CLAIMS

1. A hydrocracking catalyst for hydrocarbon oil, the catalyst comprising:

a support comprising:

a post-framework modified ultra-stable Y-type (USY) zeolite component, and

a binder component comprising:

5-10 W% titania relative to the total mass of the binder component and

one or more additional inorganic oxides; and

active components comprising

a phosphorous active component; and

one or more hydrocracking metal active components,

in which the active components are loaded on the support.

2. A hydrocracking catalyst according to Claim 1, comprising 0.01-5.0 W% of the phosphorous active component relative to the total mass of the hydrocracking catalyst, in which the binder component comprises an amorphous binary composite of alumina-titania or an amorphous ternary composite of alumina-silica-titania, and in which hydrocracking metal active components comprise one or more metals or metal compounds (oxides or sulphides) selected from the Periodic Table of the Elements IUPAC Groups 6, 7, 8, 9 and 10.

3. A hydrocracking catalyst according to Claim 1, comprising 0.01-5.0 W% of the phosphorous active component relative to the total mass of the hydrocracking catalyst, in which the binder component further comprises 5-10 W% silica, and 80-90 W% alumina, each relative to the total mass of the binder component, and in which hydrocracking metal active components comprise one or more metals or metal compounds (oxides or sulphides) selected from the Periodic Table of the Elements IUPAC Groups 6, 7, 8, 9 and 10.

4. A hydrocracking catalyst according to Claim 3, comprising 1.0-3.0 W% of the phosphorus active component relative to the total mass of the hydrocracking catalyst.

5. A hydrocracking catalyst according to any preceding claim, comprising, as one or more hydrocracking metal active components, one or more metals or metal compounds (oxides or sulphides) of Mo, W, Co or Ni.

6. A hydrocracking catalyst according to any of Claims 1 to 4, having a specific surface area of 200 to 450 m^2/g; a volume of pores having a diameter of 600 Å or less of 0.40 to 0.75 ml/g.

7. A hydrocracking catalyst according to any of Claims 1 to 4 in the form of extrudates, in which the extrudates are calcined.

8. A hydrocracking catalyst according to any of Claims 1 to 4, in which the post-framework modified USY zeolite comprise one or more of titanium, zirconium and/or hafnium substituting aluminium atoms constituting a zeolite framework of the USY zeolite.

9. A hydrocracking catalyst according to any of Claims 1 to 4, in which the post-framework modified USY zeolite comprise titanium and zirconium substituting aluminium atoms constituting a zeolite framework of the USY zeolite.

10. A hydrocracking catalyst according to Claim 9, in which the post-framework modified USY zeolite is substituted with 0.1-5 W% zirconium atoms and 0.1-5 W% titanium ions calculated on an oxide basis.

11. A hydrocracking catalyst according to any of Claims 1 to 4, in which the post framework-substituted USY zeolite has the following characteristics: (a) a crystal lattice constant of 2.430 to 2.450 nm, (b) a specific surface area of 600 to 900 m^2/g, and (c) a molar ratio of SiO_2 to Al_2O_3 of 10 to 100.

12. A method for making hydrocracking catalyst particles comprising:

providing post-framework modified ultra-stable Y-type (USY) zeolite component in which a portion of aluminium atoms constituting a zeolite framework thereof is substituted with zirconium atoms and/or titanium atoms and/or hafnium atoms;

providing a titania-containing binder component;

mixing and kneading the post-framework modified USY zeolite component with the titania-containing binder component to form a composite;

forming the composite into extrudates as composite support particles;

thermally treating the composite support particles;

recovering intermediate calcined catalyst support particles that are characterized by outer surfaces and pores which define inner surfaces; and

loading active components comprising a phosphorus component and one or more hydrocracking metal active components.

13. A hydrocracking catalyst according to Claim 12, in which loading active components comprises

(a) loading active components on outer surfaces and/or on pore inner surfaces of the intermediate calcined catalyst support particles, the process further comprising thermally treating active component loaded intermediate calcined catalyst support particles, and recovering final calcined catalyst particles;

(b) loading active components on outer surfaces and/or on pore inner surfaces of the titania-containing binder component, the process further comprising thermally treating active component loaded intermediate calcined catalyst support particles, and recovering final calcined catalyst particles; or

(c) loading active components on outer surfaces and/or on pore inner surfaces of the composite of the titania-containing binder component and the post-framework modified USY zeolite component, the process further comprising thermally treating active component loaded intermediate calcined catalyst support particles, and recovering final calcined catalyst particles.

14. A hydrocracking catalyst according to Claim 13, in which

(a) the phosphorus component is loaded on the calcined catalyst particles

(b) the phosphorus component and the one or more hydrocracking metal active components are loaded on the intermediate calcined catalyst support particles;

(c) the phosphorus component is loaded on the titania-containing binder component;

(d) the phosphorus component and the one or more hydrocracking metal active components are loaded on the titania-containing binder component;

(e) the phosphorus component is loaded on the composite of the post-framework modified USY zeolite component and the titania-containing binder component; or

(f) the phosphorus component and the one or more hydrocracking metal active components are loaded on the composite of the post-framework modified USY zeolite component and the titania-containing binder component.

15. A method for hydrocracking hydrocarbon oil, comprising hydrocracking hydrocarbon oil with a hydrocracking catalyst according to any of Claims 1 to 4.