Hydridoborohydridobis(tricyclohexylphosphine)nickel: A New Route to the Preparation of Nickel and Palladium Hydride Complexes

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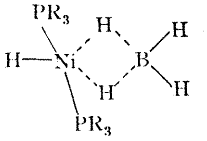
Summary The nickel borohydride complex $[(C_6H_{11})_3P]_2$-$NiH(BH_4)$ reduces $(R_3P)_2MX_2$ to form new hydride complexes, M = Ni or Pd.

A STABLE nickel hydride complex, *trans*-hydridochlorobis(tricyclohexylphosphine)nickel (I), has been reported.[1] We have now found that the treatment of (I) with sodium borohydride in a mixed solvent (acetone and ethanol) at room temperature under argon gave a bright yellow crystalline complex which is formulated as *trans*-hydridoborohydridobis(tricyclohexylphosphine)nickel, (II).



R = cyclohexyl

The complex (II) is stable at room temperature and fairly stable in air: i.r. (mull) 2360s (terminal B–H stretching) 2040m, 1860m, (bridging B–H bonds[2]), and 1920m, sh (Ni-H stretching): ^1H n.m.r. (benzene, room temperature) τ 30·1 (br 1 : 2 : 1 t; J_{P-H} 72 c./sec.; Ni–H).

The complex (II) acts as a hydridic reducing agent and, in benzene, reduces $(R_3P)_2MX_2$ (M = Ni or Pd) forming new hydride complexes. When R = cyclohexyl or Pr^i, M = Ni and X = Cl or Br, ^1H n.m.r. spectra of the reaction solutions show bands identical with those of the fully characterised hydride complexes *trans*-$(R_3P)_2NiHX$.[3] However, when R = Et, Pr^n, or Bu^n, M = Ni, and X = Cl, new nickel hydride signals were observed as well as the triplet due to (I). The bands consist of a double doublet suggesting that *cis*-Ni–H$(R_3P)_2$– species are present. Thus, in general, the reactions appear to proceed according to an equation of the type:

$$(Cy_3P)_2NiH(BH_4) + (R_3P)_2NiX_2 \rightarrow$$
$$(Cy_3P)_2NiHX + \textit{cis-}\text{ or }\textit{trans-}(R_3P)_2NiHX + B_2H_6$$

Cy = cyclohexyl

When M = Pd, R = Et or Bu^n, and X = Cl, Pd–H species are detected in the n.m.r. spectra.

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[2] J. M. Davidson, *Chem. and Ind.*, 1964, 2021.
[3] M. L. H. Green, T. Saito, and P. J. Tanfield, *J. Chem. Soc. (A)*, submitted for publication.