bis(tri-tert-butylphosphine)palladium, tetrakis(triphenylphosphine)palladium(0) ($Pd(PPh_3)_4$), bis[1,2-bis(diphenylphosphino)ethane]palladium(0) ($Pd(dppe)_2$), 1,1'-bis(diphenylphosphino)ferrocene palladium (Pd(dppf)), (2,2'-bis(diphenylphosphino)-1,1'-binaphthyl palladium (Pd(BINAP).

**[0023]** The palladium phosphine catalyst may comprise palladium tetrakis(triphenylphosphine).

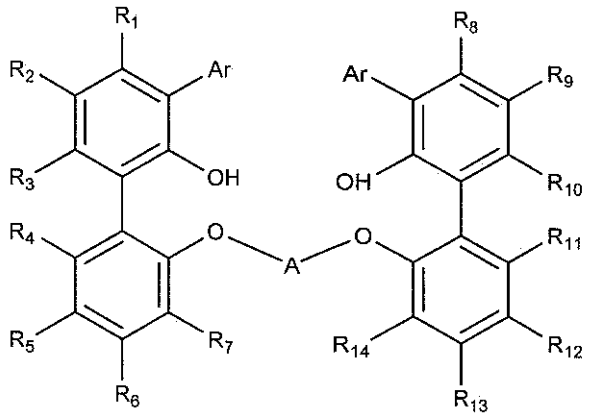
**[0024]** In any one of the hereinbefore disclosed embodiments the catalyst may further comprise a base.

**[0025]** In any one of the hereinbefore disclosed embodiments the base may comprise an alkali metal carbonate, alkali metal phosphate, alkali metal hydroxide, alkali metal alkoxide or an amine.

**[0026]** In any one of the hereinbefore disclosed embodiments X may be bromo or chloro. The source of halogen may be bromine or chlorine.

**[0027]** In any one of the hereinbefore disclosed embodiments the compound of formula $ArBR^b_2$ or $ArBF_3^-M^+$ may be selected from an optionally substituted arylborane, heteroarylborane, aryl boronic acid, heteroaryl boronic acid, aryl boronic ester, heteroaryl boronic ester, aryl trifluoroborate metal salt or heteroaryl trifluoroborate metal salt.

**[0028]** In any one of the hereinbefore disclosed embodiments the ligand of formula (I) may have formula (IX);




(IX)

wherein $R^1$, $R^2$, $R^3$, $R^4$, $R^5$, $R^6$, $R^7$, $R^8$, $R^9$, $R^{10}$, $R^{11}$, $R^{12}$, $R^{13}$ and $R^{14}$ Ar and A are as hereinbefore defined.

**[0029]** The present disclosure further provides a ligand of formula (I) or formula (IX) prepared by any one of the hereinbefore disclosed methods.

bis[1,2-bis(diphenylphosphino)ethane]palladium(0) ($Pd(dppe)_2$), 1,1'-bis(diphenylphosphino)ferrocene palladium (Pd(dppf)), or (2,2'-bis(diphenylphosphino)-1,1'-binaphthyl palladium (Pd(BINAP).

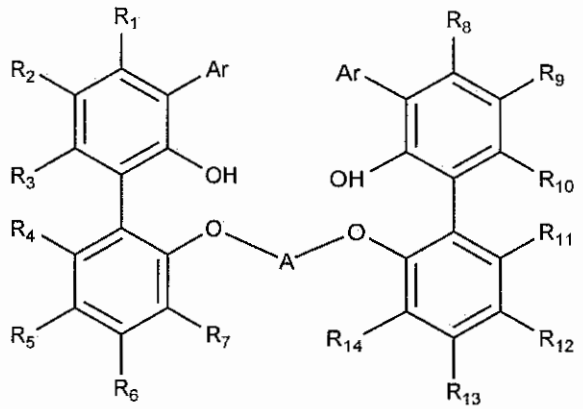
8. A method according to claim 2 wherein the catalyst further comprises a base,

wherein the base comprises an alkali metal carbonate, alkali metal phosphate, alkali metal hydroxide, alkali metal alkoxide or an amine; or

wherein X is bromo or chloro; or

wherein the compound of formula $ArBR^b_2$ or $ArBF_3^-M^+$ is selected from an optionally substituted arylborane, heteroarylborane, aryl boronic acid, heteroaryl boronic acid, aryl boronic ester, heteroaryl boronic ester, aryl trifluoroborate metal salt or heteroaryl trifluoroborate metal salt.

9. A method according to claim 1 wherein the ligand of formula (I) has formula (IX):




(IX)

wherein $R^1$, $R^2$, $R^3$, $R^4$, $R^5$, $R^6$, $R^7$, $R^8$, $R^9$, $R^{10}$, $R^{11}$, $R^{12}$, $R^{13}$, $R^{14}$, Ar and A are as defined in any one of the previous claims; or

wherein $R^1$, $R^2$, $R^3$, $R^4$, $R^5$, $R^6$, $R^7$, $R^8$, $R^9$, $R^{10}$, $R^{11}$, $R^{12}$, $R^{13}$ and $R^{14}$ are selected from hydride and optionally substituted alkyl; Ar is selected from optionally substituted phenyl, naphthyl, biphenyl, anthracenyl, and phenanthrenyl; A is divalent alkyl.