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MECHANISM OF THE FORMATION OF TETRAPHENYL-LEAD FROM LEAD CHLORIDE AND PHENYLLITHIUM

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The following three reactions picture the generally accepted mechanism for the synthesis of tetraphenyllead from lead chloride and phenylmagnesium bromide (1).

$$PbCl_2 + 2C_6H_5MgBr \rightarrow (C_6H_5)_2Pb + MgCl_2 + MgBr_2 \quad (I)$$

$$3\,(C_6H_5)_2Pb \rightarrow 2\,(C_6H_5)_3Pb + Pb \quad (II)$$

$$4\,(C_6H_5)_3Pb \rightarrow 3\,(C_6H_5)_4Pb + Pb \quad (III)$$

The present study is concerned with the formation of tetraphenyllead from lead chloride and phenyllithium. It is probable that the closely related phenyllithium and phenylmagnesium bromide react with lead chloride by closely related mechanisms. By using, at this time, phenyllithium in place of phenylmagnesium bromide, we were able to avoid possible secondary reactions involving magnesious bromide and magnesium bromide.

Reaction (II) appears to be incorrect, for there was neither a deposit of lead nor the visible formation of the red-colored diphenyllead during the reaction of phenyllithium with lead chloride at -5°. Under these conditions triphenyllead-lithium was produced, a fact which proved that three phenyl groups became attached to the lead atom without the production of metallic lead.

Reaction (III) also appears to be incorrect, because refluxing of triphenyllead in an ether-toluene medium (conditions used in the preparation of tetraphenyllead from lead chloride and phenylmagnesium bromide) gave no tetraphenyllead. Actually, we have shown that tetraphenyllead was produced by the reaction of triphenyllead and phenyllithium in accordance with the following equation.

$$2\,(C_6H_5)_3Pb + C_6H_5Li \rightarrow (C_6H_5)_4Pb + (C_6H_5)_3PbLi \quad (IV)$$

The triphenyllead-lithium formed in reaction (IV) was characterized by conversion to triphenylbenzyllead by means of benzyl chloride.

(1) Krause and v. Grosse, "Die Chemie der Metallorganischen Verbindungen," Borntraeger, Berlin (1937), p. 409.

Reaction (IV) may require revision of the reaction recently postulated in the study of the relative reacativities of R_3Pb and R_4Pb compounds (2).

(2) Gilman and Moore, *J. Am. Chem. Soc., 62,* 3206 (1940).

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