Dependence of the Distortion of the Square Pyramids in
\(N, N\)-Dimethylethylenediammonium Pentachloroantimonate(III)
on the Geometry of Hydrogen Bonds

Maciej Bujak and Jacek Zaleski

Institute of Chemistry, University of Opole, Oleska 48, 45-052 Opole, Poland

Reprint requests to Prof. J. Zaleski. Fax: ++48 774410741. | E-mail: zaleski@uni.opole.pl

Z. Naturforsch. 56b, 521–525 (2001); received March 12, 2001

\(N, N\)-Dimethylethylenediammonium Cation, Chloroantimonate(III)

\(N, N\)-Dimethylethylenediammonium pentachloroantimonate(III) crystallizes in the monoclinic system, in space group \(P2_1/c\) (\(a = 12.460(2)\), \(b = 10.252(2)\), \(c = 10.330(2)\) Å, \(\beta = 97.75(3)^\circ\), \(V = 1307.5(4)\) Å\(^3\), \(Z = 4\), \(d_c = 1.997\), \(d_m = 1.99(2)\) g/cm\(^3\)). The crystal structure of \([\text{CH}_3\text{NCH}_2\text{N}]\text{SbCl}_5\) consists of isolated \([\text{SbCl}_5]^{2-}\) anions and \([\text{CH}_3\text{NCH}_2\text{N}]^{2+}\) cations. The \([\text{SbCl}_5]^{2-}\) anion has a distorted square pyramidal geometry, presenting one short axial and four long equatorial Sb-Cl bonds. The square pyramids are characteristically stacked one close to the other, parallel to the \(c\) axis. The voids between the anionic sublattice are filled by \([\text{CH}_3\text{NCH}_2\text{N}]^{2+}\) cations. The five non-equivalent Sb-Cl bond distances within the \([\text{SbCl}_5]^{2-}\) square pyramid are significantly different. The equatorial Sb-Cl bonds are in the range 2.427(2)-2.968(2) Å, whereas the axial one is 2.384(1) Å long. The study reveals that N-H...Cl hydrogen bonds are responsible for the deformation of equatorial Sb-Cl bonds from the mean value of 2.654(7) Å. Analysis of intermolecular interactions between the \([\text{SbCl}_5]^{2-}\) pyramids in the structure, reflected in changes of Sb-Cl bond lengths from the values characteristic of non-interacting pyramids, leads to the conclusion that the van der Waals radius of Sb is significantly smaller than that estimated by Pauling.