Calculations were carried out on the HITAC-M200H computer at the Computer Center of the Institute for Molecular Science with the *Universal Crystallographic Computation Program System, UNICS* III (Sakurai & Kobayashi, 1979).

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Dimethylammonium Hexachlorostannate(IV)

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Abstract. [NH$_2$(CH$_3$)$_2$]$_2$[SnCl$_6$], orthorhombic, *Pmnn*, $Z = 2$, $a = 7\cdot220$ (1), $b = 7\cdot340$ (2), $c = 14\cdot446$ (3) Å, $V = 765\cdot6$ (3) Å^3, $D_c = 1\cdot837$, $D_m = 1\cdot83$ (5) Mg m^{-3}; 1207 non-equivalent diffractometer data up to sin $\theta/\lambda = 0\cdot7$ Å^{-1}; final $R(F) = 0\cdot046$, $R_w(F) = 0\cdot048$. The structure consists of [SnCl$_6$]$^-$ octahedra and [NH$_2$(CH$_3$)$_2$]$^+$ groups, connected by a weak bifurcated hydrogen bond. The Sn—Cl distances corrected for libration are 2·437 (1) and 2·450 (1) Å.

Introduction. Single crystals of [NH$_2$(CH$_3$)$_2$]$_2$[SnCl$_6$] were obtained by slow evaporation of an acid solution containing stoichiometric amounts of [NH$_2$(CH$_3$)$_2$]Cl and SnCl$_4$. A prismatic crystal with dimensions 0·2 × 0·3 × 0·35 mm was selected for the experiments. Precession photographs showed the space group to be either *P2nn* or *Pmnn*; the latter was confirmed during the structure refinement. Data were collected in a quadrant of reciprocal space up to sin $\theta/\lambda = 0\cdot7$ Å^{-1} with Mo *K*α radiation on a Syntex *R*3 diffractometer equipped with a graphite monochromator. 2661 reflections were obtained, of which 1207 were unique. Three standard reflections observed after every 100 reflections showed a gradual intensity increase of 5% during the measurement. The data were rescaled with respect to the standards. No absorption correction was performed. A weight was assigned to each reflection according to $w(I) = [\sigma^2(I)_{counting} + (0\cdot03I)^2]^{-1}$. The equivalent reflections were averaged [$R(I) = \sum |I - \langle I \rangle|/\sum I = 0\cdot032$].

The structure was determined by heavy-atom and Fourier techniques. Atomic scattering factors were from *International Tables for X-ray Crystallography* (1974), except for H (Stewart, Davidson & Simpson, 1965). Anomalous-dispersion factors were applied to Sn and Cl (Cromer & Liberman, 1970). A difference synthesis showed the positions of the H atoms. They were included in the refinement, but their isotropic thermal parameters were not varied. A correction was made for secondary extinction (Larson, 1969). The structure was refined to $R(F) = 0\cdot046$, $R_w(F) = 0\cdot048$ and $S = [\sum w(F_o - F_c)^2/(\mathrm{NO} - \mathrm{NV})]^{\frac{1}{2}} = 2\cdot65$.*

The calculations were carried out with the XRAY system (Stewart, Kruger, Ammon, Dickinson & Hall, 1972) on the Univac 1108 computer of the University of Frankfurt. The positional parameters of the atoms are reported in Table 1, bond lengths and angles in Table 2.

Table 1. *Positional parameters and equivalent values of the anisotropic temperature factor* ($U_{eq} = \frac{1}{3}$ trace $\mathbf{U}$)

	x	y	z	U_{eq} (Å^2)
Sn	0·0	0·0	0·0	0·036 (1)
Cl(1)	0·0	0·17854 (18)	0·14195 (8)	0·063 (1)
Cl(2)	0·24124 (11)	0·19241 (11)	−0·06378 (5)	0·056 (1)
N	0·0	0·6877 (6)	0·3626 (3)	0·054 (2)
C(1)	0·0	0·8863 (8)	0·3637 (6)	0·088 (5)
C(2)	0·0	0·6004 (11)	0·2728 (4)	0·076 (4)
H(1)	0·086 (6)	0·652 (4)	0·398 (3)	0·055*
H(2)	0·0	0·483 (8)	0·281 (5)	0·085*
H(3)	0·118 (7)	0·653 (5)	0·246 (4)	0·085*
H(4)	0·0	0·958 (9)	0·437 (5)	0·090*
H(5)	0·099 (8)	0·927 (7)	0·331 (3)	0·090*

* Not refined.
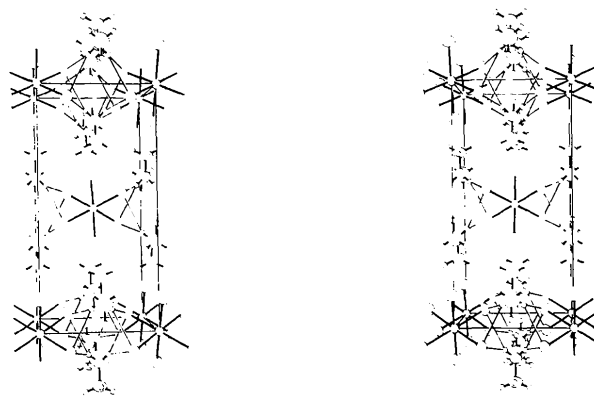

Fig. 1. Stereoscopic view of the structure along **b**. The thermal ellipsoids correspond to the 50% probability surfaces.

Table 2. *Bond distances* (Å) *and angles* (°)

2 × Sn—Cl(1)	2·434 (1)	Cl(1)—Sn—Cl(2)	90·37 (3)
	[2·450 (1)]*	Cl(1)—Sn—Cl(2)	89·63 (3)
4 × Sn—Cl(2)	2·424 (1)	Cl(2)—Sn—Cl(2)	88·14 (3)
	[2·437 (1)]	Cl(2)—Sn—Cl(2)	91·86 (3)
1 × N—C(1)	1·458 (7)	C(1)—N—C(2)	116·9 (5)
1 × N—C(2)	1·447 (7)	C(1)—N—H(1)	108 (2)
2 × N—H(1)	0·85 (4)	C(2)—N—H(1)	114 (2)
1 × C(1)—H(4)	1·18 (8)	H(1)—N—H(1)	94 (4)
2 × C(1)—H(5)	0·91 (5)		
1 × C(2)—H(2)	0·87 (6)		
2 × C(2)—H(3)	1·01 (5)		

* Values in square brackets are corrected for libration.

Table 3. *Hydrogen bonds*

N—H···Cl	H···Cl (Å)	N···Cl (Å)	∠N—H···Cl (°)
N—H(1)···Cl(2)^a	2·87 (3)	3·522 (4)	135 (3)
N—H(1)···Cl(2)^b	2·72 (4)	3·455 (3)	147 (3)

Symmetry code

(a) $\frac{1}{2} - x, \frac{1}{2} - y, \frac{1}{2} + z$ (b) $\frac{1}{2} - x, \frac{1}{2} + y, \frac{1}{2} - z$

Discussion. A stereoscopic view of the structure is shown in Fig. 1. The structure consists of [SnCl$_6$]$^-$ octahedra and [NH$_2$(CH$_3$)$_2$]$^+$ groups. The two independent Sn—Cl bonds, corrected for libration (Schomaker & Trueblood, 1968), are, respectively, 2·437 (1) and 2·450 (1) Å. They agree well with the values of 2·426 and 2·428 Å in the corresponding K$^+$ and NH$_4^+$ compounds (Lerbscher & Trotter, 1976) and the values of 2·404 to 2·447 Å in the [N(C$_2$H$_5$)$_4$]$^+$ analogue (Sowa, Drück & Kutoglu, 1981). The packing of the structure consists of a bifurcated hydrogen bond between H(1) and Cl(2), reported in Table 3. The H(1)···Cl(2) distances of 2·87 (3) and 2·72 (4) Å are rather long. Therefore, the hydrogen bonds have to be classified as weak.

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