process of Claim 31, wherein the base extrudate is formed using an amorphous silica alumina support having a nanopore volume in the 6 nm to 11 nm range of 0.6 to 0.9 cc/g.

35. The process of Claim 31, wherein the base extrudate has a nanopore volume in the 6 nm to 11 nm range of 0.5 to 0.9 cc/g.

36. The process of Claim 35, wherein the base extrudate has a total nanopore volume in the 2 to 50 nm of 0.7 to 1.2 cc/g.

37. A hydrocracking catalyst, comprising:

a base extrudate comprising at least one molecular sieve, an alumina and an amorphous silica alumina support, wherein the base extrudate is formed using an amorphous silica alumina support having a nanopore volume in the 6 nm to 11 nm range of 0.6 to 0.9 cc/g; and

at least one metal selected from the group consisting of elements from Group 6 and Groups 8 through 10 of the Periodic Table.

38. The hydrocracking catalyst of Claim 37, wherein the base extrudate is formed using an alumina having a nanopore volume in the 6 nm to 11 nm range of 0.1 to 0.3 cc/g.

39. The hydrocracking catalyst of Claim 37, wherein the base extrudate has a particle density of 0.7 to 0.9 g/cc.

40. The hydrocracking catalyst of Claim 37, wherein the base extrudate has a nanopore volume in the 6 nm to 11 nm range of 0.5 to 0. cc/g.

41. The hydrocracking catalyst of Claim 40, wherein the base extrudate has a total nanopore volume in the 2 to 50 nm of 0.7 to 1.2 cc/g.

42. A process for hydrocracking a hydrocarbonaceous feedstock, comprising contacting the feedstock with a hydrocracking catalyst under hydrocracking conditions to produce a hydrocracked effluent;

the hydrocracking catalyst comprising

a base extrudate comprising at least one molecular sieve, an alumina and an amorphous silica alumina support, wherein the base extrudate is formed using an amorphous silica alumina support having a nanopore volume in the 6 nm to 11 nm range of 0.6 to 0.9 cc/g; and

at least one metal selected from the group consisting of elements from Group 6 and Groups 8 through 10 of the Periodic Table.

43. The process of Claim 42, wherein the base extrudate is formed using an alumina having a nanopore volume in the 6 nm to 11 nm range of 0.1 to 0.3 cc/g.

44. The process of Claim 42, wherein the base extrudate has a particle density of 0.7 to 0.9 g/cc.

45. The process of Claim 42, wherein the base extrudate has a nanopore volume in the 6 nm to 11 nm range of 0.5 to 0.9 cc/g.

46. The process of Claim 45, the base extrudate having a total nanopore volume in the 2 to 50 nm of 0.7 to 1.2 cc/g.