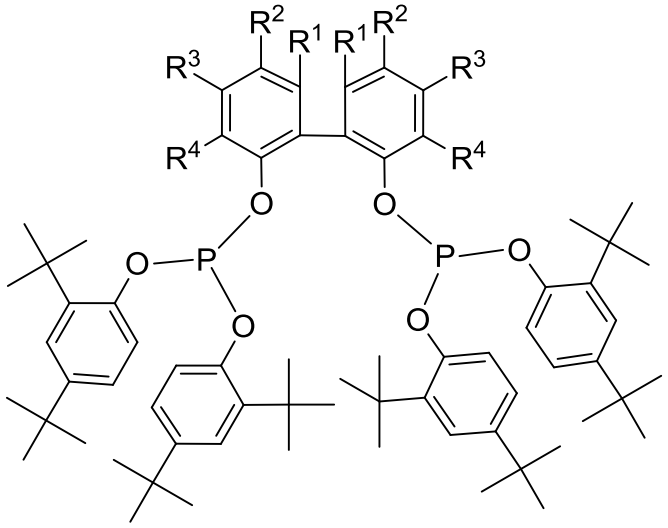
Claims

1. Compound of the formula (**I**):



(**I**)

where

R^1 and R^3 are selected from: -H, -(C_1-C_{12})-alkyl, -O-(C_1-C_{12})-alkyl,

R^2 and R^4 are selected from: -H, ethyl, propyl, isopropyl, n-butyl, isobutyl, sec-butyl, tert-butyl, n-pentyl, 2-pentyl, 2-methylbutyl, 3-methylbutyl, 1,2-dimethylpropyl, 1,1-dimethylpropyl, 2,2-dimethylpropyl, 1-ethylpropyl, n-hexyl, 2-hexyl, 2-methylpentyl, 3-methylpentyl, 4-methylpentyl, 1,1-dimethylbutyl, 1,2-dimethylbutyl, 2,2-dimethylbutyl, 1,3-dimethylbutyl, 2,3-dimethylbutyl, 3,3-dimethylbutyl, 1,1,2-trimethylpropyl, 1,2,2-trimethylpropyl, 1-ethylbutyl, 1-ethyl-2-methylpropyl, n-heptyl, 2-heptyl, 3-heptyl, 2-ethylpentyl, 1-propylbutyl, n-octyl, 2-ethylhexyl, 2-propylheptyl, nonyl, decyl and -O-(C_1-C_{12})-alkyl,

wherein the alkyl groups mentioned may be substituted as follows:

substituted -(C_1-C_{12})-alkyl groups and substituted -(C_1-C_{12})-alkoxy groups, depending on their chain length, may have one or more substituents; the substituents are mutually independently selected from -(C_3-C_{12})-cycloalkyl, -(C_3-C_{12})-heterocycloalkyl, -(C_6-C_{20})-aryl, fluorine, chlorine, cyano, formyl, acyl or alkoxycarbonyl;

and at least one of the R^1, R^2, R^3, R^4 radicals is not -H.

2. Compound according to Claim 1,

where R^2 and R^4 are not –H.

3. Compound according to either of Claims 1 and 2,

where R^2 and R^4 are selected from: ethyl, propyl, isopropyl, n-butyl, isobutyl, sec-butyl, tert-butyl, n-pentyl, 2-pentyl, 2-methylbutyl, 3-methylbutyl, 1,2-dimethylpropyl, 1,1-dimethylpropyl, 2,2-dimethylpropyl, 1-ethylpropyl, n-hexyl, 2-hexyl, 2-methylpentyl, 3-methylpentyl, 4-methylpentyl, 1,1-dimethylbutyl, 1,2-dimethylbutyl, 2,2-dimethylbutyl, 1,3-dimethylbutyl, 2,3-dimethylbutyl, 3,3-

dimethylbutyl, 1,1,2-trimethylpropyl, 1,2,2-trimethylpropyl, 1-ethylbutyl, 1-ethyl-2-methylpropyl, n-heptyl, 2-heptyl, 3-heptyl, 2-ethylpentyl, 1-propylbutyl, n-octyl, 2-ethylhexyl, 2-propylheptyl, nonyl, decyl and -O-(C_1-C_{12})-alkyl.

4. Compound according to any of Claims 1 to 3,
where R^2 is -O-(C_1-C_{12})-alkyl.

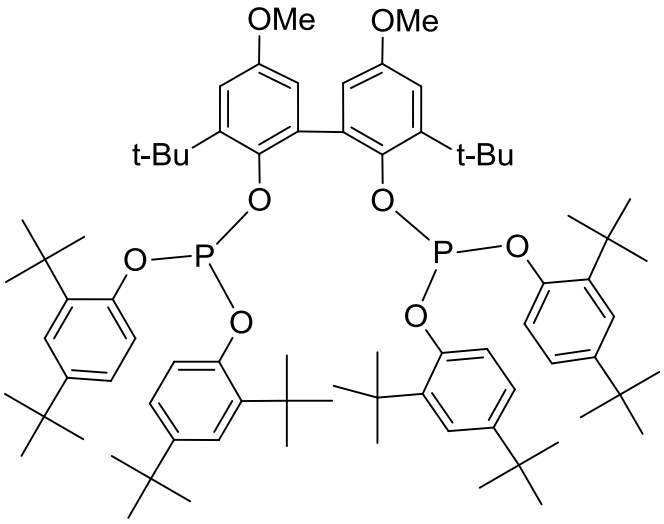
5. Compound according to any of Claims 1 to 4,
where R^4 is ethyl, propyl, isopropyl, n-butyl, isobutyl, sec-butyl, tert-butyl, n-pentyl, 2-pentyl, 2-methylbutyl, 3-methylbutyl, 1,2-dimethylpropyl, 1,1-dimethylpropyl, 2,2-dimethylpropyl, 1-ethylpropyl, n-hexyl, 2-hexyl, 2-methylpentyl, 3-methylpentyl, 4-methylpentyl, 1,1-dimethylbutyl, 1,2-dimethylbutyl, 2,2-dimethylbutyl, 1,3-dimethylbutyl, 2,3-dimethylbutyl, 3,3-dimethylbutyl, 1,1,2-trimethylpropyl, 1,2,2-trimethylpropyl, 1-ethylbutyl, 1-ethyl-2-methylpropyl, n-heptyl, 2-heptyl, 3-heptyl, 2-ethylpentyl, 1-propylbutyl, n-octyl, 2-ethylhexyl, 2-propylheptyl, nonyl, decyl.

6. Compound according to any of Claims 1 to 5,
where R^2 is selected from: -tBu, -OMe.

7. Compound according to any of Claims 1 to 6,
where R^2 is -OMe.

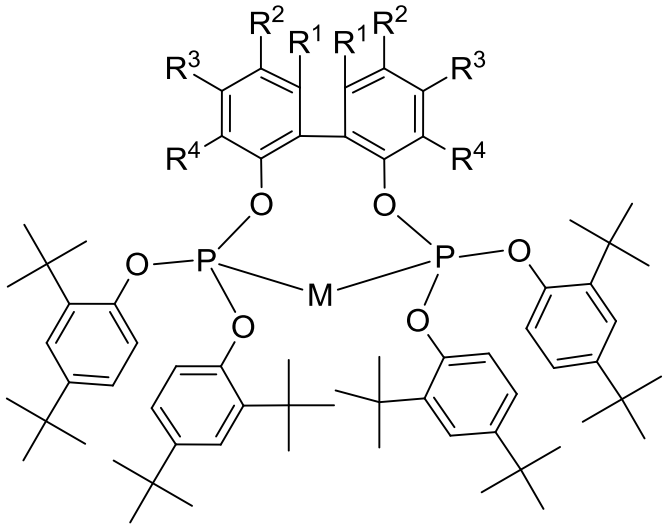
8. Compound according to any of Claims 1 to 7,
where R^4 is -tBu.

9. Compound according to any of Claims 1 to 8,
according to the formula (**1**):



(**1**)

10. Complex according to the formula (**II**):



(**II**)

where

R^1 and R^3 are selected from: -H, -(C_1-C_{12})-alkyl, -O-(C_1-C_{12})-alkyl,

R^2 and R^4 are selected from: -H, ethyl, propyl, isopropyl, n-butyl, isobutyl, sec-butyl, tert-butyl, n-pentyl, 2-pentyl, 2-methylbutyl, 3-methylbutyl, 1,2-dimethylpropyl, 1,1-dimethylpropyl, 2,2-dimethylpropyl, 1-ethylpropyl, n-hexyl, 2-hexyl, 2-methylpentyl, 3-methylpentyl, 4-methylpentyl, 1,1-dimethylbutyl, 1,2-dimethylbutyl, 2,2-dimethylbutyl, 1,3-dimethylbutyl, 2,3-dimethylbutyl, 3,3-dimethylbutyl, 1,1,2-trimethylpropyl, 1,2,2-trimethylpropyl, 1-ethylbutyl, 1-ethyl-2-methylpropyl, n-heptyl, 2-heptyl, 3-heptyl, 2-ethylpentyl, 1-propylbutyl, n-octyl, 2-ethylhexyl, 2-propylheptyl, nonyl, decyl and -O-(C_1-C_{12})-alkyl,

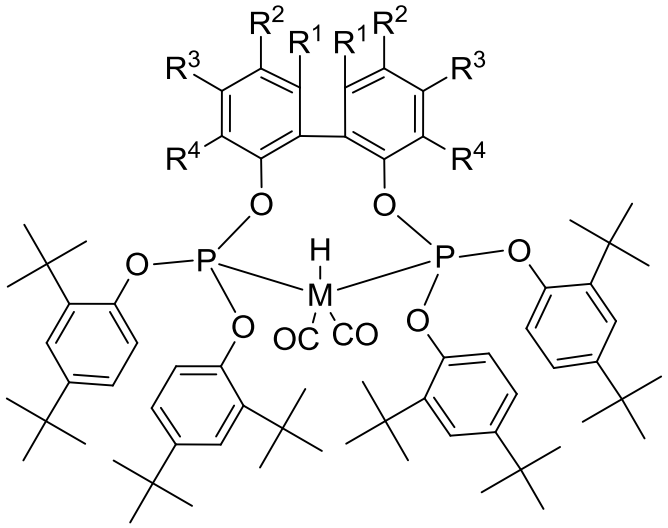
wherein the alkyl groups mentioned may be substituted as follows:

substituted -(C_1-C_{12})-alkyl groups and substituted -(C_1-C_{12})-alkoxy groups, depending on their chain length, may have one or more substituents; the substituents are mutually independently selected from -(C_3-C_{12})-cycloalkyl, -(C_3-C_{12})-heterocycloalkyl, -(C_6-C_{20})-aryl, fluorine, chlorine, cyano, formyl, acyl or alkoxycarbonyl;

at least one of the R^1, R^2, R^3, R^4 radicals is not -H;

and M is selected from: Rh, Ru, Co, Ir.

11. Complex according to the formula (**III**):



(**III**)

where

R^1 and R^3 are selected from: -H, -(C_1-C_{12})-alkyl, -O-(C_1-C_{12})-alkyl,

R^2 and R^4 are selected from: -H, ethyl, propyl, isopropyl, n-butyl, isobutyl, sec-butyl, tert-butyl, n-pentyl, 2-pentyl, 2-methylbutyl, 3-methylbutyl, 1,2-dimethylpropyl, 1,1-dimethylpropyl, 2,2-dimethylpropyl, 1-ethylpropyl, n-hexyl, 2-hexyl, 2-methylpentyl, 3-methylpentyl, 4-methylpentyl, 1,1-dimethylbutyl, 1,2-dimethylbutyl, 2,2-dimethylbutyl, 1,3-dimethylbutyl, 2,3-dimethylbutyl, 3,3-dimethylbutyl, 1,1,2-trimethylpropyl, 1,2,2-trimethylpropyl, 1-ethylbutyl, 1-ethyl-2-methylpropyl, n-heptyl, 2-heptyl, 3-heptyl, 2-ethylpentyl, 1-propylbutyl, n-octyl, 2-ethylhexyl, 2-propylheptyl, nonyl, decyl and -O-(C_1-C_{12})-alkyl,

wherein the alkyl groups mentioned may be substituted as follows:

substituted -(C_1-C_{12})-alkyl groups and substituted -(C_1-C_{12})-alkoxy groups, depending on their chain length, may have one or more substituents; the substituents are mutually independently selected from -(C_3-C_{12})-cycloalkyl, -(C_3-C_{12})-heterocycloalkyl, -(C_6-C_{20})-aryl, fluorine, chlorine, cyano, formyl, acyl or alkoxycarbonyl;

at least one of the R^1, R^2, R^3, R^4 radicals is not -H;

and M is selected from: Rh, Ru, Co, Ir.

12. Complex according to Claim 10 or 11,

where M = Rh.

13. Use of a compound according to Claims 1 to 9,

in a ligand-metal complex for catalysis of a hydroformylation reaction.

14. Process comprising the following process steps:

a) initially charging an olefin,

b) adding a complex according to either of Claims 10 and 11,

or a compound according to any of Claims 1 to 9 and a substance including a metal selected from: Rh, Ru, Co, Ir,

c) feeding in H_2 and CO,

d) heating the reaction mixture, wherein the olefin is converted to an aldehyde.