Hydrogen-exchange between Triphenylgermane and Alcohols

By COLIN EABORN* and IAN D. JENKINS
(*School of Molecular Sciences, University of Sussex, Brighton* BN1 9QJ)

Summary Triphenylgermane readily undergoes hydrogen-exchange (at the Ge–H bond) with alcohols in the presence of base.

TRIORGANO-SILANES and -STANNANES readily evolve hydrogen when treated with alcoholic alkali, but trialkylgermanes enter much less readily, if at all, into this type of solvolysis.[1] However, triphenylgermane has been reported to evolve hydrogen rapidly when treated with dilute alcoholic alkali, although tri-n-hexylgermane is unreactive under similar conditions.[2] We have found that triphenylgermane does not, in fact, undergo significant solvolysis during 48 h at room temperature (*ca.* 21°) in MeOH containing 2·3M MeONa (98% was recovered unchanged after such treatment), but does undergo hydrogen exchange fairly readily with alcoholic alkali.

A solution of triphenyldeuteriogermane (containing *ca.* 5% of Ph_3GeH), m.p. 41°, (20 mg) in EtOH (3·0 ml) containing 1·7M KOH was kept at *ca.* 21° for 15 min then added to ice-water. Pentane extraction, followed by drying of the extract and removal of the solvent left an oil (20 mg, 100%), which crystallized on standing, and gave an i.r. spectrum (liquid film) identical with that of the starting material except that both ν(Ge–H) and ν(Ge–D) bands were present (at 2030 and 1470 cm^{-1}, respectively), in intensities consistent with a Ph_3GeD/Ph_3GeH ratio of *ca.* 1·5 : 1. Thus the exchange was about one-third complete.

Again, when a solution of triphenylgermane (20 mg) in methan[^{2}H]ol (20 ml, >99% MeOD) containing MeONa (0·25 g) was kept for 2 h at *ca.* 21°, work-up as before gave triphenyldeuteriogermane (19·5 mg, 97%), the i.r. spectrum of which indicated that <5% of Ph_3GeH was present.

In view of the ease of formation of triphenylgermyl-lithium from triphenylgermane and n-butyl-lithium in ether[3] and of the considerable stability of the optically active ethyl-(1-naphthyl)phenylgermyl-lithium,[4] it is probable that the exchange arises from the reversible reaction (1).

$$Ph_3GeH + OR^- \rightleftharpoons Ph_3Ge^- + ROH \qquad (1)$$

This work was carried out by I.D.J. during the tenure of an Imperial Chemical Industries Fellowship.

(*Received, 13th August* 1973; *Com.* 1153.)

---

[1] G. Schott and C. Harzdorf, *Z. Anorg. Chem.*, 1960, **307**, 105; J. Satgé, *Ann. Chim.* (*France*), 1961, **6**, 519.
[2] R. Fuchs and H. Gilman, *J. Org. Chem.*, 1957, **22**, 1009.
[3] H. Gilman and C. W. Gerow, *J. Amer. Chem. Soc.*, 1956, **78**, 5435.
[4] C. Eaborn, R. E. E. Hill, and P. Simpson, *J. Organometallic Chem.*, 1972, **37**, 267, 275.