

Novel Formation of Polygermanes

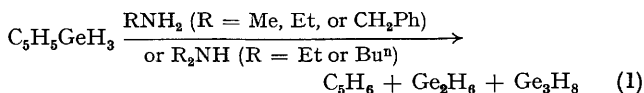
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Summary Reaction of germylcyclopentadiene in the presence of primary or secondary amines provides a synthetic route to digermane and trigermane.

ACCESSIBILITY of the higher germanes depends upon their formation as minor products in hydrolysis reactions¹ used to prepare monogermane, or by silent electric discharge synthesis² from the latter. We now report a novel formation of Ge-Ge bonds, providing the first example of conversion of a monogermyl derivative into polygermanes.

On warming to room temperature in the presence of a primary or secondary amine, germylcyclopentadiene³ reacts smoothly to give Ge₂H₆ and Ge₃H₈ but remarkably no GeH₄ [equation (1)]. A typical experiment



using 0.5 mol. equiv. of diethylamine gave, after 10 min at 20 °C, *ca.* 45% conversion into trigermane with *ca.* 20% of digermane. The germanes were identified by their gas-phase i.r. spectra⁴ and by mass spectroscopy (parent-ion multiplets, found *m/e*: Ge₂H₆, 142—156; Ge₃H₈, 210—234). An orange, involatile residue remained, which from its i.r. spectrum contained polymeric germanium hydride, GeH_z. With larger mol. ratios of amine, yields were lower and more involatile material was formed. With ammonia, reaction was slow leaving unchanged C₅H₅GeH₃ and forming only traces of Ge₃H₈ while with NEt₃ even slower formation of a hard, orange solid was accompanied by a little GeH₄, C₅H₆, and unchanged base as the only volatile products.

Reaction (1) thus constitutes a convenient route to trigermane, rendering its availability comparable with that of trisilane, which although not preparable by any related method can be obtained⁵ by reduction of Si₃Cl₈.

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