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Bis(μ-*N*,*N*-dimethylhydrazido-$\kappa^2N':N'$)bis[dimethylgallium(III)]

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Key indicators

Single-crystal X-ray study
T = 213 K
Mean σ(N–C) = 0.006 Å
R factor = 0.032
wR factor = 0.079
Data-to-parameter ratio = 16.6

For details of how these key indicators were automatically derived from the article, see http://journals.iucr.org/e.

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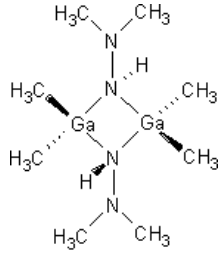
The title centrosymmetric coordination compound, $[Ga_2(CH_3)_4(C_2H_7N_2)_2]$, contains tetrahedral Ga atoms bonded to two N atoms of the hydrazide ligands and two C atoms of the methyl groups. The Ga atoms are bridged by hydrazide moieties, creating a planar four-membered Ga_2N_2 ring, which may be considered as the main structural feature. The Ga—N bond distances are equal [2.018 (2) and 2.019 (2) Å] within experimental error.

Comment

Amide and hydrazide derivatives of gallium have attracted considerable interest due to their application as precursors for the formation of gallium nitride, which is widely used as a semiconducting material. The structures of several complexes of aluminium and gallium with amide ligands have been reported (Carmalt, 2001; Carmalt *et al.*, 2001). Compounds of this type usually form dimeric molecules comprising a central four-membered Ga_2N_2 ring as the main structural feature.



(I)

The Ga atoms in the title compound, (I), adopt a tetrahedral geometry formed by two N atoms of the bridging hydrazide ligand [Ga—N = 2.018 (2) and 2.019 (2) Å] and two C atoms of methyl groups [Ga—C = 1.966 (4) and 1.970 (3) Å]. As a result of the bridging by the hydrazide ligands, centrosymmetric dimeric molecules are formed.

Experimental

The title compound, (I), was prepared according to the procedure of Uhl *et al.* (2001) by reaction of equimolar amounts (20 mmol) of trimethylgallium with *N*,*N*-dimethylhydrazine in toluene (50 ml). The reaction mixture was refluxed for 6 h and the solvent removed *in vacuo* to give a colourless precipitate. The resulting solid was collected and dried *in vacuo*. Suitable crystals were obtained by cooling a saturated solution of (I) in *n*-pentane. Analysis calculated for $C_8H_{26}Ga_2N_4$: C 29.81, H 8.07, Ga 43.47%; found: C 30.01, H 8.23, Ga 43.68%.

Crystal data

$[Ga_2(CH_3)_4(C_2H_7N_2)_2]$
$M_r = 317.77$
Triclinic, $P\overline{1}$
$a = 6.7439\ (1)$ Å
$b = 8.2016\ (1)$ Å
$c = 8.2846\ (2)$ Å
$\alpha = 114.052\ (1)^\circ$
$\beta = 95.798\ (1)^\circ$
$\gamma = 107.406\ (1)^\circ$
$V = 385.991\ (12)$ Å^3
$Z = 1$
$D_x = 1.367$ Mg m^{-3}
Mo $K\alpha$ radiation
Cell parameters from 1543 reflections
$\theta = 2$–27°
$\mu = 3.47$ mm^{-1}
$T = 213\ (2)$ K
Block, colourless
0.30 × 0.30 × 0.20 mm

Data collection

Bruker SMART CCD diffractometer
ω scans
Absorption correction: multi-scan (*SADABS*; Sheldrick, 1996)
$T_{min} = 0.388$, $T_{max} = 0.500$
3427 measured reflections
1543 independent reflections
1383 reflections with $I > 2\sigma(I)$
$R_{int} = 0.024$
$\theta_{max} = 27.1^\circ$
$h = -8 \rightarrow 8$
$k = -10 \rightarrow 9$
$l = -10 \rightarrow 10$

Refinement

Refinement on F^2
$R[F^2 > 2\sigma(F^2)] = 0.032$
$wR(F^2) = 0.080$
$S = 1.07$
1543 reflections
93 parameters
H atoms treated by a mixture of independent and constrained refinement
$w = 1/[\sigma^2(F_o^2) + (0.0491P)^2]$ where $P = (F_o^2 + 2F_c^2)/3$
$(\Delta/\sigma)_{max} < 0.001$
$\Delta\rho_{max} = 0.84$ e Å^{-3}
$\Delta\rho_{min} = -0.45$ e Å^{-3}

Table 1
Selected geometric parameters (Å, °).

Ga1—C2	1.966 (4)	Ga1—N1	2.019 (2)
Ga1—C1	1.970 (3)	Ga1···Ga1^{i}	2.9397 (6)
Ga1—N1^{i}	2.018 (2)	N1—N2	1.452 (3)
C2—Ga1—N1	112.50 (15)	N2—N1—Ga1	118.71 (19)
C1—Ga1—N1	105.73 (15)	Ga1^{i}—N1—Ga1	93.46 (9)
N2—N1—Ga1^{i}	117.22 (18)		

Symmetry code: (i) $-x, 1-y, 2-z$.

H atoms on C2 and C3 were placed in geometrically idealized positions and constrained to ride on their parent atoms, with C—H distances of 0.97 Å and a common U_{iso} value. All other H atoms were located in a difference Fourier map and freely refined.

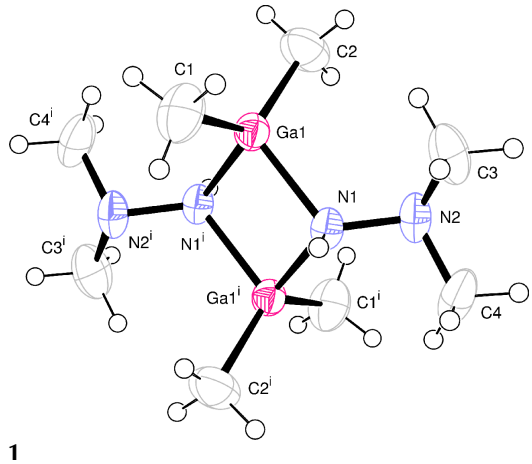


Figure 1
View of the dimeric molecule of (I), showing the atom-labelling scheme. Displacement ellipsoids are drawn at the 50% probability level. [Symmetry code: (i) $-x, 1-y, 2-z$.]

Data collection: *SMART* (Bruker, 2000); cell refinement: *SAINT* (Bruker, 2000; data reduction: *SAINT*; program(s) used to solve structure: *SHELXS*86 (Sheldrick, 1990); program(s) used to refine structure: *SHELXL*97 (Sheldrick, 1997); molecular graphics: *ORTEP*-3 (Farrugia, 1997); software used to prepare material for publication: *SHELXL*97 and *PLATON* (Spek, 2003).

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