Novel Five- and Six-Membered Diazasilacycloalkanes: Synthesis, Structure and Properties

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The reactions of \(N,N'-\text{dimethylethylenediamine}\) 1 and \(N,N'-\text{diphenylethylenediamine}\) 2 with equimolar amounts of 1,2-dichlorotetramethyldisilane 3 give six-membered heterocycles. Five-membered rings are formed in the reaction of the diamines 1 and 2 with 1,1,2,2-tetrachlorodimethylsilane 4 as well as with hexachlorodisilane 5. Whilst the conversions of the disilanes 3 and 4 with the diamine 2 gave no products of a disproportionation reaction, the treatment of the disilane 4 with the diamine 1 and of the disilane 5 with both diamines resulted in cyclic aminosubstituted monosilanes which originate from the disproportionation of 4 and 5 beside the expected five-membered cyclic disilanes. All compounds have been characterized by multi-nuclear NMR, IR and mass spectroscopy. In case of the \(N\)-phenylsubstituted compounds 6, 7 and 9 the crystal structures have been determined by X-ray diffraction analysis. Bis-[\(N,N'-\text{diphenyl-2-methyl-1,3-diaza-2-silacyclopentane}\)] 6 crystallizes in the chiral orthorhombic space group \(P2_1_2_1_2_1\) (\(Z = 4\)). Both silaimidazolidine rings in 6 show half chair conformation. All nitrogen atoms of this molecule are almost planarized (sum of angles: 356.3° at N1, 359.5° at N2, 356.7° at N3 and 357.5° at N4). Bis-[\(N,N'-\text{diphenyl-2-chloro-1,3-diaza-2-silacyclopentane}\)] 7, resulting from the reaction of disilane 5 with diamine 2, crystallizes in the orthorhombic space group \(Pbcn\) (\(Z = 4\)). Its nitrogen atoms are almost planar (sum of angles: 357.9° at N1, 356.7° at N2). \(N,N'-\text{diphenyl-2,2,3,3-tetramethyl-1,4-diaza-2,3-disilacyclohexane}\) 9 crystallizes in the chiral monoclinic space group \(P2_1\) (\(Z = 2\)) and shows a twisted conformation. One nitrogen atom has a trigonal planar environment (sum of angles: 359.9° at N1), while the angle sum of the second one indicates a trigonal pyramidal conformation (sum of angles at N2: 350.6°).

Key words: Aminosilane, Disilane, Heterocycle, Diazasilacyclopentane, Diazadisilacyclohexane