The Preparation of Platinum Hydrides from Imides

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Summary The reaction of tetrakistriphenylphosphineplatinum(0) with succinimide, phthalimide, and saccharin has been found to give imide–hydride–platinum(II) complexes.

THE use of the oxidative addition reaction of a protonic acid to a low-valent transition-metal complex has been found in several cases to lead to the formation of a metal hydride.[1] The reaction is normally carried out with strong mineral acids, but hydrides of platinum have been formed in a similar manner by oxidative addition reactions of hydrogen cyanide[2] and 1-ethynylcyclohexanol.[2]

TABLE

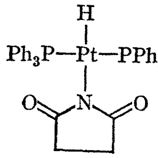
Complex	M.p.	$\nu_{C=O}$ (cm.$^{-1}$)	ν_{Pt-H} (cm.$^{-1}$)	τ_{phenyl}	τ_{Pt-H}
$(PPh_3)_2Pt$ succinimide ..	220—233°(d)	1635	2190	2·47	24·1
$(PPh_3)_2Pt$ phthalimide ..	194—215°(d)	1650	2200	2·57	
$(PPh_3)_2Pt$ saccharin	197—205°(d)	1680	2230	2·50	25·7 t

t = triplet, J_{PH} 12·8 c./sec.

It has now been found that even some imides can be oxidatively added to tetrakistriphenylphosphineplatinum(0) to give, in good yield, imide–hydride complexes. These colourless compounds melt to red liquids, although over a rather wide range because of accompanying decomposition. The complexes which have been characterised have been prepared from succinimide (pK_a 10·5), phthalimide (pK_a 8·3), and saccharin (pK_a 11·7) and satisfactory analyses have been obtained for each of these complexes. Each compound shows sharp bands in the i.r. spectrum due to a Pt–H stretch and to the organic carbonyl group in the co-ordinated imide, but no bond due to an N–H stretch.

The succinimide complex has the structure (I) and the other two complexes have similar structures. Further confirmation is obtained by the ^{1}H n.m.r. spectrum, which shows three resonances centred at τ 2·47 (15), 8·47 (2) and 24·1, being due to the phenyl, methylene, and hydride protons, respectively. The relative integration of the phenyl : methylene protons shows that there must be only one succinimide group present in the complex for every two triphenylphosphines, confirming that only one imide has added to each $Pt(PPh_3)_2$ group to form a complex of platinum(II).

The stereochemistry is *trans*, as expected, which is shown by the n.m.r. spectrum of the hydride peak of the saccharin complex. This resolves into a triplet (J_{PH} 12·8 c./sec.) due to coupling of the hydride proton with two equivalent phosphorus atoms, and this can only occur when the two triphenylphosphine groups are *trans* to each other.



(I)

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[2] D. M. Roundhill and H. B. Jonassen, *Chem. Comm.*, 1968, 1233.