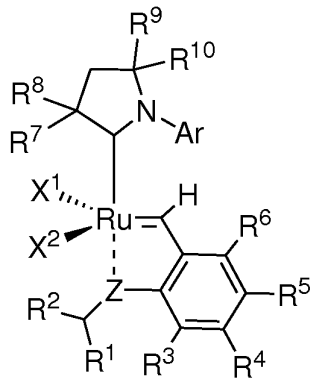
Claims

1. A process for producing a compound represented by the Formula **1**,



1

wherein:

X^1 and X^2 are each independently an anionic ligand selected from halogen atoms, -CN, -SCN, -OR', -SR', -O(C=O)R', -O(SO_2)R', and -OSi(R')$_3$ group, wherein R' is C_1-C_{12} alkyl, C_3-C_{12} cycloalkyl, C_2-C_{12} alkenyl, C_5-C_{20} aryl, which are optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or a halogen atom;

Z is an atom selected from a group of O, S, NR', wherein R' is C_1-C_{12} alkyl, C_3-C_{12} cycloalkyl, C_2-C_{12} alkenyl, C_5-C_{20} aryl, which are optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or a halogen atom;

Ar is an aryl group substituted with hydrogen atoms or optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, and C_5-C_{20} heteroaryloxy group, or a halogen atom;

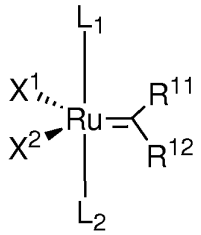
R^1 and R^2 are each independently hydrogen atom, C_1-C_{25} alkyl group, C_1-C_{25} alkoxy group, C_2-C_{25} alkenyl group, C_1-C_{12} perfluoroalkyl, C_5-C_{20} aryl, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or can be combined together to form substituted or unsubstituted C_4-C_{10} cyclic or C_4-C_{12} polycyclic system, can also be an ester (-COOR'), amide (-CONR'$_2$), formyl (-CHO), ketone (-COR'), and hydroxamic (-CON(OR')(R')) group or a halogen atom, in which R' is C_1-C_{12} alkyl, C_3-C_{12} cycloalkyl, C_2-C_{12} alkenyl, C_5-C_{20} aryl, which are optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or a halogen atom;

R^3, R^4, R^5, R^6 are each independently hydrogen atom, C_1-C_{25} alkyl group, C_1-C_{25} alkoxy group, or C_2-C_{25} alkenyl group, wherein R^3, R^4, R^5, R^6 substituents can be combined together to form substituted or unsubstituted C_4-C_{10} cyclic or C_4-C_{12} polycyclic system, can also independently be an alkoxy (-OR'), sulphide (-SR'), sulfoxide (-S(O)R'), sulphonium (-S^+R'$_2$), sulphone (-SO_2R'), sulphonamide (-SO_2NR'$_2$), amine (-NR'$_2$), ammonium (-N^+R'$_3$), nitro (-NO_2), cyano (-CN), phosphonate (-P(O)(OR')$_2$), phosphinate (-P(O)R'(OR')), phosphoninum (-P(OR')$_2$), phosphine (-PR'$_2$), phosphine oxide (-P(O)R'$_2$), phosphonium (-P^+R'$_3$), carboxy (-COOH), ester (-COOR'), amide (-CONR'$_2$, or -NR'C(O)R'), formyl (-CHO), and ketone (-

COR') group, wherein R' is C_1-C_5 alkyl, C_1-C_5 perfluoroalkyl, C_5-C_{24} aryl, C_7-C_{24} aralkyl, C_5-C_{24} perfluoroaryl;

R^7, R^8, R^9, and R^{10} are each independently hydrogen atom, or C_1-C_{25} alkyl group, R^7 and/or R^8 can be combined with R^9 and/or R^{10} to form cyclic system, are also independently C_1-C_{12} alkyl group, C_3-C_{12} cycloalkyl, C_2-C_{12} alkenyl, C_5-C_{20} aryl, C_1-C_5 perfluoroalkyl, C_7-C_{24} aralkyl, C_5-C_{24} perfluoroaryl, which are optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or a halogen atom;

characterised in that the alkylidene ruthenium complex represented by the Formula **2**



2

wherein:

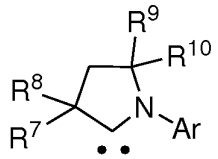
L^1, L^2 are each a neutral ligand selected from a group including phosphine, in particular $P(R')_3$, wherein each R' is independently C_1-C_{12} alkyl, C_3-C_{12} cycloalkyl, C_5-C_{20} aryl, C_7-C_{24} aralkyl, C_5-C_{24} perfluoroaryl, 5-12-membered heteroaryl; two R' can be combined together to form cycloalkyl ring containing phosphorus atom in the ring.

X^1, X^2 are each an anionic ligand selected independently from a group including halide anions, -CN, -SCN, -OR', -SR', -O(C=O)R', -$O(SO_2)$R', and -$OSi(R')_3$ group, wherein R' is C_1-C_{12} alkyl, C_3-C_{12} cycloalkyl, C_2-C_{12} alkenyl, or C_5-C_{20} aryl, which is optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or a halogen atom;

R^{11}, R^{12} are each independently hydrogen atom, halogen atom, optionally substituted C_1-C_{25} alkyl, optionally substituted C_1-C_{25} perfluoroalkyl, optionally substituted C_2-C_{25} alkene, optionally substituted C_3-C_7 cycloalkyl, optionally substituted C_2-C_{25} alkenyl, optionally substituted C_3-C_{25} cycloalkenyl, optionally substituted C_2-C_{25} alkynyl, optionally substituted C_3-C_{25} cycloalkynyl, optionally substituted C_1-C_{25} alkoxy, optionally substituted C_5-C_{24} aryloxy, optionally substituted C_5-C_{20} heteroaryloxy, optionally substituted C_5-C_{24} aryl, optionally substituted C_5-C_{20} heteroaryl, optionally substituted C_7-C_{24} aralkyl, optionally substituted C_5-C_{24} perfluoroaryl, optionally substituted 3-12-membered heterocycle;

wherein R^{11} and R^{12} substituents can be combined together to form a ring selected from a group including C_3-C_7 cycloalkyl, C_3-C_{25} cycloalkenyl, C_3-C_{25} cycloalkynyl, C_5-C_{24} aryl, C_5-C_{20} heteroaryl, C_5-C_{24} perfluoroaryl, 3-12-membered heterocycle, which can be substituted independently with one and/or more substituents selected from a group including hydrogen atom, halogen atom, C_1-C_{25} alkyl, C_1-C_{25} perfluoroalkyl, C_2-C_{25} alkene, C_3-C_7 cycloalkyl, C_2-C_{25} alkenyl, C_3-C_{25} cycloalkenyl, C_2-C_{25} alkynyl, C_3-C_{25} cycloalkynyl, C_1-C_{25} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, C_5-C_{24} aryl, C_5-C_{20} heteroaryl, C_7-C_{24} aralkyl, C_5-C_{24} perfluoroaryl, 3-12-membered heterocycle;

is reacted with carbene represented by the Formula **3**



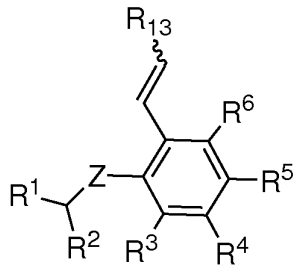
3

wherein:

Ar is an aryl group substituted with hydrogen atoms or optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy group, or a halogen atom;

R^7, R^8, R^9, and R^{10} are each independently hydrogen atom, or C_1-C_{25} alkyl group, R^7 and/or R^8 can be combined with R^9 and/or R^{10} to form cyclic system, can be also independently C_1-C_{12} alkyl, C_3-C_{12} cycloalkyl, C_2-C_{12} alkenyl, C_5-C_{20} aryl, C_1-C_5 perfluoroalkyl, C_7-C_{24} aralkyl, and C_5-C_{24} perfluoroaryl group, which are optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or a halogen atom;

thus formed reaction mixture is then contacted with the compound represented by the Formula **4**



4

wherein:

Z is an atom selected from a group of O, S, NR', wherein R' is C_1-C_{12} alkyl, C_3-C_{12} cycloalkyl, C_2-C_{12} alkenyl, C_5-C_{20} aryl, which are optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or a halogen atom;

R^1 and R^2, are each independently hydrogen atom, C_1-C_{25} alkyl group, C_1-C_{25} alkoxy group, C_2-C_{25} alkenyl group, C_1-C_{12} perfluoroalkyl, C_5-C_{20} aryl, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or can be combined together to form substituted or unsubstituted C_4-C_{10} cyclic or C_4-C_{12} polycyclic system, can also be an ester (-COOR'), amide (-CONR'$_2$), formyl (-CHO), ketone (-COR'), and hydroxamic (-CON(OR')(R')) group or a halogen atom, wherein R' is C_1-C_{12} alkyl, C_3-C_{12} cycloalkyl, C_2-C_{12} alkenyl, C_5-C_{20} aryl, which are optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or a halogen atom;

R^3, R^4, R^5, R^6 are each independently hydrogen atom, C_1-C_{25} alkyl group, C_1-C_{25} alkoxy group, or C_2-C_{25} alkenyl group, wherein R^3, R^4, R^5, R^6 substituents can be combined together to form substituted or unsubstituted C_4-C_{10} cyclic or C_4-C_{12} polycyclic system; can independently also be alkoxy (-OR'), sulphide (-SR'), sulfoxide (-S(O)R'), sulphonium (-S^+R'$_2$), sulphone (-SO_2R'), sulphonamide (-SO_2NR'$_2$), amine (-NR'$_2$), ammonium (-N^+R'$_3$), nitro (-NO_2), cyano (-CN), phosphonate (-P(O)(OR')$_2$), phosphinate (-P(O)R'(OR')), phosphoninum (-P(OR')$_2$), phosphine (-PR'$_2$), phosphine oxide (-P(O)R'$_2$), phosphonium (-P^+R'$_3$), carboxy (-COOH), ester (-COOR'), amide (-CONR'$_2$, or -NR'C(O)R'), formyl (-CHO), and ketone (-

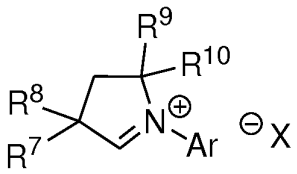
COR') group, wherein R' is C_1-C_5 alkyl, C_1-C_5 perfluoroalkyl, C_5-C_{24} aryl, C_7-C_{24} aralkyl, C_5-C_{24} perfluoroaryl;

R^{13} is a hydrogen atom, C_1-C_{25} alkyl group, C_1-C_{25} alkoxy group, C_2-C_{25} alkenyl group, C_1-C_{12} perfluoroalkyl, C_5-C_{20} aryl, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or can be combined together to form substituted or unsubstituted C_4-C_{10} cyclic or C_4-C_{12} polycyclic system or a halogen atom;

to form the compound represented by the Formula **1**.

2. A process according to claim 1, **characterised in that** the reaction mixture is contacted with the compound represented by the Formula **4** in the presence of phosphine ligand scavenger PR'$_3$ and/or CAAC ligand scavenger.

3. A process for producing compound represented by the Formula **1** according to claims 1 or 2, **characterised in that** carbenes represented by the Formula **3** are provided to the reaction medium by their generation *in situ* from suitable carbene precursors, CAAC salts represented by the Formula **3a**,



3a

wherein:

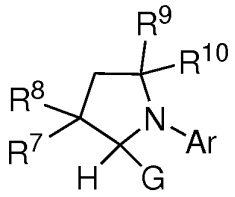
Ar is an aryl group substituted with hydrogen atoms or optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, and C_5-C_{20} heteroaryloxy group, or a halogen atom;
R^7, R^8, R^9, and R^{10} are each independently hydrogen atom, or C_1-C_{25} alkyl group, R^7 and/or R^8 can be combined with R^9 and/or R^{10} to form cyclic system, can be also independently C_1-C_{12} alkyl, C_3-C_{12} cycloalkyl, C_2-C_{12} alkenyl, C_5-C_{20} aryl, C_1-C_5 perfluoroalkyl, C_7-C_{24} aralkyl, and C_5-C_{24} perfluoroaryl group, which are optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or a halogen atom;
X^- is a halide anion, or BF_4^-, PF_6^-, ClO_4^-, $CF_3SO_2O^-$.

involving contacting compound represented by the Formula **3a** with suitable base selected from potassium *N,N'*-bis(trimethylsilyl)amide, lithium *N,N'*-bis(trimethylsilyl)amide, sodium *N,N'*-bis(trimethylsilyl)amide, potassium *tert*-amylate, potassium *tert*-butoxide, sodium hydride.

4. A process for producing a compound represented by the Formula **1** according to any one of claims 1 to 3, **characterised in that** carbenes represented by the Formula **3** are provided in the reaction medium by their generation *in situ* from suitable carbene precursors represented by the Formula **3a**, which are contacted with a base such as alkali metal *N,N'*-bis(trimethylsilyl)amide.

5. A process for producing a compound represented by the Formula **1** according to claim 1 or 2, **characterised in that** the carbenes represented by the Formula **3** are provided in the reaction medium

by their thermal generation *in situ* from suitable carbene precursors represented by the Formula **3b** which are chloroform or alcohol adducts,



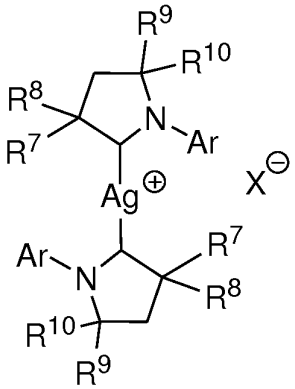
3b

wherein:

G is CCl_3 or OR', wherein R' is C_1-C_{12} alkyl, C_3-C_{12} cycloalkyl, C_2-C_{12} alkenyl, or C_5-C_{20} aryl, which is optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy or a halogen atom;

Ar is an aryl group substituted with hydrogen atoms or optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, and C_5-C_{20} heteroaryloxy group, or a halogen atom;
R^7, R^8, R^9, and R^{10} are each independently hydrogen atom or C_1-C_{25} alkyl group, R^7 and/or R^8 can be combined with R^9 and/or R^{10} to form cyclic system, can be also independently C_1-C_{12} alkyl, C_3-C_{12} cycloalkyl, C_2-C_{12} alkenyl, C_5-C_{20} aryl, C_1-C_5 perfluoroalkyl, C_7-C_{24} aralkyl, C_5-C_{24} perfluoroaryl group, which are optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or a halogen atom.

6. A process for producing a compound represented by the Formula **1** according to any one of claims 1 to 5, **characterised in that** the alkylidene ruthenium complex represented by the Formula **2** is contacted with the compound represented by the Formula **3c** which acts as CAAC carbene ligand donor represented by the Formula **3**,



3c

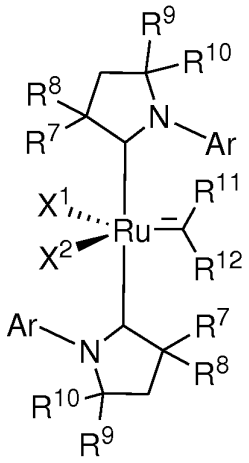
wherein:

Ar is an aryl group substituted with hydrogen atoms or optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, and C_5-C_{20} heteroaryloxy group, or a halogen atom;
R^7, R^8, R^9, and R^{10} are each independently hydrogen atom or C_1-C_{25} alkyl group, R^7 and/or R^8 can be combined with R^9 and/or R^{10} to form cyclic system, can be also independently C_1-C_{12} alkyl, C_3-C_{12}

cycloalkyl, C_2-C_{12} alkenyl, C_5-C_{20} aryl, C_1-C_5 perfluoroalkyl, C_7-C_{24} aralkyl, and C_5-C_{24} perfluoroaryl group, which are optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or a halogen atom;
X is a halide anion or BF_4^-, PF_6^-, ClO_4^-, $CF_3SO_3^-$.

7. A process for producing a compound represented by the Formula **1** according to claim 1 to 2, **characterised in that** the carbenes represented by the Formula **3** are provided to the reaction medium by their direct adding to the reaction mixture.

8. A process for producing a compound represented by the Formula **1** according to any one of claims 1 to 7, **characterised in that** the alkylidene ruthenium complex represented by the Formula **2** is reacted with carbene represented by the Formula **3** to form an intermediate represented by the Formula **5**



5

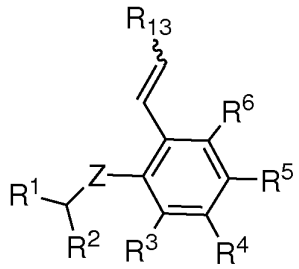
wherein:

X^1 and X^2 are each independently an anionic ligand selected from halogen atoms, -CN, -SCN, -OR', -SR', -O(C=O)R', -O(SO_2)R', and -OSi(R')$_3$ group, wherein R' is C_1-C_{12} alkyl, C_3-C_{12} cycloalkyl, C_2-C_{12} alkenyl, C_5-C_{20} aryl, which are optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or a halogen atom;
Ar is an aryl group substituted with hydrogen atoms or optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, and C_5-C_{20} heteroaryloxy group, or a halogen atom;
R^7, R^8, R^9, and R^{10} are each independently hydrogen atom or C_1-C_{25} alkyl group, R^7 and/or R^8 can be combined with R^9 and/or R^{10} to form cyclic system, can be also independently C_1-C_{12} alkyl, C_3-C_{12} cycloalkyl, C_2-C_{12} alkenyl, C_5-C_{20} aryl, C_1-C_5 perfluoroalkyl, C_7-C_{24} aralkyl, and C_5-C_{24} perfluoroaryl group, which are optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or a halogen atom;
R^{11}, R^{12} are each independently hydrogen atom, halogen atom, optionally substituted C_1-C_{25} alkyl, optionally substituted C_1-C_{25} perfluoroalkyl, optionally substituted C_2-C_{25} alkene, optionally substituted C_3-C_7 cycloalkyl, optionally substituted C_2-C_{25} alkenyl, optionally substituted C_3-C_{25} cycloalkenyl, optionally

substituted C_2-C_{25} alkynyl, optionally substituted C_3-C_{25} cycloalkynyl, optionally substituted C_1-C_{25} alkoxy, optionally substituted C_5-C_{24} aryloxy, optionally substituted C_5-C_{20} heteroaryloxy, optionally substituted C_5-C_{24} aryl, optionally substituted C_5-C_{20} heteroaryl, optionally substituted C_7-C_{24} aralkyl, optionally substituted C_5-C_{24} perfluoroaryl, optionally substituted 3-12-membered heterocycle;

wherein R^{11} and R^{12} substituents can be combined together to form a ring selected from a group including C_3-C_7 cycloalkyl, C_3-C_{25} cycloalkenyl, C_3-C_{25} cycloalkynyl, C_5-C_{24} aryl, C_5-C_{20} heteroaryl, C_5-C_{24} perfluoroaryl, 3-12-membered heterocycle, which can be substituted independently with one and/or more substituents selected from a group including hydrogen atom, halogen atom, C_1-C_{25} alkyl, C_1-C_{25} perfluoroalkyl, C_2-C_{25} alkene, C_3-C_7 cycloalkyl, C_2-C_{25} alkenyl, C_3-C_{25} cycloalkenyl, C_2-C_{25} alkynyl, C_3-C_{25} cycloalkynyl, C_1-C_{25} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, C_5-C_{24} aryl, C_5-C_{20} heteroaryl, C_7-C_{24} aralkyl, C_5-C_{24} perfluoroaryl, 3-12-membered heterocycle;

which then is contacted with the compound represented by the Formula **4**



4

wherein:

Z is an atom selected from a group of O, S, NR', wherein R' is C_1-C_{12} alkyl, C_3-C_{12} cycloalkyl, C_2-C_{12} alkenyl, C_5-C_{20} aryl, which are optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or a halogen atom;

R^1 and R^2, are each independently hydrogen atom, C_1-C_{25} alkyl group, C_1-C_{25} alkoxy group, C_2-C_{25} alkenyl group, C_1-C_{12} perfluoroalkyl, C_5-C_{20} aryl, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or can be combined together to form substituted or unsubstituted C_4-C_{10} cyclic or C_4-C_{12} polycyclic system, can also be an ester (-COOR'), amide (-CONR'$_2$), formyl (-CHO), ketone (-COR'), and hydroxamic (-CON(OR')(R')) group or a halogen atom, wherein R' is C_1-C_{12} alkyl, C_3-C_{12} cycloalkyl, C_2-C_{12} alkenyl, C_5-C_{20} aryl, which are optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or a halogen atom;

R^3, R^4, R^5, R^6 are each independently hydrogen atom, C_1-C_{25} alkyl group, C_1-C_{25} alkoxy group, or C_2-C_{25} alkenyl group, wherein R^3, R^4, R^5, R^6 substituents can be combined together to form substituted or unsubstituted C_4-C_{10} cyclic or C_4-C_{12} polycyclic system; can also independently be an alkoxy (-OR'), sulphide (-SR'), sulfoxide (-S(O)R'), sulphonium (-S$^+$R'$_2$), sulphone (-SO$_2$R'), sulphonamide (-SO$_2$NR'$_2$), amine (-NR'$_2$), ammonium (-N$^+$R'$_3$), nitro (-NO$_2$), cyano (-CN), phosphonate (-P(O)(OR')$_2$), phosphinate (-P(O)R'(OR')), phosphoninum (-P(OR')$_2$), phosphine (-PR'$_2$), phosphine oxide (-P(O)R'$_2$), phosphonium (-P$^+$R'$_3$), carboxy (-COOH), ester (-COOR'), amide (-CONR'$_2$, or -NR'C(O)R'), formyl (-CHO), and ketone (-COR') group, wherein R' is C_1-C_5 alkyl, C_1-C_5 perfluoroalkyl, C_5-C_{24} aryl, C_7-C_{24} aralkyl, C_5-C_{24} perfluoroaryl;

R^{13} is a hydrogen atom, C_1-C_{25} alkyl group, C_1-C_{25} alkoxy group, C_2-C_{25} alkenyl group, C_1-C_{12} perfluoroalkyl, C_5-C_{20} aryl, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or can be combined together to form substituted or unsubstituted C_4-C_{10} cyclic or C_4-C_{12} polycyclic system or a halogen atom;

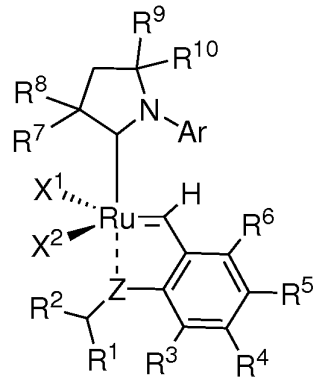
to form the compound represented by the Formula **1**.

9. A process according to claim 8, **characterised in that** the reaction of compound 5 with compound 4 is conducted in the presence of phosphine ligand scavenger PR'$_3$ and/or CAAC ligand scavenger.

10. A process for producing a compound represented by the Formula **1** according to any one of claims 2 to 7 or 9, **characterised in that** as phosphine ligand scavenger PR'$_3$ and/or CAAC ligand scavenger a compound selected from copper(I) salts and/or HCl is used.

11. A process for producing a compound represented by the Formula **1** according to any one of claims 1 to 10, **characterised in that** all reaction steps are conducted in a polar and/or nonpolar solvent, preferably in aliphatic or aromatic hydrocarbons, over a period of 1 minute to 24 hours.

12. A compound represented by the Formula **1**,



1

wherein:

X^1 and X^2 are each independently an anionic ligand selected from halogen atoms, -CN, -SCN, -OR', -SR', -O(C=O)R', -O(SO_2)R', and -OSi(R')$_3$ group, wherein R' is C_1-C_{12} alkyl, C_3-C_{12} cycloalkyl, C_2-C_{12} alkenyl, C_5-C_{20} aryl, which are optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or a halogen atom;

Z is an atom selected from a group of O, S, NR', wherein R' is C_1-C_{12} alkyl, C_3-C_{12} cycloalkyl, C_2-C_{12} alkenyl, C_5-C_{20} aryl, which are optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or a halogen atom;

Ar is an aryl group substituted with hydrogen atoms or optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, and C_5-C_{20} heteroaryloxy group, or a halogen atom;

R^1 and R^2, are each independently hydrogen atom, C_1-C_{25} alkyl group, C_1-C_{25} alkoxy group, C_2-C_{25} alkenyl group, C_1-C_{12} perfluoroalkyl, C_5-C_{20} aryl, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or can be combined together to form C_4-C_{10} cyclic or C_4-C_{12} polycyclic system, can also be an ester (-COOR'), amide (-

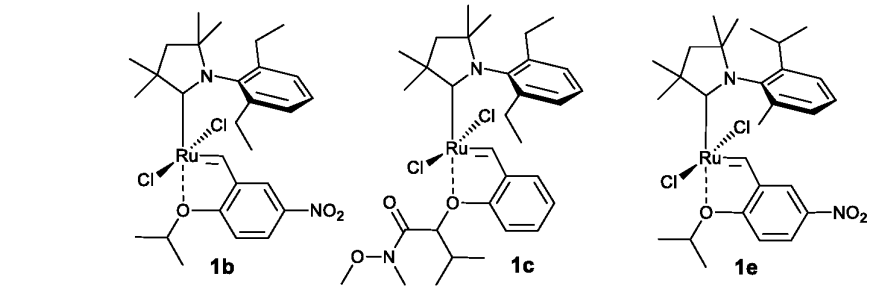
$CONR'_2$), formyl (-CHO), ketone (-COR'), and hydroxamic (-CON(OR')(R')) group or a halogen atom, in which R' is C_1-C_{12} alkyl, C_3-C_{12} cycloalkyl, C_2-C_{12} alkenyl, C_5-C_{20} aryl, which are optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or a halogen atom;

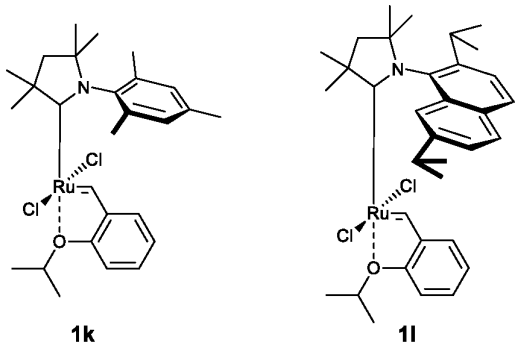
R^3, R^4, R^5, R^6 are each independently hydrogen atom, phosphonate group ($-P(O)(OR')_2$), phosphinate group (-P(O)R'(OR')), phosphoninum group ($-P(OR')_2$), phosphine group ($-PR'_2$), nitro group (-NO2), nitroso group (-NO), carboxy group (-COOH), ester group (-COOR'), formyl group (-CHO), ketone group (-COR'), wherein R' is C_1-C_5 alkyl, C_1-C_5 perfluoroalkyl, C_5-C_{24} aryl, C_7-C_{24} aralkyl, C_5-C_{24} perfluoroaryl;

wherein when R^1 and R^2 are $-CH_3$ group, then at least one of R^3, R^4, R^5, R^6 substituents is not hydrogen atom;

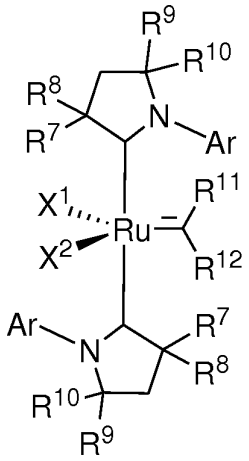
R^7, R^8, R^9, and R^{10} are each independently hydrogen atom or C_1-C_{25} alkyl group, R^7 and/or R^8 can be combined with R^9 and/or R^{10} to form cyclic system, are also independently C_1-C_{12} alkyl, C_3-C_{12} cycloalkyl, C_2-C_{12} alkenyl, C_5-C_{20} aryl, C_1-C_5 perfluoroalkyl, C_7-C_{24} aralkyl, and C_5-C_{24} perfluoroaryl group, which are optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or a halogen atom.

13. A compound according to claim 12 of a structure represented by the formula selected from **1b, 1c, 1e, 1f, 1h, 1i-1l**:





14. A compound represented by the Formula **5**,



5

wherein:

X^1 and X^2 are each independently an anionic ligand selected from halogen atoms, -CN, -SCN, -OR', -SR', -O(C=O)R', -O(SO_2)R', and -OSi(R')$_3$ group, wherein R' is C_1-C_{12} alkyl, C_3-C_{12} cycloalkyl, C_2-C_{12} alkenyl, C_5-C_{20} aryl, which are optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or a halogen atom;

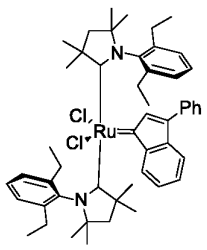
Ar is an aryl group substituted with hydrogen atoms or optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy group, or a halogen atom;

R^7, R^8, R^9, and R^{10} are each independently hydrogen atom or C_1-C_{25} alkyl group, R^7 and/or R^8 can be combined with R^9 and/or R^{10} to form cyclic system, can be also independently C_1-C_{12} alkyl, C_3-C_{12} cycloalkyl, C_2-C_{12} alkenyl, C_5-C_{20} aryl, C_1-C_5 perfluoroalkyl, C_7-C_{24} aralkyl, and C_5-C_{24} perfluoroaryl group, which are optionally substituted with at least one C_1-C_{12} alkyl, C_1-C_{12} perfluoroalkyl, C_1-C_{12} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, or a halogen atom;

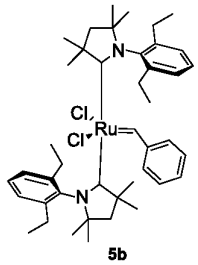
R^{11}, R^{12} are each independently hydrogen atom, halogen atom, C_1-C_{25} alkyl, C_1-C_{25} perfluoroalkyl, C_2-C_{25} alkene, C_3-C_7 cycloalkyl, C_2-C_{25} alkenyl, C_3-C_{25} cycloalkenyl, C_2-C_{25} alkynyl, C_3-C_{25} cycloalkynyl, C_1-C_{25} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, C_5-C_{24} aryl, C_5-C_{20} heteroaryl, C_7-C_{24} aralkyl, C_5-C_{24} perfluoroaryl, 3-12-membered heterocycle;

wherein R^{11} and R^{12} substituents can be combined together to form a ring selected from a group including C_3-C_7 cycloalkyl, C_3-C_{25} cycloalkenyl, C_3-C_{25} cycloalkynyl, C_5-C_{24} aryl, C_5-C_{20} heteroaryl, C_5-C_{24} perfluoroaryl, 3-12-membered heterocycle, which can be substituted independently with one and/or more substituents selected from a group including hydrogen atom, halogen atom, C_1-C_{25} alkyl, C_1-C_{25} perfluoroalkyl, C_2-C_{25} alkene, C_3-C_7 cycloalkyl, C_2-C_{25} alkenyl, C_3-C_{25} cycloalkenyl, C_2-C_{25} alkynyl, C_3-C_{25} cycloalkynyl, C_1-C_{25} alkoxy, C_5-C_{24} aryloxy, C_5-C_{20} heteroaryloxy, C_5-C_{24} aryl, C_5-C_{20} heteroaryl, C_7-C_{24} aralkyl, C_5-C_{24} perfluoroaryl, 3-12-membered heterocycle.

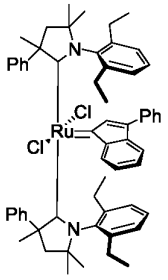
15. A compound according to claim 14 of a structure represented by the formula selected from **5a** -**5j**:



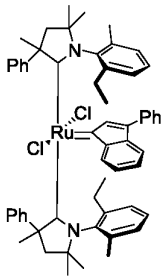
5a



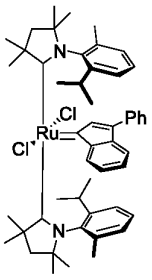
5b



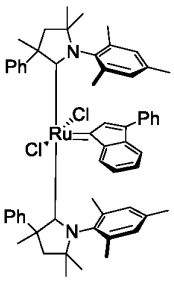
5c



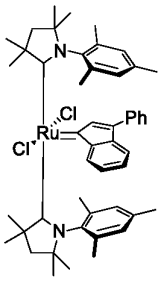
5d



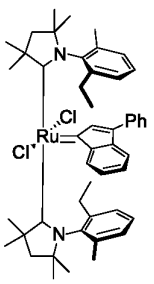
5e



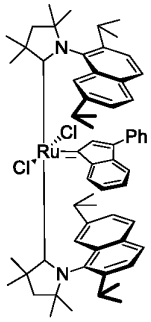
5f



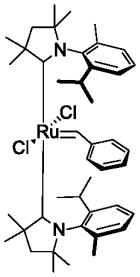
5g



5h



5i



5j

16. The use of a compound represented by the Formula **1** produced by the process according to any one of claims 1 to 11 as a precatalyst and/or catalyst in olefin metathesis reactions, particularly in ring-closing metathesis (RCM), homometathesis, cross-metathesis (CM), ethenolysis, isomerisation reactions, in diastereoselective ring-rearrangement metathesis (DRRM) reaction, „alkene-alkyne" (en-yn) type metathesis or ROMP type polymerisation reactions.

17. The use according to claim 16, wherein compound represented by the Formula **1** is used as a precatalyst and/or catalyst in a reaction mixture over a period of 1 minute to 24 hours in an organic solvent, mixture of organic solvents or without solvent.

18. The use of a compound represented by the Formula **1** produced by the process according to any one of claims 1 to 11 as a substrate to synthesis of other ruthenium complex compounds being olefin metathesis precatalysts and/or catalysts.

19. The use of a compound represented by the Formula **5** according to claims 14 or 15 as a precatalyst and/or catalyst in olefin metathesis reactions, particularly in ring-closing metathesis (RCM), homometathesis, cross-metathesis (CM), ethenolysis, isomerisation reactions, in reaction of

diastereoselective ring-rearrangement metathesis (DRRM), „alkene-alkyne" (en-yn) type metathesis or ROMP type polymerisation reactions and in metathetic depolymerisation reaction.

20. The use of a compound represented by the Formula **5** according to claims 14 or 15 as a precatalyst and/or catalyst in olefin metathesis reactions in the presence of CAAC ligand scavenger.