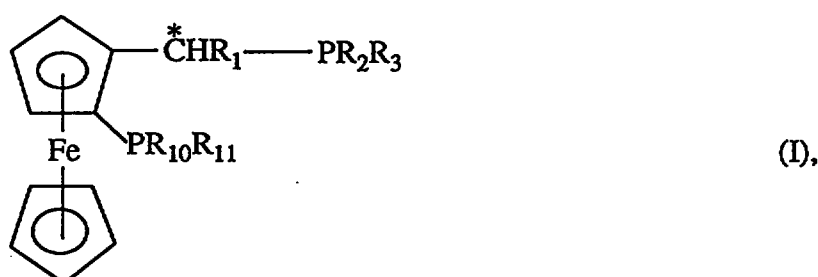


Fluoroalkyl-substituted ferrocenyl diphosphines as ligands for homogeneous catalysts

Abstract of the Disclosure

Compounds of formula I



wherein R_1 is C_1 - C_8 alkyl, phenyl or phenyl which is substituted by 1 to 3 C_1 - C_4 alkyl or C_1 - C_4 alkoxy groups; R_2 is a radical of formula II



wherein R_{12} is C_1 - C_5 alkyl which is partially or completely fluorinated;

R_{13} is C_1 - C_4 alkyl, C_1 - C_4 alkoxy, $-\text{SiR}_4\text{R}_5\text{R}_6$, halogen, $-\text{SO}_3\text{M}$, $-\text{CO}_2\text{M}$, $-\text{PO}_3\text{M}$, $-\text{NR}_7\text{R}_8$ or $-\text{[}^\oplus\text{NR}_7\text{R}_8\text{R}_9\text{]X}^\ominus$;

m is an integer from 1 to 3, n is 0 or an integer from 1 to 4, and the sum of $m+n$ is 1 to 5;

R_3 , R_{10} , R_{11} have each independently of one another the same meaning as R_2 or are each independently of one another C_1 - C_{12} alkyl, C_5 - C_{12} cycloalkyl, phenyl, C_1 - C_4 alkyl- or C_1 - C_4 alkoxy-substituted C_5 - C_{12} cycloalkyl, or phenyl which is substituted by one to three identical or different members selected from the group consisting of C_1 - C_4 alkyl, C_1 - C_4 alkoxy, $-\text{SiR}_4\text{R}_5\text{R}_6$, halogen, $-\text{SO}_3\text{M}$, $-\text{CO}_2\text{M}$, $-\text{PO}_3\text{M}$, $-\text{NR}_7\text{R}_8$ and $-\text{[}^\oplus\text{NR}_7\text{R}_8\text{R}_9\text{]X}^\ominus$;

R_4 , R_5 and R_6 are each independently of one another C_1 - C_{12} alkyl or phenyl;

R_7 and R_8 are H, C_1 - C_{12} alkyl or phenyl or

R_7 and R_8 , taken together, are tetramethylene, pentamethylene or 3-oxa-1,5-pentylene;

R_9 is H or C_1 - C_4 alkyl,

M is H or an alkali metal, $X^\ominus$ is the anion of a monobasic acid, and $*$ is a stereogenic carbon atom, in the form of their racemates and diastereoisomers or mixtures of

diastereoisomers.

Rhodium and iridium complexes with these ligands are suitable for use as homogeneous enantioselective catalysts for the hydrogenation of prochiral compounds containing carbon double bonds or carbon/hetero atom double bonds.
