

Crystal structure of poly[μ_6 -adipato-di-aquadi- μ_2 -oxalato-didysprosium(III)]

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Received 5 November 2014; accepted 8 November 2014

Edited by M. Gdaniec, Adam Mickiewicz University, Poland

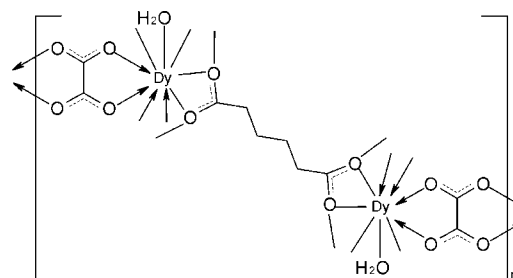
In the title coordination polymer, $[\text{Dy}_2(\text{C}_6\text{H}_8\text{O}_4)(\text{C}_2\text{O}_4)_2(\text{H}_2\text{O})_2]_n$, the asymmetric unit consists of one Dy^{3+} cation, one half of an adipate anion, two halves of oxalate anions and one coordinating water molecule. The adipate and oxalate ions are located on centres of inversion. The Dy^{3+} cation has a distorted tricapped trigonal-prismatic geometry and is coordinated by nine O atoms, four belonging to three adipate anions, four to two oxalate anions and one from an aqua ligand. The cations are bridged by adipate ligands, generating a two-dimensional network parallel to (010). This network is further extended into three dimensions by coordination of the rigid oxalate ligands and is further consolidated by $\text{O}-\text{H}\cdots\text{O}$ hydrogen bonds. A part of the adipate anion is disordered over two positions in a 0.75:0.25 ratio.

Keywords: crystal structure; dysprosium(III) complex; three-dimensional coordination polymer; oxalate; adipate.

CCDC reference: 1033325

1. Related literature

For the isotopic structures of La, Sm and Gd complexes, see: Dan *et al.* (2005); Li & Wang (2010); Li (2011).



2. Experimental

2.1. Crystal data

$[\text{Dy}_2(\text{C}_6\text{H}_8\text{O}_4)(\text{C}_2\text{O}_4)_2(\text{H}_2\text{O})_2]$
 $M_r = 681.20$
 Triclinic, $P\bar{1}$
 $a = 6.772$ (2) Å
 $b = 6.929$ (2) Å
 $c = 8.949$ (3) Å
 $\alpha = 104.916$ (5)°
 $\beta = 108.069$ (4)°

$\gamma = 104.306$ (4)°
 $V = 360.5$ (2) Å³
 $Z = 1$
 Mo $K\alpha$ radiation
 $\mu = 10.37$ mm⁻¹
 $T = 295$ K
 $0.21 \times 0.09 \times 0.07$ mm

2.2. Data collection

Bruker SMART APEXII CCD
 area-detector diffractometer
 Absorption correction: multi-scan
 (SADABS; Sheldrick, 2003)
 $T_{\min} = 0.245$, $T_{\max} = 0.531$

1813 measured reflections
 1234 independent reflections
 1179 reflections with $I > 2\sigma(I)$
 $R_{\text{int}} = 0.014$

2.3. Refinement

$R[F^2 > 2\sigma(F^2)] = 0.021$
 $wR(F^2) = 0.057$
 $S = 1.05$
 1234 reflections

122 parameters
 H-atom parameters constrained
 $\Delta\rho_{\max} = 1.41$ e Å⁻³
 $\Delta\rho_{\min} = -1.45$ e Å⁻³

Table 1

Hydrogen-bond geometry (Å, °).

$D-\text{H}\cdots A$	$D-\text{H}$	$\text{H}\cdots A$	$D\cdots A$	$D-\text{H}\cdots A$
$\text{O7}-\text{H7A}\cdots\text{O3}^{\text{i}}$	0.85	1.96	2.787 (4)	166
$\text{O7}-\text{H7B}\cdots\text{O6}^{\text{ii}}$	0.85	2.10	2.883 (5)	153

Symmetry codes: (i) $-x + 1, -y + 1, -z + 1$; (ii) $-x, -y + 1, -z$.

Data collection: APEX2 (Bruker, 2004); cell refinement: SAINT (Bruker, 2004); data reduction: SAINT; program(s) used to solve structure: SHELXS97 (Sheldrick, 2008); program(s) used to refine structure: SHELXL97 (Sheldrick, 2008); molecular graphics: SHELXTL (Sheldrick, 2008); software used to prepare material for publication: SHELXTL.

Acknowledgements

This work was supported by the National Natural Science Foundation of China (51372104), the Natural Science Foundation of Jiangxi Province (2010GQC0064), the Science and Technology Support Foundation of Jiangxi Province (2012BBE500038, 20141BBE50019) and the Jiangxi University of Science and Technology Foundation (3304000027).

Supporting information for this paper is available from the IUCr electronic archives (Reference: GK2622).

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supporting information

Acta Cryst. (2014). E70, m399–m400 [doi:10.1107/S1600536814024544]

Crystal structure of poly[μ_6 -adipato-diaquadi- μ_2 -oxalato-didysprosium(III)]

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S1. Structural commentary

The title compound is isostructural with $[M_2(C_6H_8O_4)(C_2O_4)_2(H_2O)_2]$ [$M = La, Sm, Gd$] (Dan *et al.*, 2005; Li & Wang, 2010; Li, 2011). The asymmetric unit consists of one Dy^{3+} cation, a half of adipate anion, two half of oxalate anions and one aqua ligand (Fig. 1). The Dy atom is each coordinated by nine oxygen atoms, in which four oxygen atoms are from three adipate anions, four from two oxalate anions and one from a water molecule, to form a DyO_9 polyhedron of a distorted tricapped trigonal-prismatic geometry. In the title complex, the adipate anions are located on a centre of symmetry and atom C3 is positionally disordered (C3A and C3B sites; occupancies 0.75/0.25). The adipate ligands act in a $\eta^2, \mu_3-\eta^2, \mu_3$ -chelating-bridging octadentate coordination modes and link the DyO_9 polyhedra into layers parallel to (010), in which the adjacent Dy...Dy distances are 4.20 (2) Å and 4.223 (9) Å, respectively. In the title complex, two symmetry independent oxalate ions are also located on centres of inversion and act as double bidentate (tetradentate) ligands in a zigzag chain along [001]. Through the oxalate and adipate ligands bridging interactions, the Dy atoms build up three-dimensional framework. The aqua ligand provides hydrogen-bond donors form hydrogen bonds with oxalate atoms O3 and O6.

The structure of the title complex is similar to that of other lanthanide (gadolinium, samarium and lanthanum) coordination polymers with adipate and oxalate ligands, and the mean Dy—O distance in the title complex of 2.438 Å is shorter than that of Ga—O (2.463 Å), Sm—O (2.482 Å) and La—O (2.566 Å).

S2. Synthesis and crystallization

A mixture of $DyCl_3 \cdot 6H_2O$ (1.00 mmol, 0.38 g), oxalic acid (0.50 mmol, 0.05 g), adipic acid (0.50 mmol, 0.07 g), NaOH (2.00 mmol, 0.08 g) and H_2O (10.0 ml) was heated in a 23 ml stainless steel reactor with a Teflon liner at 443 K for 48 h. A small amount of colorless plate-like crystals were filtered and washed with water and acetone. Yield 5% based on Dy.

S3. Refinement

Crystal data, data collection and structure refinement details are summarized in Table 1. Atom C3 of the adipate anion is positionally disordered (C3A and C3B) and these atoms were refined with occupancies of 0.75/0.25. The C-bound H atoms were included in calculated positions and treated as riding atoms: C—H = 0.97 Å and $U_{iso}(H) = 1.2U_{eq}(C)$. The water H-atoms were located in difference Fourier maps and were refined with distance restraints: O—H distance of 0.85 Å and $U_{iso}(H) = 1.5U_{eq}(O)$. The highest density peak and deepest hole are located at 0.95 Å and 0.87 Å from the Dy atom, respectively.

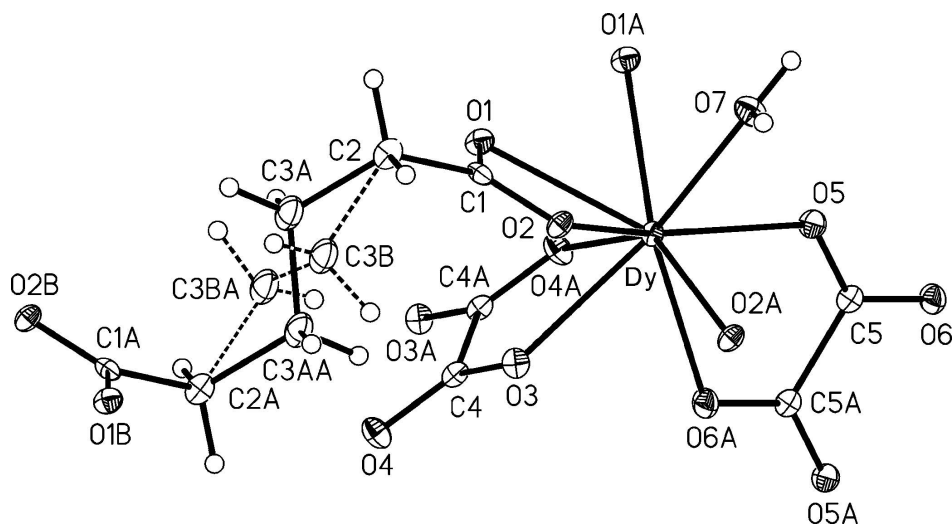


Figure 1

The fragment of the structure of the title compounds, with the atom-numbering scheme. Displacement ellipsoids are drawn at the 30% probability level and H atoms are shown as small spheres of arbitrary radii. Symmetry code: (i) $-x, 1 - y, 1 - z$; (ii) $1 - x, 1 - y, 1 - z$; (iii) $-x, -y, 1 - z$; (iv) $-x, -y, -z$; (v) $1 - x, 1 - y, 2 - z$.

Poly[μ_6 -adipato-diaquadi- μ_2 -oxalato-didysprosium(III)]

Crystal data

$[\text{Dy}_2(\text{C}_6\text{H}_8\text{O}_4)(\text{C}_2\text{O}_4)_2(\text{H}_2\text{O})_2]$

$M_r = 681.20$

Triclinic, $P\bar{1}$

Hall symbol: $-p\ 1$

$a = 6.772\ (2)\ \text{\AA}$

$b = 6.929\ (2)\ \text{\AA}$

$c = 8.949\ (3)\ \text{\AA}$

$\alpha = 104.916\ (5)^\circ$

$\beta = 108.069\ (4)^\circ$

$\gamma = 104.306\ (4)^\circ$

$V = 360.5\ (2)\ \text{\AA}^3$

$Z = 1$

$F(000) = 316$

$D_x = 3.138\ \text{Mg m}^{-3}$

Mo $K\alpha$ radiation, $\lambda = 0.71073\ \text{\AA}$

Cell parameters from 198 reflections

$\theta = 4.6\text{--}28.3^\circ$

$\mu = 10.37\ \text{mm}^{-1}$

$T = 295\ \text{K}$

Plate, colorless

$0.21 \times 0.09 \times 0.07\ \text{mm}$

Data collection

Bruker SMART APEXII CCD area-detector diffractometer

Radiation source: fine-focus sealed tube

Graphite monochromator

φ and ω scans

Absorption correction: multi-scan

(*SADABS*; Sheldrick, 2003)

$T_{\min} = 0.245$, $T_{\max} = 0.531$

1813 measured reflections

1234 independent reflections

1179 reflections with $I > 2\sigma(I)$

$R_{\text{int}} = 0.014$

$\theta_{\max} = 25.0^\circ$, $\theta_{\min} = 2.6^\circ$

$h = -8 \rightarrow 7$

$k = -6 \rightarrow 8$

$l = -10 \rightarrow 7$

Refinement

Refinement on F^2

Least-squares matrix: full

$R[F^2 > 2\sigma(F^2)] = 0.021$

$wR(F^2) = 0.057$

$S = 1.05$

1234 reflections

122 parameters

0 restraints

Primary atom site location: structure-invariant direct methods

Secondary atom site location: difference Fourier map

Hydrogen site location: inferred from neighbouring sites
 H-atom parameters constrained
 $w = 1/[\sigma^2(F_o^2) + (0.0422P)^2 + 0.1716P]$
 where $P = (F_o^2 + 2F_c^2)/3$
 $(\Delta/\sigma)_{\max} < 0.001$

$\Delta\rho_{\max} = 1.41 \text{ e } \text{\AA}^{-3}$
 $\Delta\rho_{\min} = -1.45 \text{ e } \text{\AA}^{-3}$
 Extinction correction: *SHELXL97* (Sheldrick, 2008), $F_c^* = kFc[1 + 0.001x\text{Fc}^2\lambda^3/\sin(2\theta)]^{-1/4}$
 Extinction coefficient: 0.0039 (11)

Special details

Geometry. All e.s.d.'s (except the e.s.d. in the dihedral angle between two l.s. planes) are estimated using the full covariance matrix. The cell e.s.d.'s are taken into account individually in the estimation of e.s.d.'s in distances, angles and torsion angles; correlations between e.s.d.'s in cell parameters are only used when they are defined by crystal symmetry. An approximate (isotropic) treatment of cell e.s.d.'s is used for estimating e.s.d.'s involving l.s. planes.

Refinement. Refinement of F^2 against ALL reflections. The weighted R -factor wR and goodness of fit S are based on F^2 , conventional R -factors R are based on F , with F set to zero for negative F^2 . The threshold expression of $F^2 > \sigma(F^2)$ is used only for calculating R -factors(gt) *etc.* and is not relevant to the choice of reflections for refinement. R -factors based on F^2 are statistically about twice as large as those based on F , and R -factors based on ALL data will be even larger.

Fractional atomic coordinates and isotropic or equivalent isotropic displacement parameters (\AA^2)

	<i>x</i>	<i>y</i>	<i>z</i>	$U_{\text{iso}}^*/U_{\text{eq}}$	Occ. (<1)
Dy	0.15576 (3)	0.34496 (3)	0.36280 (2)	0.01182 (14)	
O1	0.1519 (6)	0.5222 (6)	0.6470 (4)	0.0145 (7)	
O2	0.4801 (6)	0.5972 (6)	0.6395 (4)	0.0162 (8)	
O3	0.2699 (6)	0.1546 (6)	0.5391 (4)	0.0154 (8)	
O4	0.1535 (6)	-0.0812 (6)	0.6512 (5)	0.0181 (8)	
O5	-0.0072 (6)	0.2564 (6)	0.0712 (4)	0.0172 (8)	
O6	-0.1314 (7)	0.0203 (6)	-0.1913 (5)	0.0201 (8)	
O7	0.2677 (6)	0.6848 (6)	0.3381 (5)	0.0206 (8)	
H7A	0.4060	0.7539	0.3786	0.031*	
H7B	0.1863	0.7472	0.2931	0.031*	
C1	0.3632 (9)	0.6131 (8)	0.7234 (6)	0.0135 (11)	
C2	0.4635 (9)	0.7252 (9)	0.9114 (7)	0.0178 (12)	
H2A	0.3960	0.8298	0.9403	0.021*	
H2B	0.6211	0.8016	0.9479	0.021*	
C3A	0.4334 (12)	0.5740 (12)	1.0066 (9)	0.0162 (14)	0.75
H3A1	0.2770	0.4877	0.9624	0.019*	0.75
H3A2	0.4788	0.6577	1.1245	0.019*	0.75
C3B	0.576 (4)	0.593 (4)	1.005 (3)	0.0162 (14)	0.25
H3B1	0.6770	0.5536	0.9564	0.019*	0.25
H3B2	0.6640	0.6824	1.1227	0.019*	0.25
C4	0.1215 (8)	0.0215 (7)	0.5549 (6)	0.0127 (10)	
C5	-0.0395 (8)	0.0806 (8)	-0.0350 (7)	0.0150 (11)	

Atomic displacement parameters (\AA^2)

	U^{11}	U^{22}	U^{33}	U^{12}	U^{13}	U^{23}
Dy	0.01277 (19)	0.01272 (18)	0.01252 (19)	0.00465 (11)	0.00650 (12)	0.00663 (11)
O1	0.0132 (17)	0.0169 (18)	0.0168 (18)	0.0054 (14)	0.0085 (15)	0.0081 (14)
O2	0.0179 (19)	0.0165 (19)	0.0181 (19)	0.0061 (15)	0.0117 (16)	0.0070 (14)
O3	0.0135 (18)	0.0175 (19)	0.0164 (18)	0.0052 (15)	0.0049 (15)	0.0093 (15)

O4	0.0134 (18)	0.022 (2)	0.0213 (19)	0.0068 (15)	0.0054 (15)	0.0131 (16)
O5	0.0220 (19)	0.0161 (19)	0.0167 (19)	0.0095 (15)	0.0092 (16)	0.0062 (15)
O6	0.027 (2)	0.022 (2)	0.014 (2)	0.0111 (17)	0.0083 (17)	0.0095 (16)
O7	0.0178 (19)	0.020 (2)	0.031 (2)	0.0080 (16)	0.0105 (17)	0.0177 (17)
C1	0.021 (3)	0.008 (2)	0.015 (3)	0.009 (2)	0.007 (2)	0.0074 (19)
C2	0.017 (3)	0.019 (3)	0.019 (3)	0.006 (2)	0.009 (2)	0.007 (2)
C3A	0.017 (3)	0.029 (4)	0.013 (3)	0.013 (3)	0.010 (3)	0.012 (3)
C3B	0.017 (3)	0.029 (4)	0.013 (3)	0.013 (3)	0.010 (3)	0.012 (3)
C4	0.018 (3)	0.008 (2)	0.015 (2)	0.0022 (19)	0.011 (2)	0.0058 (19)
C5	0.012 (2)	0.019 (3)	0.019 (3)	0.007 (2)	0.009 (2)	0.009 (2)

Geometric parameters (Å, °)

Dy—O5	2.336 (4)	O7—H7A	0.8468
Dy—O4 ⁱ	2.360 (4)	O7—H7B	0.8496
Dy—O3	2.376 (4)	C1—C2	1.501 (7)
Dy—O7	2.379 (4)	C2—C3A	1.525 (9)
Dy—O2 ⁱⁱ	2.406 (3)	C2—C3B	1.57 (2)
Dy—O1 ⁱⁱⁱ	2.464 (4)	C2—H2A	0.9700
Dy—O6 ^{iv}	2.535 (4)	C2—H2B	0.9700
Dy—O1	2.535 (3)	C3A—C3A ^v	1.529 (14)
Dy—O2	2.552 (4)	C3A—H3A1	0.9700
O1—C1	1.279 (7)	C3A—H3A2	0.9700
O2—C1	1.255 (6)	C3B—C3B ^v	1.40 (4)
O3—C4	1.256 (6)	C3B—H3B1	0.9700
O4—C4	1.253 (6)	C3B—H3B2	0.9700
O5—C5	1.256 (6)	C4—C4 ⁱ	1.538 (10)
O6—C5	1.245 (7)	C5—C5 ^{iv}	1.540 (11)
O6—Dy ^{iv}	2.535 (4)		
O5—Dy—O4 ⁱ	90.45 (13)	C1—O1—Dy	95.2 (3)
O5—Dy—O3	134.27 (12)	Dy ⁱⁱⁱ —O1—Dy	115.28 (14)
O4 ⁱ —Dy—O3	68.93 (12)	C1—O2—Dy ⁱⁱ	148.4 (3)
O5—Dy—O7	78.20 (13)	C1—O2—Dy	95.1 (3)
O4 ⁱ —Dy—O7	142.35 (13)	Dy ⁱⁱ —O2—Dy	115.66 (13)
O3—Dy—O7	141.46 (12)	C4—O3—Dy	117.8 (3)
O5—Dy—O2 ⁱⁱ	91.79 (12)	C4—O4—Dy ⁱ	118.7 (3)
O4 ⁱ —Dy—O2 ⁱⁱ	142.20 (13)	C5—O5—Dy	123.8 (3)
O3—Dy—O2 ⁱⁱ	82.95 (12)	C5—O6—Dy ^{iv}	117.5 (3)
O7—Dy—O2 ⁱⁱ	74.65 (13)	Dy—O7—H7A	116.9
O5—Dy—O1 ⁱⁱⁱ	82.15 (12)	Dy—O7—H7B	128.4
O4 ⁱ —Dy—O1 ⁱⁱⁱ	69.07 (12)	H7A—O7—H7B	114.8
O3—Dy—O1 ⁱⁱⁱ	122.91 (11)	O2—C1—O1	118.8 (5)
O7—Dy—O1 ⁱⁱⁱ	73.84 (12)	O2—C1—C2	122.2 (5)
O2 ⁱⁱ —Dy—O1 ⁱⁱⁱ	148.49 (12)	O1—C1—C2	119.0 (4)
O5—Dy—O6 ^{iv}	65.84 (12)	O2—C1—Dy	59.8 (3)
O4 ⁱ —Dy—O6 ^{iv}	70.76 (13)	O1—C1—Dy	59.1 (2)
O3—Dy—O6 ^{iv}	68.84 (12)	C2—C1—Dy	173.1 (4)

O7—Dy—O6 ^{iv}	132.07 (13)	C1—C2—C3A	113.3 (5)
O2 ⁱⁱ —Dy—O6 ^{iv}	75.88 (12)	C1—C2—C3B	111.8 (9)
O1 ⁱⁱⁱ —Dy—O6 ^{iv}	127.55 (12)	C1—C2—H2A	108.9
O5—Dy—O1	146.78 (12)	C3A—C2—H2A	108.9
O4 ⁱ —Dy—O1	80.36 (12)	C3B—C2—H2A	134.9
O3—Dy—O1	71.64 (12)	C1—C2—H2B	108.9
O7—Dy—O1	89.76 (13)	C3A—C2—H2B	108.9
O2 ⁱⁱ —Dy—O1	114.93 (11)	C3B—C2—H2B	76.5
O1 ⁱⁱⁱ —Dy—O1	64.72 (14)	H2A—C2—H2B	107.7
O6 ^{iv} —Dy—O1	137.19 (12)	C2—C3A—C3A ^v	113.2 (7)
O5—Dy—O2	146.25 (12)	C2—C3A—H3A1	108.9
O4 ⁱ —Dy—O2	123.15 (12)	C3A ^v —C3A—H3A1	108.9
O3—Dy—O2	69.30 (12)	C2—C3A—H3A2	108.9
O7—Dy—O2	72.79 (13)	C3A ^v —C3A—H3A2	108.9
O2 ⁱⁱ —Dy—O2	64.34 (13)	H3A1—C3A—H3A2	107.8
O1 ⁱⁱⁱ —Dy—O2	105.43 (11)	C3B ^v —C3B—C2	113 (2)
O6 ^{iv} —Dy—O2	124.52 (12)	C3B ^v —C3B—H3B1	108.9
O1—Dy—O2	50.76 (11)	C2—C3B—H3B1	108.9
O5—Dy—C1	158.48 (13)	C3B ^v —C3B—H3B2	108.9
O4 ⁱ —Dy—C1	101.76 (14)	C2—C3B—H3B2	108.9
O3—Dy—C1	67.18 (13)	H3B1—C3B—H3B2	107.7
O7—Dy—C1	81.38 (14)	O4—C4—O3	125.9 (5)
O2 ⁱⁱ —Dy—C1	89.29 (13)	O4—C4—C4 ⁱ	116.9 (5)
O1 ⁱⁱⁱ —Dy—C1	85.74 (13)	O3—C4—C4 ⁱ	117.2 (5)
O6 ^{iv} —Dy—C1	134.90 (13)	O6—C5—O5	127.2 (5)
O1—Dy—C1	25.66 (13)	O6—C5—C5 ^{iv}	116.0 (6)
O2—Dy—C1	25.14 (13)	O5—C5—C5 ^{iv}	116.8 (6)
C1—O1—Dy ⁱⁱⁱ	132.5 (3)		
O5—Dy—O1—C1	-138.0 (3)	O1 ⁱⁱⁱ —Dy—O5—C5	-135.5 (4)
O4 ⁱ —Dy—O1—C1	146.2 (3)	O6 ^{iv} —Dy—O5—C5	1.9 (4)
O3—Dy—O1—C1	75.4 (3)	O1—Dy—O5—C5	-139.6 (4)
O7—Dy—O1—C1	-70.3 (3)	O2—Dy—O5—C5	118.4 (4)
O2 ⁱⁱ —Dy—O1—C1	2.6 (3)	C1—Dy—O5—C5	168.2 (4)
O1 ⁱⁱⁱ —Dy—O1—C1	-142.5 (4)	Dy ⁱⁱ —O2—C1—O1	-171.1 (4)
O6 ^{iv} —Dy—O1—C1	98.7 (3)	Dy—O2—C1—O1	-4.5 (5)
O2—Dy—O1—C1	-2.5 (3)	Dy ⁱⁱ —O2—C1—C2	5.7 (9)
O5—Dy—O1—Dy ⁱⁱⁱ	4.5 (3)	Dy—O2—C1—C2	172.3 (4)
O4 ⁱ —Dy—O1—Dy ⁱⁱⁱ	-71.31 (15)	Dy ⁱⁱ —O2—C1—Dy	-166.6 (6)
O3—Dy—O1—Dy ⁱⁱⁱ	-142.17 (17)	Dy ⁱⁱⁱ —O1—C1—O2	-127.1 (4)
O7—Dy—O1—Dy ⁱⁱⁱ	72.19 (15)	Dy—O1—C1—O2	4.5 (5)
O2 ⁱⁱ —Dy—O1—Dy ⁱⁱⁱ	145.10 (14)	Dy ⁱⁱⁱ —O1—C1—C2	56.0 (6)
O1 ⁱⁱⁱ —Dy—O1—Dy ⁱⁱⁱ	0.0	Dy—O1—C1—C2	-172.3 (4)
O6 ^{iv} —Dy—O1—Dy ⁱⁱⁱ	-118.82 (18)	Dy ⁱⁱⁱ —O1—C1—Dy	-131.7 (4)
O2—Dy—O1—Dy ⁱⁱⁱ	139.9 (2)	O5—Dy—C1—O2	-86.1 (5)
C1—Dy—O1—Dy ⁱⁱⁱ	142.5 (4)	O4 ⁱ —Dy—C1—O2	150.6 (3)
O5—Dy—O2—C1	138.8 (3)	O3—Dy—C1—O2	89.7 (3)
O4 ⁱ —Dy—O2—C1	-35.1 (3)	O7—Dy—C1—O2	-67.6 (3)

O3—Dy—O2—C1	-80.2 (3)	O2 ⁱⁱ —Dy—C1—O2	7.0 (3)
O7—Dy—O2—C1	106.9 (3)	O1 ⁱⁱⁱ —Dy—C1—O2	-141.9 (3)
O2 ⁱⁱ —Dy—O2—C1	-172.2 (4)	O6 ^{iv} —Dy—C1—O2	76.1 (3)
O1 ⁱⁱⁱ —Dy—O2—C1	39.7 (3)	O1—Dy—C1—O2	-175.4 (5)
O6 ^{iv} —Dy—O2—C1	-123.4 (3)	O5—Dy—C1—O1	89.3 (5)
O1—Dy—O2—C1	2.6 (3)	O4 ⁱ —Dy—C1—O1	-34.1 (3)
O5—Dy—O2—Dy ⁱⁱ	-49.0 (3)	O3—Dy—C1—O1	-95.0 (3)
O4 ⁱ —Dy—O2—Dy ⁱⁱ	137.16 (15)	O7—Dy—C1—O1	107.8 (3)
O3—Dy—O2—Dy ⁱⁱ	92.06 (16)	O2 ⁱⁱ —Dy—C1—O1	-177.6 (3)
O7—Dy—O2—Dy ⁱⁱ	-80.87 (16)	O1 ⁱⁱⁱ —Dy—C1—O1	33.5 (3)
O2 ⁱⁱ —Dy—O2—Dy ⁱⁱ	0.001 (1)	O6 ^{iv} —Dy—C1—O1	-108.5 (3)
O1 ⁱⁱⁱ —Dy—O2—Dy ⁱⁱ	-148.06 (15)	O2—Dy—C1—O1	175.4 (5)
O6 ^{iv} —Dy—O2—Dy ⁱⁱ	48.8 (2)	O2—C1—C2—C3A	-110.4 (6)
O1—Dy—O2—Dy ⁱⁱ	174.8 (2)	O1—C1—C2—C3A	66.3 (7)
C1—Dy—O2—Dy ⁱⁱ	172.2 (4)	O2—C1—C2—C3B	-71.7 (11)
O5—Dy—O3—C4	-74.6 (4)	O1—C1—C2—C3B	105.1 (10)
O4 ⁱ —Dy—O3—C4	-5.9 (3)	C1—C2—C3A—C3A ^v	68.2 (9)
O7—Dy—O3—C4	145.5 (3)	C3B—C2—C3A—C3A ^v	-27.2 (14)
O2 ⁱⁱ —Dy—O3—C4	-160.2 (3)	C1—C2—C3B—C3B ^v	-70 (2)
O1 ⁱⁱⁱ —Dy—O3—C4	39.2 (4)	C3A—C2—C3B—C3B ^v	29.9 (15)
O6 ^{iv} —Dy—O3—C4	-82.6 (3)	Dy ⁱ —O4—C4—O3	-174.4 (4)
O1—Dy—O3—C4	80.6 (3)	Dy ⁱ —O4—C4—C4 ⁱ	4.9 (7)
O2—Dy—O3—C4	134.6 (4)	Dy—O3—C4—O4	-175.0 (4)
C1—Dy—O3—C4	107.6 (4)	Dy—O3—C4—C4 ⁱ	5.8 (7)
O4 ⁱ —Dy—O5—C5	-66.7 (4)	Dy ^{iv} —O6—C5—O5	178.5 (4)
O3—Dy—O5—C5	-6.3 (5)	Dy ^{iv} —O6—C5—C5 ^{iv}	-2.6 (7)
O7—Dy—O5—C5	149.5 (4)	Dy—O5—C5—O6	177.5 (4)
O2 ⁱⁱ —Dy—O5—C5	75.6 (4)	Dy—O5—C5—C5 ^{iv}	-1.4 (7)

Symmetry codes: (i) $-x, -y, -z+1$; (ii) $-x+1, -y+1, -z+1$; (iii) $-x, -y+1, -z+1$; (iv) $-x, -y, -z$; (v) $-x+1, -y+1, -z+2$.

Hydrogen-bond geometry ($\text{\AA}, ^\circ$)

$D-H\cdots A$	$D-H$	$H\cdots A$	$D\cdots A$	$D-H\cdots A$
O7—H7A \cdots O3 ⁱⁱ	0.85	1.96	2.787 (4)	166
O7—H7B \cdots O6 ^{vi}	0.85	2.10	2.883 (5)	153

Symmetry codes: (ii) $-x+1, -y+1, -z+1$; (vi) $-x, -y+1, -z$.