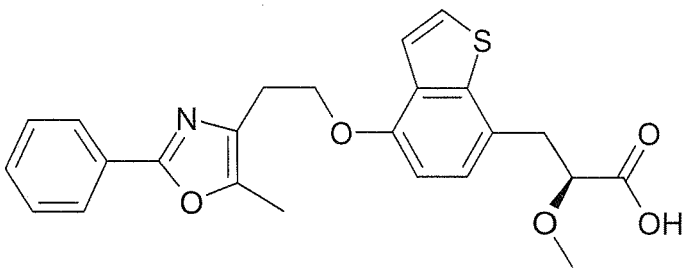
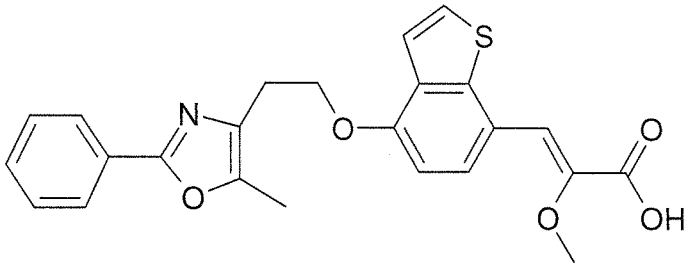
Claims

1. A process for the preparation of a compound of formula (I)



(I)

or a salt thereof, wherein a compound of formula (II)

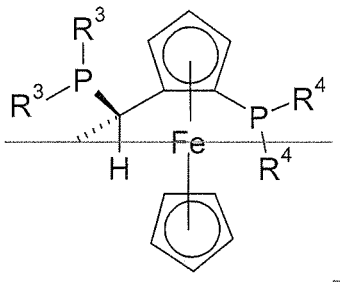


(II)

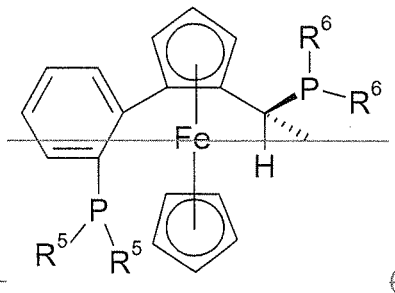
or a salt thereof is hydrogenated

~~(a)~~ in the presence of a catalyst comprising iridium; ~~or~~

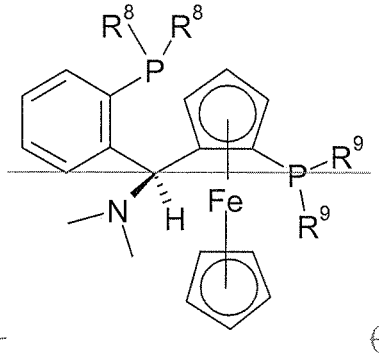
~~(b) in the presence of a catalyst comprising ruthenium and a compound of formula (IV), (V) or (VII)~~



~~(IV);~~



~~(V);~~



~~or~~ ~~(VII);~~

~~wherein~~

~~R^3 is alkyl, cycloalkyl or aryl;~~

~~R^4 is cycloalkyl, aryl or heteroaryl;~~

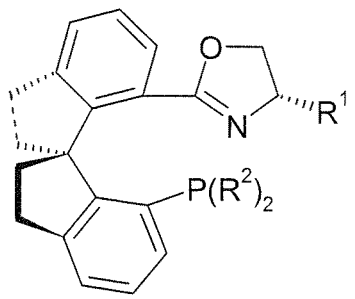
~~R^5 is cycloalkyl or aryl;~~

~~R^6 is cycloalkyl or aryl;~~

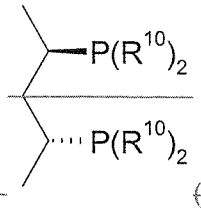
~~R^8 is cycloalkyl or aryl; and~~

~~R^9 is cycloalkyl or aryl.~~

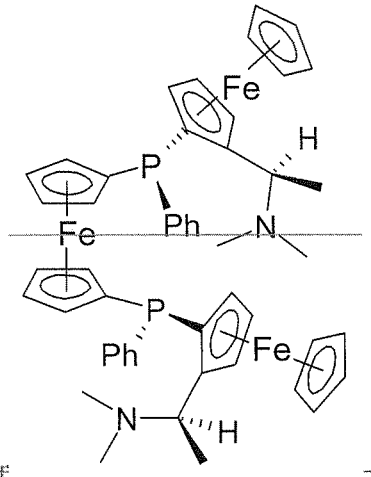
~~2.A process according to claim 1,~~ wherein the catalyst comprises iridium and a compound of formula (III)~~, (VIII) or (IX)~~



(III);



~~(VIII);~~



~~or~~ ~~(IX);~~

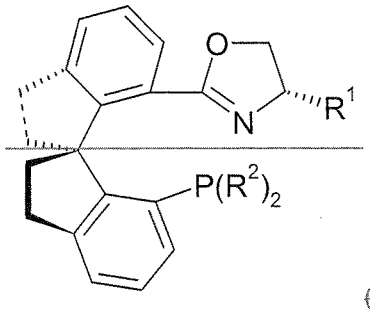
wherein

R^1 is hydrogen, *iso*-propylalkyl, ~~aryl~~-phenyl or ~~arylalkyl~~benzyl; and

R^2 is ~~aryl~~phenyl, 3,5-di-methylphenyl or 3,5-di-*tert*-butyl-phenyl; ~~and~~

~~R^{10} is aryl~~.

~~3. A process according to claim 1 or 2, wherein the catalyst comprises iridium and a compound of formula (III)~~



~~(III)~~

~~wherein R^1 and R^2 are as defined in claim 2.~~

~~4. A process according to claim 2 or 3, wherein R^1 is hydrogen, *iso*-propyl, phenyl or benzyl.~~

~~5. A process according to any one of claims 2 to 4, wherein R^2 is phenyl, 3,5-di-methylphenyl or 3,5-di-*tert*-butyl-phenyl.~~

~~6. A process according to any one of claims 2 to 5, wherein R^{10} is 3,5-di-methyl-phenyl.~~

~~7~~2. A process according to ~~any one of~~ claims ~~2 to 6~~1, wherein the compound of formula (III) is

(Sa,S)-7-[4,5-Dihydro-4-benzyloxazol-2-yl]-7'-diphenylphosphino-1,1'-spirobiindane;

(Sa,S)-7-[4,5-Dihydro-4-benzyloxazol-2-yl]-7'-di(3,5-di-methylphenyl)phosphino-1,1'-spirobiindane;

(Sa,S)-7-[4,5-Dihydro-4-benzyloxazol-2-yl]-7'-di(3,5-di-tert-butylphenyl) phosphino-1,1'-spirobiindane;

(Sa,S)-7-[4,5-Dihydro-4-phenyloxazol-2-yl]-7'-di(3,5-di-tert-butylphenyl) phosphino-1,1'-spirobiindane;

(Sa,S)-7-[4,5-Dihydro-4-isopropyloxazol-2-yl]-7'-di(3,5-di-tert-butylphenyl) phosphino-1,1'-spirobiindane; or

(Sa)-7-[4,5-Dihydrooxazol-2-yl]-7'-di(3,5-di-tert-butylphenyl)phosphino-1,1'-spirobiindane.

~~8~~3. A process according to ~~any one of~~ claims 1 or ~~2 to 7~~, wherein the compound of formula (III) is

(Sa,S)-7-[4,5-Dihydro-4-benzyloxazol-2-yl]-7'-di(3,5-di-tert-butylphenyl) phosphino-1,1'-spirobiindane;

(Sa,S)-7-[4,5-Dihydro-4-isopropyloxazol-2-yl]-7'-di(3,5-di-tert-butylphenyl) phosphino-1,1'-spirobiindane; or

(Sa)-7-[4,5-Dihydrooxazol-2-yl]-7'-di(3,5-di-tert-butylphenyl)phosphino-1,1'-spirobiindane.

94. A process according to any one of claims 1 to 83, wherein the catalyst is $Ir(L^1)(L^2)_nY$

wherein

L^1 is a compound of formula (III), ~~(VIII) or (IX)~~ as defined in any one of claims ~~2~~ 1 to 83;

L^2 is cyclooctene, 1,5-cyclooctadiene, ethylene, 1,5-hexadiene or norbornadiene;

Y is chloride, iodide, bromide, fluoride, trifluoroacetate, tetrafluoroborate, tetrakis[3,5-bis(trifluoromethyl)phenyl]borate, tetraphenylborate, hexafluoroantimonate, hexafluorophosphate, triflate, mesylate, perchlorate, perbromate, periodate, nitrate, hydrogene sulfate or acetylacetonate; and

n is 1 or 2.

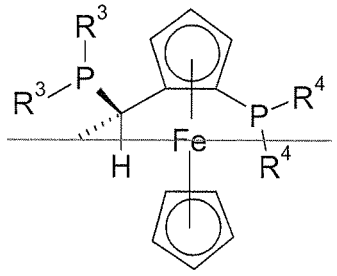
~~105~~. A process according to any one of claims 1 to 94, wherein the catalyst is

[Ir((S,S)-7-[4,5-dihydro-4-benzyloxazol-2-yl]-7'-di(3,5-di-tert-butylphenyl) phosphino-1,1'-spirobiindane)(1,5-cyclooctadiene)][tetrakis[3,5-bis(trifluoromethyl)phenyl]borate];

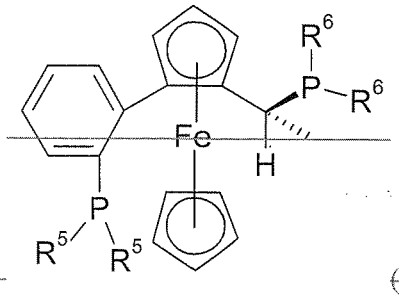
[Ir((S,S)-7-[4,5-dihydro-4-isopropyloxazol-2-yl]-7'-di(3,5-di-tert-butylphenyl) phosphino-1,1'-spirobiindane)(1,5-cyclooctadiene)][tetrakis[3,5-bis(trifluoromethyl)phenyl]borate]; or

[Ir((S)-7-[4,5-dihydrooxazol-2-yl]-7'-di(3,5-di-tert-butylphenyl)phosphino-1,1'-spirobiindane)(1,5-cyclooctadiene)][tetrakis[3,5-bis(trifluoromethyl) phenyl]borate].

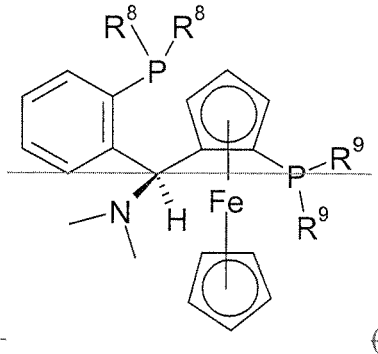
11. A process according to claim 1, wherein the catalyst comprises ruthenium and a compound of formula (IV), (V) or (VII)



(IV);



(V);



or (VII),

wherein R^3 to R^9 are defined as in claim 1.

12. A process according to claim 1 or 11, wherein R^3 is *tert*-butyl, cyclohexyl, phenyl, 2-methyl-phenyl or 3,5-di-methyl-phenyl.

13. A process according to any one of claims 1 or 11 or 12, wherein R^4 is *tert*-butyl, cyclohexyl, phenyl, 3,5-di-trifluoromethyl-phenyl, 4-trifluoromethyl-phenyl, 3,5-di-methyl-4-methoxy-phenyl, 1-naphtyl or 2-furyl.

14. A process according to any one of claims 1 or 11 to 13, wherein R^5 is phenyl, cyclohexyl, 3,5-di-methyl-4-methoxy-phenyl or 3,5-di-methyl-phenyl.

15. A process according to any one of claims 1 or 11 to 14, wherein R^6 is phenyl, cyclohexyl, 3,5-di-methyl-phenyl, 3,5-di-trifluoromethyl-phenyl or norbornyl.

16. A process according to any one of claims 1 or 11 to 15, wherein R^8 is cyclohexyl or phenyl.

17. A process according to any one of claims 1 or 11 to 16, wherein R^9 is cyclohexyl or phenyl.

18. A process according to any one of claims 1 or 11 to 17, wherein the compound of formula (IV), (V) or (VII) is

(S)-1-[(R)-2-(Diphenylphosphino)ferrocenyl]ethyldi-tert-butylphosphine;

(S)-1-[(R)-2-(Dicyclohexylphosphino)ferrocenyl]ethyldi-tert-butylphosphine;

(S)-1-[(R)-2-(Di-(4-trifluoromethylphenyl)phosphino)ferrocenyl]ethyldi-tert-butyl phosphine;

(S)-1-[(R)-2-(Di-(3,5-dimethyl-4-methoxyphenyl)phosphino)ferrocenyl]ethyldi-tert-butylphosphine;

(S)-1-[(R)-2-(Di-2-furylphosphino)ferrocenyl]ethyldi-tert-butylphosphine;

(R)-1-Diphenylphosphino-2-[(S)-α-(N,N-dimethylamino)-o-diphenylphosphinophenyl)methyl]ferrocene;

(S)-1-[(S)-2-(2'-Diphenylphosphinophenyl)ferrocenyl]ethyldi(bis-3,5-trifluoromethyl phenyl)phosphine;

(R)-1-[(R)-2-(2'-Dicyclohexylphosphinophenyl)ferrocenyl]ethyldi(bis-3,5-trifluoromethylphenyl)phosphine; or

(R)-1-[(R)-2-(2'-Diphenylphosphinophenyl)ferrocenyl]ethyldi-(2-norbornyl)phosphine.

19. A process according to any one of claims 1 or 11 to 18, wherein the compound of formula (IV), (V) or (VII) is

(S)-1-[(R)-2-(Diphenylphosphino)ferrocenyl]ethyldi-tert-butylphosphine; or

(S)-1-[(R)-2-(Di-(3,5-dimethyl-4-methoxyphenyl)phosphino)ferrocenyl]ethyldi-tert-butylphosphine.

20. A process according to any one of claims 1 or 11 to 19, wherein the catalyst is $Ru(L^3)(L^4)(L^5)_mY_p$

wherein,

L^3 is a compound of formula (IV), (V) or (VII) as defined in any one of claims 11 to 20;

L^4 is η^5-2,4-dimethylpentadienyl, cyclopentadienyl or η^5-2,3,4-trimethylpenta-dienyl;

L^5 is halide, acetonitrile, diethyl ether, water, acetone, tetrahydrofuran, dioxane, pyridine, imidazole or thiophene;

Y is tetrakis[3,5-bis(trifluoromethyl)phenyl]borate, hexafluoroantimonate, hexafluorophosphate, triflate, mesylate, hydrogene sulfate or perchlorate;

m is 0 or 1; and

p is 0 or 1.

21. A process according to any one of claims 1 or 11 to 20, wherein the catalyst is

[Ru(η^5-2,4-dimethylpentadienyl)((S)-1-[(R)-2-(diphenylphosphino)ferrocenyl]-ethyldi-tert-butylphosphine)(acetonitrile)] [tetrafluoroborate];

[Ru(η^5-2,4-dimethylpentadienyl)((S)-1-[(R)-2-(dicyclohexylphosphino)ferrocenyl]-ethyldi-tert-butylphosphine)(acetonitrile)] [tetrafluoroborate];

[Ru(η^5-2,4-dimethylpentadienyl)((S)-1-[(R)-2-(di-(4-trifluoromethylphenyl) phosphino)ferrocenyl]ethyldi-tert-butylphosphine)(acetonitrile)] [tetrafluoroborate];

[Ru(η^5-2,4-dimethylpentadienyl)((S)-1-[(R)-2-(di-(3,5-dimethyl-4-methoxyphenyl) phosphino)ferrocenyl]ethyldi-tert-butylphosphine)(acetonitrile)] [tetrafluoroborate];

[Ru(η^5-2,4-dimethylpentadienyl)((S)-1-[(R)-2-(di-2-furylphosphino)ferrocenyl]-ethyldi-tert-butylphosphine)(acetonitrile)] [tetrafluoroborate];

[RuI(η^5-2,4-dimethylpentadienyl)((R)-1-diphenylphosphino-2-[(S)-α-(N,N-dimethylamino)-o-diphenylphosphinophenyl)methyl]ferrocene)];

[Ru(η^5-2,4-dimethylpentadienyl)((S)-1-[(S)-2-(2'-diphenylphosphinophenyl) ferrocenyl]ethyldi(bis-3,5-trifluoromethylphenyl)phosphine)(acetonitrile)] [tetrafluoroborate];

[Ru(η^5-2,4-dimethylpentadienyl)((R)-1-[(R)-2-(2'-dicyclohexylphosphinophenyl) ferrocenyl]ethyldi(bis-3,5-trifluoromethylphenyl)phosphine)(acetonitrile)] [tetrafluoroborate]; or

[Ru(η^5-2,4-dimethylpentadienyl)((R)-1-[(R)-2-(2'-diphenylphosphinophenyl) ferrocenyl]ethyldi-(2-norbornyl)phosphine)(acetonitrile)] [tetrafluoroborate].

22. A process according to any one of claims 1 or 11 to 21, wherein the catalyst is

[Ru(η^5-2,4-dimethylpentadienyl)((S)-1-[(R)-2-(diphenylphosphino)ferrocenyl]-ethyldi-tert-butylphosphine)(acetonitrile)] [tetrafluoroborate]; or

[Ru(η^5-2,4-dimethylpentadienyl)((S)-1-[(R)-2-(di-(3,5-dimethyl-4-methoxyphenyl) phosphino)ferrocenyl]ethyldi-tert-butylphosphine)(acetonitrile)] [tetrafluoroborate].

~~23~~6. The use of a catalyst as defined in any one of claims 1 to ~~22~~ 5 for the preparation of a compound of formula (I) as defined in claim 1.

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