CLAIMS

1. A process for converting a first feedstock comprising pyrolysis oil obtained from a steam cracking unit and a second heavy hydrocarbon-based feedstock having an initial boiling point of at least 550° C., said process comprising the following steps:

a) a step of hydroconverting said feedstocks in at least one reactor, in the presence of hydrogen and of at least one hydroconversion catalyst, with the reactor being fed with the first feedstock at a feed temperature T1 of between 80 and 200° C. and, separately, with the second feedstock at a feed temperature T2 greater than 250° C., producing a hydroconverted liquid effluent;

b) a step of separating at least a portion of the hydroconverted liquid effluent obtained from step a) into at least a naphtha fraction, a gas oil fraction, a vacuum gas oil fraction and an unconverted residue fraction;

c) a hydrocracking step in a fixed-bed reactor in the presence of a catalyst for hydrocracking at least a portion of the vacuum gas oil fraction obtained from step b), producing a hydrocracked liquid effluent;

d) a step of fractionating at least a portion of the hydrocracked liquid effluent obtained from step c) into a naphtha fraction, a gas oil fraction and an unconverted vacuum gas oil fraction;

e) a step of steam cracking of at least a portion of the naphtha fraction obtained from step d) and optionally of a portion of the unconverted vacuum gas oil fraction obtained from step d) to obtain a steam-cracked effluent;

f) a step of fractionating at least a portion of the steam-cracked effluent obtained from step e) into an ethylene fraction, a propylene fraction, a butadiene and C4 olefin fraction, a pyrolysis gasoline fraction and a pyrolysis oil fraction;

g) a step in which at least a portion of the pyrolysis oil fraction obtained from step f) is sent into the hydroconverting step a).

2. The process according to claim 1, wherein, in step g), the pyrolysis oil fraction obtained from step f) is sent to the hydroconverting step a), either directly or after at least one intermediate treatment chosen from deasphalting and steam stripping and/or hydrogen stripping.

3. The process according to claim 1, wherein the first feedstock comprising pyrolysis oil obtained from a steam cracking unit is introduced at the end of the hydroconverting step a).

4. The process according to claim 1, wherein the hydroconverting step a) in the presence of hydrogen is performed in at least one ebullated-bed three-phase reactor.

5. The process according to claim 1, which also comprises a step h) of deasphalting by liquid/liquid extraction of at least a portion of the unconverted residue fraction from step b), so as to obtain an asphalt phase and a deasphalted unconverted residue, said deasphalted unconverted residue being at least partly sent to the hydrocracking step c).

6. The process according to claim 5, wherein the deasphalting step h) is performed in two successive steps so as to obtain an asphalt phase, a light deasphalted unconverted residue and a heavy deasphalted unconverted residue, said light deasphalted unconverted residue

being sent at least partly to the hydrocracking step c), said heavy deasphalted unconverted residue being sent at least partly to step a) in the second feedstock.

7. The process according to claim 1, which also comprises a step a′) of deasphalting the pyrolysis oil fraction obtained from the fractionating step f), so as to obtain an asphalt phase and a deasphalted pyrolysis oil, said deasphalted pyrolysis oil being at least partly sent to the hydroconverting step a) as first feedstock.

8. The process according to claim 7, wherein the pyrolysis oil deasphalting step a′) is performed by liquid/liquid extraction in two steps, so as to obtain an asphalt phase, a light deasphalted pyrolysis oil and a heavy deasphalted pyrolysis oil, said light deasphalted pyrolysis oil being at least partly or totally sent to the hydrocracking step c), and said heavy deasphalted pyrolysis oil being at least partly sent to the hydroconverting step a) in the first feedstock.

9. The process according to claim 1, which also comprises a step i) of deasphalting by liquid/liquid extraction of the pyrolysis oil obtained from step f) and of at least a portion of the unconverted residue obtained from step b), so as to obtain an asphalt phase and a deasphalted oil DAO cut, said deasphalted oil cut being at least partly sent to the hydroconverting step a) in the first feedstock.

10. The process according to claim 9, wherein the deasphalting step i) is performed by liquid/liquid extraction in two steps, so as to obtain an asphalt phase, a light deasphalted oil cut and a heavy deasphalted oil cut, said light deasphalted oil cut being at least partly sent to the hydrocracking step c), and said heavy deasphalted oil cut being at least partly or totally sent to the hydroconverting step a) in the first feedstock.

11. The process according to claim 1, wherein the hydroconverting step a) is performed in the presence of a colloidal or molecular catalyst, and in the presence of a porous supported catalyst.

12. The process according to claim 1, which also comprises at least one of the following additional steps:

a hydrotreatment step j), performed in a reactor in the presence of at least one fixed-bed hydrotreatment catalyst, of at least a portion of the naphtha fraction obtained from step b), optionally followed by a step k) of recycling of at least a portion of the hydrotreated naphtha fraction obtained from step j) into the steam cracking step e);

a hydrotreatment step l), performed in a reactor in the presence of at least one fixed-bed hydrotreatment catalyst, of at least a portion of the gas oil fraction obtained from step b), optionally followed by a step m) of recycling of at least a portion of the hydrotreated gas oil fraction obtained from step l) into the hydrocracking step c).

13. The process according to claim 1, wherein the proportion of pyrolysis oil of the first feedstock relative to the total feedstock of the hydroconverting step a) is greater than or equal to 5% by weight.

14. The process according to claim 13, wherein the proportion of pyrolysis oil of the first feedstock relative to the total feedstock of the hydroconverting step a) is 5% to 50% by weight.

15. The process according to claim 13, wherein the proportion of pyrolysis oil of the first feedstock relative to the total feedstock of the hydroconverting step a) is 5% to 25% or 40% by weight.

16. The process according to claim 13, wherein the proportion of pyrolysis oil of the first feedstock relative to the total feedstock of the hydroconverting step a) is 5% to 25% by weight.

17. The process according to claim 1, wherein the proportion of pyrolysis oil of the first feedstock relative to the total feedstock of the hydroconverting step a) is greater than or equal to 10% by weight.

18. The process according to claim 1, wherein the second feedstock of the hydroconverting step a) comprises hydrocarbons chosen from at least one of the following hydrocarbons: hydrocarbons obtained from the atmospheric distillation or vacuum distillation of crude oil, residual fraction obtained from the direct liquefaction of coal, vacuum gas oil, residual fraction obtained from the direct liquefaction of lignocellulosic biomass alone or as a mixture with coal, residual petroleum fraction.