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Didysprosium heptanickel

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Key indicators: single-crystal X-ray study; *T* = 293 K; mean σ(Dy–Ni) = 0.002 Å; *R* factor = 0.047; *wR* factor = 0.115; data-to-parameter ratio = 10.1.

The title compound, Dy_2Ni_7, adopts the β-Gd_2Co_7-type structure type. The asymmetric unit contains two Dy sites (both site symmetry $3m$) and five Ni sites (site symmetries $.m$, $.2/m$ and $\overline{3}m$, and two $3m$). The four different Ni coordination polyhedra are Frank–Kasper icosahedra formed by five Dy and seven Ni atoms, four Dy and eight Ni, three Dy and nine Ni, and six Dy and six Ni atoms, respectively. The two different Dy coordination polyhedra are either pseudo Frank–Kasper icosahedra formed by two Dy and 18 Ni atoms or normal Frank–Kasper icosahedra formed by four Dy and 12 Ni atoms.

Related literature

For the β-Gd_2Co_7 structure type, see: Bertaut *et al.* (1965). For previous powder diffraction studies of the title compound, see: Lemaire *et al.* (1967); Lemaire & Paccard (1969). For related compounds, see: Buschow & van der Goot (1970). For intergrowth structures, see: Parthé *et al.* (1985); Grin (1992).

Experimental

Crystal data

Dy_2Ni_7
$M_r = 735.97$
Trigonal, $R\overline{3}m$
$a = 4.9460\ (9)$ Å
$c = 36.191\ (9)$ Å
$V = 766.7\ (3)$ Å^3
$Z = 6$
Mo $K\alpha$ radiation
$\mu = 53.83$ mm^{-1}
$T = 293$ K
0.14 × 0.09 × 0.06 mm

Data collection

Stoe IPDS II diffractometer
Absorption correction: numerical (*X-RED*; Stoe & Cie, 2009)
$T_{min} = 0.067$, $T_{max} = 0.135$
372 measured reflections
253 independent reflections
208 reflections with $I > 2\sigma(I)$
$R_{int} = 0.027$

Refinement

$R[F^2 > 2\sigma(F^2)] = 0.047$
$wR(F^2) = 0.115$
$S = 1.07$
253 reflections
25 parameters
$\Delta\rho_{max} = 5.07$ e Å^{-3}
$\Delta\rho_{min} = -2.37$ e Å^{-3}

Data collection: *X-AREA* (Stoe & Cie, 2009); cell refinement: *X-AREA*; data reduction: *X-AREA*; program(s) used to solve structure: *SIR2011* (Burla *et al.*, 2012); program(s) used to refine structure: *SHELXL97* (Sheldrick, 2008) and *WinGX* (Farrugia, 1999); molecular graphics: *DIAMOND* (Brandenburg, 2006); software used to prepare material for publication: *publCIF* (Westrip, 2010).

Supplementary data and figures for this paper are available from the IUCr electronic archives (Reference: VN2032).

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supplementary materials

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Didysprosium heptanickel

Volodymyr Levytskyy, Volodymyr Babizhetskyy, Bohdan Kotur and Volodymyr Smetana

Comment

The existence of the Dy_2Ni_7 structure isotypic with the rhombohedral β-Gd_2Co_7 structure was reported by Lemaire *et al.* (1967) and Lemaire & Paccard (1969). The lattice parameters were determined from X-ray powder diffraction data without specifying atomic coordinates. Buschow & van der Goot (1970) prepared a series of isotypic compounds with a composition close to R_2Ni_7 (R = Y, La–Nd, Sm, Gd–Er) and from the X-ray powder diffraction data confirmed the lattice parameters for Dy_2Ni_7.

In this work we carried out a single-crystal investigation of the Dy_2Ni_7 inter-metallic compound. A view of the crystal structure of Dy_2Ni_7 is shown in Fig. 1. The structure belongs to the β-Gd_2Co_7 structure type (Bertaut *et al.*, 1965) and consists of stacks of RX_5 blocks corresponding to the $CaCu_5$-type structure and R_2X_4 blocks corresponding to the $MgCu_2$-type structure. The presence of the same Kagome net in the structure types of $CaCu_5$ and the Laves phase $MgCu_2$ allows a combination of both structural motifs along the 3-fold inversion axis giving an inter-growth structure: $2RX_5 + R_2X_4 = 2R_2X_7$. The Kagome net serves as the common interface in the structure (Parthé *et al.*, 1985; Grin, 1992).

In Fig. 2 the *ab* projection of the unit cell and the coordination polyhedra for all atom types are shown. The coordination number for all Ni atoms is 12, but the Wyckoff site occupation is different. The coordination polyhedra are Frank–Kasper icosahedra (coordination number 12). The Ni1 atom (Wyckoff site 18*h*, site symmetry .*m*) is surrounded by 5 Dy atoms and 7 Ni atoms. The Ni2 atom (Wyckoff site 9*e*, site symmetry .2/*m*) is surrounded by 4 Dy atoms and 8 Ni atoms. The Ni3 and Ni4 atoms (both Wyckoff site 6*c*, site symmetry 3*m*) are surrounded by 3 Dy and 9 Ni atoms and by 3 Dy atoms and 9 Ni atoms respectively. The Ni5 atom (Wyckoff site 3*b*, site symmetry $\overline{3}m$) is surrounded by 6 Dy atoms and 6 Ni atoms. The coordination polyhedra for Dy1 and Dy2 atoms (both in Wyckoff site 6*c*, site symmetry 3*m*) are pseudo Frank–Kasper polyhedra (coordination number 20) and Frank–Kasper polyhedra (coordination number 16), respectively. The Dy1 atom is surrounded by 2 Dy atoms and 18 Ni atoms. The Dy2 atom is surrounded by 4 Dy atoms and 12 Ni atoms.

Experimental

The sample was prepared from the commercially available pure elements: sublimed bulk pieces of dysprosium metal with a claimed purity of 99.99 at.% (Alfa Aesar, Johnson Matthey) and electrolytic nickel (99.99% pure) piece (Aldrich). A mixture of the powders was compacted in stainless steel dies. The pellet was arc-melted under an argon atmosphere on a water-cooled copper hearth. The alloy button (~1 g) was turned over and remelted three times to improve homogeneity. Subsequently, the sample was annealed in evacuated silica tube under an argon atmosphere for four weeks at 1070 K. Shiny metallic gray plate-like single crystals were isolated mechanically by crushing the sample.

Refinement

The atomic positions found from the *ab initio* structure solution were in good agreement with those from the β-Gd_2Co_7 structure type and were used as starting point for the structure refinement. The highest Fourier difference peak of 5.07 e Å^{-3} is at (1/3 2/3 0.0305) and 0.89 Å away from the Ni4 atom. The deepest hole (-2.37 e Å^{-3}) is at (1/3 2/3 0.0984) and 1.49 Å away from the Ni1 atom.

Computing details

Data collection: *X-AREA* (Stoe & Cie, 2009); cell refinement: *X-AREA* (Stoe & Cie, 2009); data reduction: *X-AREA* (Stoe & Cie, 2009); program(s) used to solve structure: *SIR2011* (Burla *et al.*, 2012); program(s) used to refine structure: *SHELXL97* (Sheldrick, 2008) and *WinGX* (Farrugia, 1999); molecular graphics: *DIAMOND* (Brandenburg, 2006); software used to prepare material for publication: *publCIF* (Westrip, 2010).

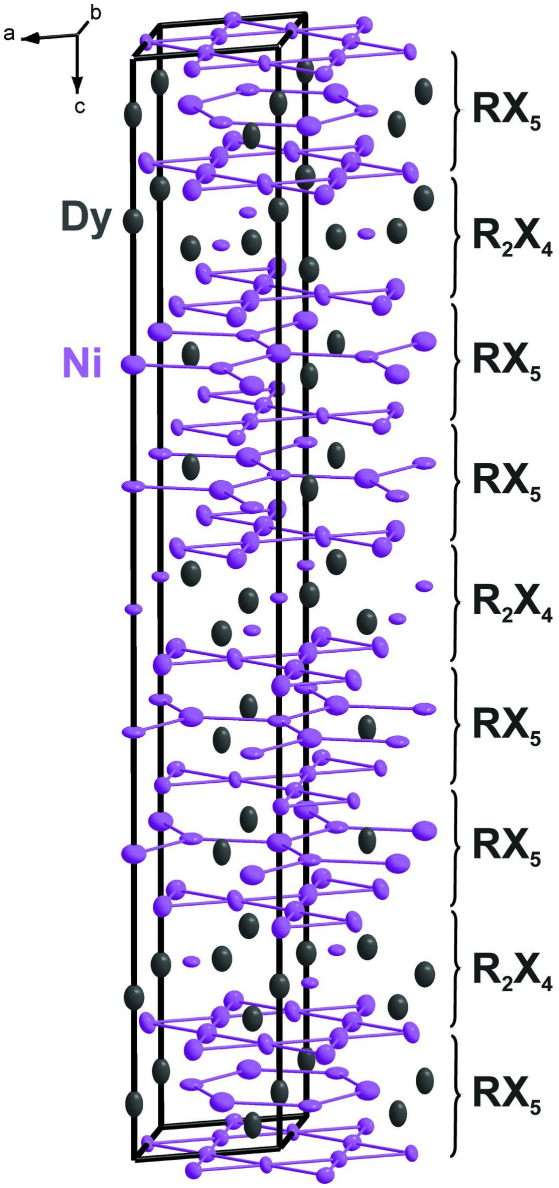

Figure 1

Perspective view of the crystal structure of Dy_2Ni_7. The unit cell and the blocks of RX_5 and R_2X_4 are emphasized. Atoms are represented by their anisotropic displacement ellipsoids at the 99% probability level

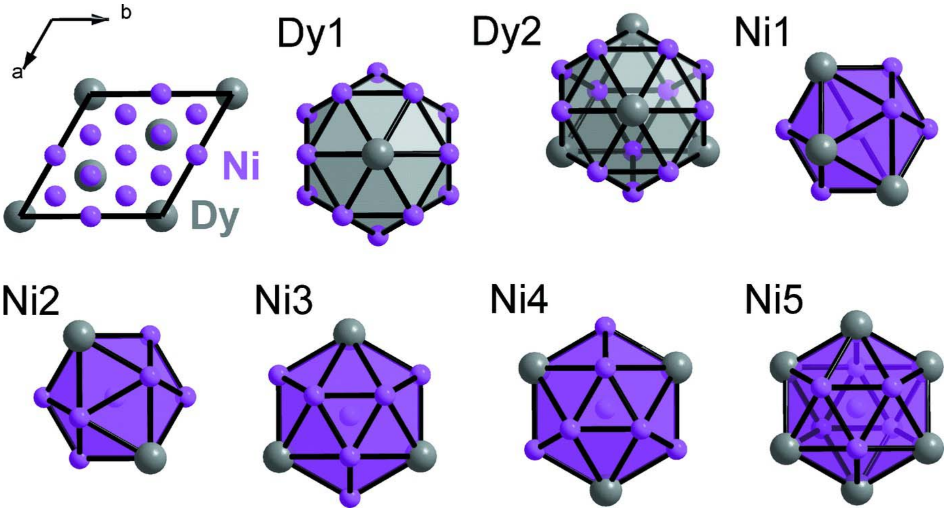

Figure 2

The *ab* projection of the unit cell and coordination polyhedra for all types of atoms in the Dy_2Ni_7 structure

Didysprosium heptanickel

Crystal data

Dy_2Ni_7
$M_r = 735.97$
Trigonal, $R\bar{3}m$
Hall symbol: -R 3 2"
$a = 4.9460 (9)$ Å
$c = 36.191 (9)$ Å
$V = 766.7 (3)$ Å^3
$Z = 6$
$F(000) = 1968$

$D_x = 9.564$ Mg m^{-3}
Mo $K\alpha$ radiation, $\lambda = 0.71073$ Å
Cell parameters from 1802 reflections
$\theta = 1.6–27.2°$
$\mu = 53.83$ mm^{-1}
$T = 293$ K
Plate-like, grey
0.14 × 0.09 × 0.06 mm

Data collection

Stoe IPDS II diffractometer
Radiation source: fine-focus sealed tube
Graphite monochromator
ω scans
Absorption correction: numerical (*X-RED*; Stoe & Cie, 2009)
$T_{\min} = 0.067$, $T_{\max} = 0.135$

372 measured reflections
253 independent reflections
208 reflections with $I > 2\sigma(I)$
$R_{\text{int}} = 0.027$
$\theta_{\max} = 26.7°$, $\theta_{\min} = 1.7°$
$h = -6 \rightarrow 3$
$k = 0 \rightarrow 6$
$l = 0 \rightarrow 45$

Refinement

Refinement on F^2
Least-squares matrix: full
$R[F^2 > 2\sigma(F^2)] = 0.047$
$wR(F^2) = 0.115$
$S = 1.07$
253 reflections
25 parameters
0 restraints

Primary atom site location: structure-invariant direct methods
Secondary atom site location: difference Fourier map
$w = 1/[\sigma^2(F_o^2) + (0.075P)^2]$ where $P = (F_o^2 + 2F_c^2)/3$
$(\Delta/\sigma)_{\max} < 0.001$
$\Delta\rho_{\max} = 5.07$ e Å^{-3}
$\Delta\rho_{\min} = -2.37$ e Å^{-3}

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 (Å^2)

	x	y	z	$U_{\rm iso}$*/$U_{\rm eq}$
Dy1	0.0000	0.0000	0.05083 (5)	0.0143 (5)
Dy2	0.0000	0.0000	0.14764 (5)	0.0152 (5)
Ni1	0.5005 (3)	0.4995 (3)	0.10972 (7)	0.0124 (7)
Ni2	0.5000	0.0000	0.0000	0.0096 (8)
Ni3	0.0000	0.0000	0.27796 (13)	0.0158 (11)
Ni4	0.0000	0.0000	0.38831 (12)	0.0133 (10)
Ni5	0.0000	0.0000	0.5000	0.0097 (13)

Atomic displacement parameters (Å^2)

	U^{11}	U^{22}	U^{33}	U^{12}	U^{13}	U^{23}
Dy1	0.0103 (6)	0.0103 (6)	0.0222 (9)	0.0052 (3)	0.000	0.000
Dy2	0.0129 (7)	0.0129 (7)	0.0199 (9)	0.0065 (3)	0.000	0.000
Ni1	0.0128 (10)	0.0128 (10)	0.0137 (11)	0.0080 (11)	0.0007 (5)	−0.0007 (5)
Ni2	0.0102 (12)	0.0080 (18)	0.0099 (14)	0.0040 (9)	0.0001 (6)	0.0003 (12)
Ni3	0.0167 (16)	0.0167 (16)	0.014 (2)	0.0083 (8)	0.000	0.000
Ni4	0.0158 (15)	0.0158 (15)	0.0083 (19)	0.0079 (7)	0.000	0.000
Ni5	0.0102 (19)	0.0102 (19)	0.009 (3)	0.0051 (10)	0.000	0.000

Geometric parameters (Å, º)

Dy1—Ni4$^{\rm i}$	2.8595 (6)	Ni2—Ni2$^{\rm xix}$	2.4730 (4)
Dy1—Ni4$^{\rm ii}$	2.8595 (6)	Ni2—Dy1$^{\rm xx}$	3.0821 (11)
Dy1—Ni4$^{\rm iii}$	2.8595 (6)	Ni2—Dy1$^{\rm xxi}$	3.0821 (11)
Dy1—Ni3$^{\rm iv}$	2.8603 (6)	Ni2—Dy1$^{\rm xxii}$	3.0821 (11)
Dy1—Ni3$^{\rm v}$	2.8603 (6)	Ni3—Ni1$^{\rm iv}$	2.428 (4)
Dy1—Ni3$^{\rm vi}$	2.8603 (6)	Ni3—Ni1$^{\rm xvi}$	2.428 (4)
Dy1—Ni2$^{\rm vii}$	3.0821 (11)	Ni3—Ni1$^{\rm xv}$	2.428 (4)
Dy1—Ni2$^{\rm viii}$	3.0821 (11)	Ni3—Ni2$^{\rm xxiii}$	2.461 (4)
Dy1—Ni2$^{\rm ix}$	3.0821 (11)	Ni3—Ni2$^{\rm xxiv}$	2.461 (4)
Dy1—Ni2$^{\rm x}$	3.0821 (11)	Ni3—Ni2$^{\rm xxv}$	2.461 (4)
Dy1—Ni2	3.0821 (11)	Ni3—Ni4$^{\rm xxvi}$	2.8556 (5)
Dy1—Ni2$^{\rm xi}$	3.0821 (11)	Ni3—Ni4$^{\rm xxvii}$	2.8556 (5)
Dy2—Ni1$^{\rm xii}$	2.8283 (14)	Ni3—Ni4$^{\rm xxviii}$	2.8556 (5)
Dy2—Ni1$^{\rm xi}$	2.8283 (14)	Ni3—Dy1$^{\rm iv}$	2.8603 (6)
Dy2—Ni1$^{\rm vii}$	2.8283 (14)	Ni3—Dy1$^{\rm v}$	2.8603 (6)
Dy2—Ni1	2.8283 (14)	Ni3—Dy1$^{\rm vi}$	2.8603 (6)

Dy2—Ni1^{xiii}	2.8283 (14)
Dy2—Ni1^{xiv}	2.8283 (14)
Dy2—Ni5^{i}	2.9374 (7)
Dy2—Ni5^{ii}	2.9374 (7)
Dy2—Ni5^{iii}	2.9374 (7)
Dy2—Ni1^{iv}	3.096 (3)
Dy2—Ni1^{xv}	3.096 (3)
Dy2—Ni1^{xvi}	3.096 (3)
Ni1—Ni3^{iv}	2.428 (4)
Ni1—Ni4^{i}	2.445 (4)
Ni1—Ni1^{x}	2.465 (5)
Ni1—Ni1^{xiv}	2.465 (5)
Ni1—Ni1^{xiii}	2.481 (5)
Ni1—Ni1^{xvii}	2.481 (5)
Ni1—Ni5^{i}	2.510 (3)
Ni1—Dy2^{xviii}	2.8283 (14)
Ni1—Dy2^{iv}	3.096 (3)
Ni1—Dy1^{xviii}	3.265 (2)
Ni2—Ni4^{iv}	2.449 (3)
Ni2—Ni4^{iii}	2.449 (3)
Ni2—Ni3^{iv}	2.461 (4)
Ni2—Ni3^{iii}	2.461 (4)
Ni2—Ni2^{xiv}	2.4730 (5)
Ni2—Ni2^{viii}	2.4730 (5)
Ni2—Ni2^{x}	2.4730 (5)
Ni4—Ni1^{xxix}	2.445 (4)
Ni4—Ni1^{xxx}	2.445 (4)
Ni4—Ni1^{xxxi}	2.445 (4)
Ni4—Ni2^{xxiii}	2.449 (3)
Ni4—Ni2^{xxv}	2.449 (3)
Ni4—Ni2^{xxiv}	2.449 (3)
Ni4—Ni3^{xxvi}	2.8556 (5)
Ni4—Ni3^{xxvii}	2.8556 (5)
Ni4—Ni3^{xxviii}	2.8556 (5)
Ni4—Dy1^{xxix}	2.8595 (6)
Ni4—Dy1^{xxxii}	2.8595 (6)
Ni4—Dy1^{xxiv}	2.8595 (6)
Ni5—Ni1^{xxvi}	2.510 (3)
Ni5—Ni1^{xxix}	2.510 (3)
Ni5—Ni1^{xxxiii}	2.510 (3)
Ni5—Ni1^{xxxi}	2.510 (3)
Ni5—Ni1^{xxxiv}	2.510 (3)
Ni5—Ni1^{xxx}	2.510 (3)
Ni5—Dy2^{xxvi}	2.9374 (7)
Ni5—Dy2^{xxix}	2.9374 (7)
Ni5—Dy2^{xxvii}	2.9374 (7)
Ni5—Dy2^{xxxii}	2.9374 (7)
Ni5—Dy2^{xxviii}	2.9374 (7)
Ni5—Dy2^{xxiv}	2.9374 (7)

Ni4^{i}—Dy1—Ni4^{ii}	119.729 (16)
Ni4^{i}—Dy1—Ni4^{iii}	119.727 (16)
Ni4^{ii}—Dy1—Ni4^{iii}	119.727 (16)
Ni4^{i}—Dy1—Ni3^{iv}	59.900 (4)
Ni4^{ii}—Dy1—Ni3^{iv}	173.70 (14)
Ni4^{iii}—Dy1—Ni3^{iv}	59.901 (4)
Ni4^{i}—Dy1—Ni3^{v}	173.70 (14)
Ni4^{ii}—Dy1—Ni3^{v}	59.900 (4)
Ni4^{iii}—Dy1—Ni3^{v}	59.901 (4)
Ni3^{iv}—Dy1—Ni3^{v}	119.67 (2)
Ni4^{i}—Dy1—Ni3^{vi}	59.901 (4)
Ni4^{ii}—Dy1—Ni3^{vi}	59.901 (4)
Ni4^{iii}—Dy1—Ni3^{vi}	173.70 (14)
Ni3^{iv}—Dy1—Ni3^{vi}	119.67 (2)
Ni3^{v}—Dy1—Ni3^{vi}	119.67 (2)
Ni4^{i}—Dy1—Ni2^{vii}	136.49 (8)
Ni4^{ii}—Dy1—Ni2^{vii}	48.50 (7)
Ni4^{iii}—Dy1—Ni2^{vii}	91.79 (5)
Ni3^{iv}—Dy1—Ni2^{vii}	136.72 (9)
Ni3^{v}—Dy1—Ni2^{vii}	48.75 (8)
Ni3^{vi}—Dy1—Ni2^{vii}	91.97 (6)
Ni4^{i}—Dy1—Ni2^{viii}	136.49 (8)
Ni4^{ii}—Dy1—Ni2^{viii}	91.79 (5)
Ni2^{viii}—Ni2—Dy1^{xx}	113.652 (8)
Ni2^{x}—Ni2—Dy1^{xx}	113.652 (8)
Ni2^{xix}—Ni2—Dy1^{xx}	66.348 (8)
Ni4^{iv}—Ni2—Dy1^{xxi}	61.00 (3)
Ni4^{iii}—Ni2—Dy1^{xxi}	119.00 (3)
Ni3^{iv}—Ni2—Dy1^{xxi}	119.08 (3)
Ni3^{iii}—Ni2—Dy1^{xxi}	60.92 (3)
Ni2^{xiv}—Ni2—Dy1^{xxi}	113.652 (8)
Ni2^{viii}—Ni2—Dy1^{xxi}	66.348 (8)
Ni2^{x}—Ni2—Dy1^{xxi}	66.348 (8)
Ni2^{xix}—Ni2—Dy1^{xxi}	113.652 (8)
Dy1^{xx}—Ni2—Dy1^{xxi}	180.00 (5)
Ni4^{iv}—Ni2—Dy1	119.00 (3)
Ni4^{iii}—Ni2—Dy1	61.00 (3)
Ni3^{iv}—Ni2—Dy1	60.92 (3)
Ni3^{iii}—Ni2—Dy1	119.08 (3)
Ni2^{xiv}—Ni2—Dy1	113.652 (8)
Ni2^{viii}—Ni2—Dy1	66.348 (8)
Ni2^{x}—Ni2—Dy1	66.348 (8)
Ni2^{xix}—Ni2—Dy1	113.652 (8)
Dy1^{xx}—Ni2—Dy1	106.71 (5)
Dy1^{xxi}—Ni2—Dy1	73.29 (5)
Ni4^{iv}—Ni2—Dy1^{xxii}	61.00 (3)

Ni4^{iii}—Dy1—Ni2^{viii}	48.50 (7)	Ni4^{iii}—Ni2—Dy1^{xxii}	119.00 (3)
Ni3^{iv}—Dy1—Ni2^{viii}	91.97 (6)	Ni3^{iv}—Ni2—Dy1^{xxii}	119.08 (3)
Ni3^{v}—Dy1—Ni2^{viii}	48.75 (8)	Ni3^{iii}—Ni2—Dy1^{xxii}	60.92 (3)
Ni3^{vi}—Dy1—Ni2^{viii}	136.72 (9)	Ni2^{xiv}—Ni2—Dy1^{xxii}	66.348 (8)
Ni2^{vii}—Dy1—Ni2^{viii}	47.304 (17)	Ni2^{viii}—Ni2—Dy1^{xxii}	113.652 (8)
Ni4^{i}—Dy1—Ni2^{ix}	91.79 (5)	Ni2^{x}—Ni2—Dy1^{xxii}	113.652 (8)
Ni4^{ii}—Dy1—Ni2^{ix}	48.50 (7)	Ni2^{xix}—Ni2—Dy1^{xxii}	66.348 (8)
Ni4^{iii}—Dy1—Ni2^{ix}	136.49 (8)	Dy1^{xx}—Ni2—Dy1^{xxii}	73.29 (5)
Ni3^{iv}—Dy1—Ni2^{ix}	136.72 (9)	Dy1^{xxi}—Ni2—Dy1^{xxii}	106.71 (5)
Ni3^{v}—Dy1—Ni2^{ix}	91.97 (6)	Dy1—Ni2—Dy1^{xxii}	180.00 (5)
Ni3^{vi}—Dy1—Ni2^{ix}	48.75 (8)	Ni1^{iv}—Ni3—Ni1^{xvi}	61.02 (15)
Ni2^{vii}—Dy1—Ni2^{ix}	47.304 (17)	Ni1^{iv}—Ni3—Ni1^{xv}	61.02 (15)
Ni2^{viii}—Dy1—Ni2^{ix}	88.03 (4)	Ni1^{xvi}—Ni3—Ni1^{xv}	61.02 (15)
Ni4^{i}—Dy1—Ni2^{x}	48.50 (7)	Ni1^{iv}—Ni3—Ni2^{xxiii}	108.64 (7)
Ni4^{ii}—Dy1—Ni2^{x}	136.49 (8)	Ni1^{xvi}—Ni3—Ni2^{xxiii}	146.09 (3)
Ni4^{iii}—Dy1—Ni2^{x}	91.79 (5)	Ni1^{xv}—Ni3—Ni2^{xxiii}	146.09 (3)
Ni3^{iv}—Dy1—Ni2^{x}	48.75 (8)	Ni1^{iv}—Ni3—Ni2^{xxiv}	146.09 (3)
Ni3^{v}—Dy1—Ni2^{x}	136.72 (9)	Ni1^{xvi}—Ni3—Ni2^{xxiv}	146.09 (3)
Ni3^{vi}—Dy1—Ni2^{x}	91.97 (6)	Ni1^{xv}—Ni3—Ni2^{xxiv}	108.64 (7)
Ni2^{vii}—Dy1—Ni2^{x}	106.71 (5)	Ni2^{xxiii}—Ni3—Ni2^{xxiv}	60.33 (11)
Ni2^{viii}—Dy1—Ni2^{x}	88.03 (4)	Ni1^{iv}—Ni3—Ni2^{xxv}	146.09 (3)
Ni2^{ix}—Dy1—Ni2^{x}	88.03 (4)	Ni1^{xvi}—Ni3—Ni2^{xxv}	108.64 (7)
Ni4^{i}—Dy1—Ni2	91.79 (5)	Ni1^{xv}—Ni3—Ni2^{xxv}	146.09 (3)
Ni4^{ii}—Dy1—Ni2	136.49 (8)	Ni2^{xxiii}—Ni3—Ni2^{xxv}	60.33 (11)
Ni4^{iii}—Dy1—Ni2	48.50 (7)	Ni2^{xxiv}—Ni3—Ni2^{xxv}	60.33 (11)
Ni3^{iv}—Dy1—Ni2	48.75 (8)	Ni1^{iv}—Ni3—Ni4^{xxvi}	107.29 (14)
Ni3^{v}—Dy1—Ni2	91.97 (6)	Ni1^{xvi}—Ni3—Ni4^{xxvi}	107.29 (14)
Ni3^{vi}—Dy1—Ni2	136.72 (9)	Ni1^{xv}—Ni3—Ni4^{xxvi}	54.40 (11)
Ni2^{vii}—Dy1—Ni2	88.03 (4)	Ni2^{xxiii}—Ni3—Ni4^{xxvi}	106.62 (14)
Ni2^{viii}—Dy1—Ni2	47.304 (17)	Ni2^{xxiv}—Ni3—Ni4^{xxvi}	54.24 (9)
Ni2^{ix}—Dy1—Ni2	106.71 (5)	Ni2^{xxv}—Ni3—Ni4^{xxvi}	106.62 (14)
Ni2^{x}—Dy1—Ni2	47.304 (17)	Ni1^{iv}—Ni3—Ni4^{xxvii}	107.29 (14)
Ni4^{i}—Dy1—Ni2^{xi}	48.50 (7)	Ni1^{xvi}—Ni3—Ni4^{xxvii}	54.40 (11)
Ni4^{ii}—Dy1—Ni2^{xi}	91.79 (5)	Ni1^{xv}—Ni3—Ni4^{xxvii}	107.29 (14)
Ni4^{iii}—Dy1—Ni2^{xi}	136.49 (8)	Ni2^{xxiii}—Ni3—Ni4^{xxvii}	106.62 (14)
Ni3^{iv}—Dy1—Ni2^{xi}	91.97 (6)	Ni2^{xxiv}—Ni3—Ni4^{xxvii}	106.62 (14)
Ni3^{v}—Dy1—Ni2^{xi}	136.72 (9)	Ni2^{xxv}—Ni3—Ni4^{xxvii}	54.24 (9)
Ni3^{vi}—Dy1—Ni2^{xi}	48.75 (8)	Ni4^{xxvi}—Ni3—Ni4^{xxvii}	119.998 (3)
Ni2^{vii}—Dy1—Ni2^{xi}	88.03 (4)	Ni1^{iv}—Ni3—Ni4^{xxviii}	54.40 (11)
Ni2^{viii}—Dy1—Ni2^{xi}	106.71 (5)	Ni1^{xvi}—Ni3—Ni4^{xxviii}	107.29 (14)
Ni2^{ix}—Dy1—Ni2^{xi}	47.304 (17)	Ni1^{xv}—Ni3—Ni4^{xxviii}	107.29 (14)
Ni2^{x}—Dy1—Ni2^{xi}	47.304 (17)	Ni2^{xxiii}—Ni3—Ni4^{xxviii}	54.24 (9)
Ni2—Dy1—Ni2^{xi}	88.03 (4)	Ni2^{xxiv}—Ni3—Ni4^{xxviii}	106.62 (14)
Ni1^{xii}—Dy2—Ni1^{xi}	52.03 (11)	Ni2^{xxv}—Ni3—Ni4^{xxviii}	106.62 (14)
Ni1^{xii}—Dy2—Ni1^{vii}	51.67 (11)	Ni4^{xxvi}—Ni3—Ni4^{xxviii}	119.997 (3)
Ni1^{xi}—Dy2—Ni1^{vii}	98.44 (6)	Ni4^{xxvii}—Ni3—Ni4^{xxviii}	119.997 (3)
Ni1^{xii}—Dy2—Ni1	121.94 (10)	Ni1^{iv}—Ni3—Dy1^{iv}	75.76 (7)
Ni1^{xi}—Dy2—Ni1	98.44 (6)	Ni1^{xvi}—Ni3—Dy1^{iv}	129.19 (18)
Ni1^{vii}—Dy2—Ni1	98.44 (6)	Ni1^{xv}—Ni3—Dy1^{iv}	75.76 (7)

Ni1^{xii}—Dy2—Ni1^{xiii}	98.44 (6)
Ni1^{xi}—Dy2—Ni1^{xiii}	51.67 (11)
Ni1^{vii}—Dy2—Ni1^{xiii}	121.94 (10)
Ni1—Dy2—Ni1^{xiii}	52.03 (11)
Ni1^{xii}—Dy2—Ni1^{xiv}	98.44 (6)
Ni1^{xi}—Dy2—Ni1^{xiv}	121.94 (10)
Ni1^{vii}—Dy2—Ni1^{xiv}	52.03 (11)
Ni1—Dy2—Ni1^{xiv}	51.67 (11)
Ni1^{xiii}—Dy2—Ni1^{xiv}	98.44 (6)
Ni1^{xii}—Dy2—Ni5^{i}	148.28 (6)
Ni1^{xi}—Dy2—Ni5^{i}	96.44 (6)
Ni1^{vii}—Dy2—Ni5^{i}	148.28 (6)
Ni1—Dy2—Ni5^{i}	51.56 (5)
Ni1^{xiii}—Dy2—Ni5^{i}	51.56 (5)
Ni1^{xiv}—Dy2—Ni5^{i}	96.44 (6)
Ni1^{xii}—Dy2—Ni5^{ii}	51.56 (5)
Ni1^{xi}—Dy2—Ni5^{ii}	51.56 (5)
Ni1^{vii}—Dy2—Ni5^{ii}	96.44 (6)
Ni1—Dy2—Ni5^{ii}	148.28 (6)
Ni1^{xiii}—Dy2—Ni5^{ii}	96.44 (6)
Ni1^{xiv}—Dy2—Ni5^{ii}	148.28 (6)
Ni5^{i}—Dy2—Ni5^{ii}	114.68 (3)
Ni1^{xii}—Dy2—Ni5^{iii}	96.44 (6)
Ni1^{xi}—Dy2—Ni5^{iii}	148.28 (6)
Ni1^{vii}—Dy2—Ni5^{iii}	51.56 (5)
Ni1—Dy2—Ni5^{iii}	96.44 (6)
Ni1^{xiii}—Dy2—Ni5^{iii}	148.28 (6)
Ni1^{xiv}—Dy2—Ni5^{iii}	51.56 (5)
Ni5^{i}—Dy2—Ni5^{iii}	114.68 (3)
Ni5^{ii}—Dy2—Ni5^{iii}	114.68 (3)
Ni1^{xii}—Dy2—Ni1^{iv}	115.48 (5)
Ni1^{xi}—Dy2—Ni1^{iv}	141.21 (5)
Ni1^{vii}—Dy2—Ni1^{iv}	94.77 (8)
Ni1—Dy2—Ni1^{iv}	115.48 (5)
Ni1^{xiii}—Dy2—Ni1^{iv}	141.21 (5)
Ni1^{xiv}—Dy2—Ni1^{iv}	94.77 (8)
Ni5^{i}—Dy2—Ni1^{iv}	90.88 (5)
Ni5^{ii}—Dy2—Ni1^{iv}	90.88 (5)
Ni5^{iii}—Dy2—Ni1^{iv}	49.08 (5)
Ni1^{xii}—Dy2—Ni1^{xv}	141.21 (5)
Ni1^{xi}—Dy2—Ni1^{xv}	115.48 (5)
Ni1^{vii}—Dy2—Ni1^{xv}	141.21 (5)
Ni1—Dy2—Ni1^{xv}	94.77 (8)
Ni1^{xiii}—Dy2—Ni1^{xv}	94.77 (8)
Ni1^{xiv}—Dy2—Ni1^{xv}	115.48 (5)
Ni5^{i}—Dy2—Ni1^{xv}	49.08 (5)
Ni5^{ii}—Dy2—Ni1^{xv}	90.88 (5)
Ni5^{iii}—Dy2—Ni1^{xv}	90.88 (5)
Ni1^{iv}—Dy2—Ni1^{xv}	46.92 (9)
Ni2^{xxiii}—Ni3—Dy1^{iv}	70.34 (6)
Ni2^{xxiv}—Ni3—Dy1^{iv}	70.34 (6)
Ni2^{xxv}—Ni3—Dy1^{iv}	122.17 (17)
Ni4^{xxvi}—Ni3—Dy1^{iv}	60.035 (7)
Ni4^{xxvii}—Ni3—Dy1^{iv}	176.4 (2)
Ni4^{xxviii}—Ni3—Dy1^{iv}	60.036 (7)
Ni1^{iv}—Ni3—Dy1^{v}	75.76 (7)
Ni1^{xvi}—Ni3—Dy1^{v}	75.76 (7)
Ni1^{xv}—Ni3—Dy1^{v}	129.19 (18)
Ni2^{xxiii}—Ni3—Dy1^{v}	70.34 (6)
Ni2^{xxiv}—Ni3—Dy1^{v}	122.17 (17)
Ni2^{xxv}—Ni3—Dy1^{v}	70.34 (6)
Ni4^{xxvi}—Ni3—Dy1^{v}	176.4 (2)
Ni4^{xxvii}—Ni3—Dy1^{v}	60.035 (7)
Ni4^{xxviii}—Ni3—Dy1^{v}	60.036 (7)
Dy1^{iv}—Ni3—Dy1^{v}	119.67 (2)
Ni1^{iv}—Ni3—Dy1^{vi}	129.19 (18)
Ni1^{xvi}—Ni3—Dy1^{vi}	75.76 (7)
Ni1^{xv}—Ni3—Dy1^{vi}	75.76 (7)
Ni2^{xxiii}—Ni3—Dy1^{vi}	122.17 (17)
Ni2^{xxiv}—Ni3—Dy1^{vi}	70.34 (6)
Ni2^{xxv}—Ni3—Dy1^{vi}	70.34 (6)
Ni4^{xxvi}—Ni3—Dy1^{vi}	60.036 (7)
Ni4^{xxvii}—Ni3—Dy1^{vi}	60.036 (7)
Ni4^{xxviii}—Ni3—Dy1^{vi}	176.4 (2)
Dy1^{iv}—Ni3—Dy1^{vi}	119.67 (2)
Dy1^{v}—Ni3—Dy1^{vi}	119.67 (2)
Ni1^{xxix}—Ni4—Ni1^{xxx}	60.97 (14)
Ni1^{xxix}—Ni4—Ni1^{xxxi}	60.97 (14)
Ni1^{xxx}—Ni4—Ni1^{xxxi}	60.97 (14)
Ni1^{xxix}—Ni4—Ni2^{xxiii}	108.47 (6)
Ni1^{xxx}—Ni4—Ni2^{xxiii}	146.02 (3)
Ni1^{xxxi}—Ni4—Ni2^{xxiii}	146.02 (3)
Ni1^{xxix}—Ni4—Ni2^{xxv}	146.02 (3)
Ni1^{xxx}—Ni4—Ni2^{xxv}	146.02 (3)
Ni1^{xxxi}—Ni4—Ni2^{xxv}	108.47 (7)
Ni2^{xxiii}—Ni4—Ni2^{xxv}	60.66 (9)
Ni1^{xxix}—Ni4—Ni2^{xxiv}	146.02 (3)
Ni1^{xxx}—Ni4—Ni2^{xxiv}	108.47 (7)
Ni1^{xxxi}—Ni4—Ni2^{xxiv}	146.02 (3)
Ni2^{xxiii}—Ni4—Ni2^{xxiv}	60.66 (9)
Ni2^{xxv}—Ni4—Ni2^{xxiv}	60.66 (9)
Ni1^{xxix}—Ni4—Ni3^{xxvi}	106.79 (14)
Ni1^{xxx}—Ni4—Ni3^{xxvi}	53.85 (12)
Ni1^{xxxi}—Ni4—Ni3^{xxvi}	106.79 (14)
Ni2^{xxiii}—Ni4—Ni3^{xxvi}	107.19 (13)
Ni2^{xxv}—Ni4—Ni3^{xxvi}	107.20 (13)
Ni2^{xxiv}—Ni4—Ni3^{xxvi}	54.62 (10)
Ni1^{xxix}—Ni4—Ni3^{xxvii}	106.79 (14)

Ni1^{xii}—Dy2—Ni1^{xvi}	94.77 (8)	Ni1^{xxx}—Ni4—Ni3^{xxvii}	106.79 (14)
Ni1^{xi}—Dy2—Ni1^{xvi}	94.77 (8)	Ni1^{xxxi}—Ni4—Ni3^{xxvii}	53.85 (12)
Ni1^{vii}—Dy2—Ni1^{xvi}	115.48 (5)	Ni2^{xxiii}—Ni4—Ni3^{xxvii}	107.19 (13)
Ni1—Dy2—Ni1^{xvi}	141.21 (5)	Ni2^{xxv}—Ni4—Ni3^{xxvii}	54.62 (10)
Ni1^{xiii}—Dy2—Ni1^{xvi}	115.48 (5)	Ni2^{xxiv}—Ni4—Ni3^{xxvii}	107.20 (13)
Ni1^{xiv}—Dy2—Ni1^{xvi}	141.21 (5)	Ni3^{xxvi}—Ni4—Ni3^{xxvii}	119.998 (3)
Ni5^{i}—Dy2—Ni1^{xvi}	90.88 (5)	Ni1^{xxix}—Ni4—Ni3^{xxviii}	53.85 (12)
Ni5^{ii}—Dy2—Ni1^{xvi}	49.08 (5)	Ni1^{xxx}—Ni4—Ni3^{xxviii}	106.79 (14)
Ni5^{iii}—Dy2—Ni1^{xvi}	90.88 (5)	Ni1^{xxxi}—Ni4—Ni3^{xxviii}	106.79 (14)
Ni1^{iv}—Dy2—Ni1^{xvi}	46.92 (9)	Ni2^{xxiii}—Ni4—Ni3^{xxviii}	54.62 (10)
Ni1^{xv}—Dy2—Ni1^{xvi}	46.92 (9)	Ni2^{xxv}—Ni4—Ni3^{xxviii}	107.20 (13)
Ni3^{iv}—Ni1—Ni4^{i}	71.75 (10)	Ni2^{xxiv}—Ni4—Ni3^{xxviii}	107.20 (13)
Ni3^{iv}—Ni1—Ni1^{x}	59.49 (7)	Ni3^{xxvi}—Ni4—Ni3^{xxviii}	119.997 (3)
Ni4^{i}—Ni1—Ni1^{x}	120.49 (7)	Ni3^{xxvii}—Ni4—Ni3^{xxviii}	119.997 (3)
Ni3^{iv}—Ni1—Ni1^{xiv}	59.49 (7)	Ni1^{xxix}—Ni4—Dy1^{xxix}	75.52 (6)
Ni4^{i}—Ni1—Ni1^{xiv}	120.49 (7)	Ni1^{xxx}—Ni4—Dy1^{xxix}	128.87 (16)
Ni1^{x}—Ni1—Ni1^{xiv}	60.0	Ni1^{xxxi}—Ni4—Dy1^{xxix}	75.52 (6)
Ni3^{iv}—Ni1—Ni1^{xiii}	120.51 (7)	Ni2^{xxiii}—Ni4—Dy1^{xxix}	70.51 (6)
Ni4^{i}—Ni1—Ni1^{xiii}	59.51 (7)	Ni2^{xxv}—Ni4—Dy1^{xxix}	70.51 (6)
Ni1^{x}—Ni1—Ni1^{xiii}	180.00 (13)	Ni2^{xxiv}—Ni4—Dy1^{xxix}	122.66 (14)
Ni1^{xiv}—Ni1—Ni1^{xiii}	120.000 (1)	Ni3^{xxvi}—Ni4—Dy1^{xxix}	177.3 (2)
Ni3^{iv}—Ni1—Ni1^{xvii}	120.51 (7)	Ni3^{xxvii}—Ni4—Dy1^{xxix}	60.063 (7)
Ni4^{i}—Ni1—Ni1^{xvii}	59.51 (7)	Ni3^{xxviii}—Ni4—Dy1^{xxix}	60.064 (7)
Ni1^{x}—Ni1—Ni1^{xvii}	120.000 (1)	Ni1^{xxix}—Ni4—Dy1^{xxxii}	75.52 (6)
Ni1^{xiv}—Ni1—Ni1^{xvii}	180.00 (13)	Ni1^{xxx}—Ni4—Dy1^{xxxii}	75.52 (6)
Ni1^{xiii}—Ni1—Ni1^{xvii}	60.000 (1)	Ni1^{xxxi}—Ni4—Dy1^{xxxii}	128.87 (16)
Ni3^{iv}—Ni1—Ni5^{i}	178.91 (14)	Ni2^{xxiii}—Ni4—Dy1^{xxxii}	70.51 (6)
Ni4^{i}—Ni1—Ni5^{i}	109.34 (12)	Ni2^{xxv}—Ni4—Dy1^{xxxii}	122.66 (14)
Ni1^{x}—Ni1—Ni5^{i}	119.62 (5)	Ni2^{xxiv}—Ni4—Dy1^{xxxii}	70.51 (6)
Ni1^{xiv}—Ni1—Ni5^{i}	119.62 (5)	Ni3^{xxvi}—Ni4—Dy1^{xxxii}	60.063 (7)
Ni1^{xiii}—Ni1—Ni5^{i}	60.38 (5)	Ni3^{xxvii}—Ni4—Dy1^{xxxii}	177.3 (2)
Ni1^{xvii}—Ni1—Ni5^{i}	60.38 (5)	Ni3^{xxviii}—Ni4—Dy1^{xxxii}	60.064 (7)
Ni3^{iv}—Ni1—Dy2^{xviii}	113.21 (6)	Dy1^{xxix}—Ni4—Dy1^{xxxii}	119.728 (17)
Ni4^{i}—Ni1—Dy2^{xviii}	113.10 (7)	Ni1^{xxix}—Ni4—Dy1^{xxiv}	128.86 (16)
Ni1^{x}—Ni1—Dy2^{xviii}	64.16 (6)	Ni1^{xxx}—Ni4—Dy1^{xxiv}	75.52 (6)
Ni1^{xiv}—Ni1—Dy2^{xviii}	116.01 (6)	Ni1^{xxxi}—Ni4—Dy1^{xxiv}	75.52 (6)
Ni1^{xiii}—Ni1—Dy2^{xviii}	115.84 (5)	Ni2^{xxiii}—Ni4—Dy1^{xxiv}	122.66 (14)
Ni1^{xvii}—Ni1—Dy2^{xviii}	63.99 (6)	Ni2^{xxv}—Ni4—Dy1^{xxiv}	70.50 (6)
Ni5^{i}—Ni1—Dy2^{xviii}	66.46 (5)	Ni2^{xxiv}—Ni4—Dy1^{xxiv}	70.50 (6)
Ni3^{iv}—Ni1—Dy2	113.21 (6)	Ni3^{xxvi}—Ni4—Dy1^{xxiv}	60.064 (7)
Ni4^{i}—Ni1—Dy2	113.10 (7)	Ni3^{xxvii}—Ni4—Dy1^{xxiv}	60.064 (7)
Ni1^{x}—Ni1—Dy2	116.01 (6)	Ni3^{xxviii}—Ni4—Dy1^{xxiv}	177.3 (2)
Ni1^{xiv}—Ni1—Dy2	64.16 (6)	Dy1^{xxix}—Ni4—Dy1^{xxiv}	119.727 (17)
Ni1^{xiii}—Ni1—Dy2	63.99 (6)	Dy1^{xxxii}—Ni4—Dy1^{xxiv}	119.727 (17)
Ni1^{xvii}—Ni1—Dy2	115.84 (5)	Ni1^{xxvi}—Ni5—Ni1^{xxix}	180.00 (6)
Ni5^{i}—Ni1—Dy2	66.46 (5)	Ni1^{xxvi}—Ni5—Ni1^{xxxiii}	59.24 (10)
Dy2^{xviii}—Ni1—Dy2	121.94 (10)	Ni1^{xxix}—Ni5—Ni1^{xxxiii}	120.76 (10)
Ni3^{iv}—Ni1—Dy2^{iv}	116.74 (12)	Ni1^{xxvi}—Ni5—Ni1^{xxxi}	120.76 (10)
Ni4^{i}—Ni1—Dy2^{iv}	171.51 (13)	Ni1^{xxix}—Ni5—Ni1^{xxxi}	59.24 (10)

Ni1^{x}—Ni1—Dy2^{iv}	66.54 (4)
Ni1^{xiv}—Ni1—Dy2^{iv}	66.54 (4)
Ni1^{xiii}—Ni1—Dy2^{iv}	113.46 (4)
Ni1^{xvii}—Ni1—Dy2^{iv}	113.46 (4)
Ni5^{i}—Ni1—Dy2^{iv}	62.17 (6)
Dy2^{xviii}—Ni1—Dy2^{iv}	64.52 (5)
Dy2—Ni1—Dy2^{iv}	64.52 (5)
Ni3^{iv}—Ni1—Dy1	58.12 (5)
Ni4^{i}—Ni1—Dy1	58.00 (5)
Ni1^{x}—Ni1—Dy1	112.33 (5)
Ni1^{xiv}—Ni1—Dy1	67.82 (5)
Ni1^{xiii}—Ni1—Dy1	67.67 (5)
Ni1^{xvii}—Ni1—Dy1	112.18 (5)
Ni5^{i}—Ni1—Dy1	122.36 (6)
Dy2^{xviii}—Ni1—Dy1	168.27 (8)
Dy2—Ni1—Dy1	69.79 (4)
Dy2^{iv}—Ni1—Dy1	125.48 (5)
Ni3^{iv}—Ni1—Dy1^{xviii}	58.12 (5)
Ni4^{i}—Ni1—Dy1^{xviii}	58.00 (5)
Ni1^{x}—Ni1—Dy1^{xviii}	67.82 (5)
Ni1^{xiv}—Ni1—Dy1^{xviii}	112.33 (5)
Ni1^{xiii}—Ni1—Dy1^{xviii}	112.18 (5)
Ni1^{xvii}—Ni1—Dy1^{xviii}	67.67 (5)
Ni5^{i}—Ni1—Dy1^{xviii}	122.36 (6)
Dy2^{xviii}—Ni1—Dy1^{xviii}	69.79 (4)
Dy2—Ni1—Dy1^{xviii}	168.27 (8)
Dy2^{iv}—Ni1—Dy1^{xviii}	125.48 (5)
Dy1—Ni1—Dy1^{xviii}	98.49 (8)
Ni4^{iv}—Ni2—Ni4^{iii}	180.00 (11)
Ni4^{iv}—Ni2—Ni3^{iv}	108.86 (8)
Ni4^{iii}—Ni2—Ni3^{iv}	71.14 (8)
Ni4^{iv}—Ni2—Ni3^{iii}	71.14 (8)
Ni4^{iii}—Ni2—Ni3^{iii}	108.86 (8)
Ni3^{iv}—Ni2—Ni3^{iii}	180.00 (13)
Ni4^{iv}—Ni2—Ni2^{xiv}	59.67 (5)
Ni4^{iii}—Ni2—Ni2^{xiv}	120.33 (5)
Ni3^{iv}—Ni2—Ni2^{xiv}	59.83 (5)
Ni3^{iii}—Ni2—Ni2^{xiv}	120.17 (5)
Ni4^{iv}—Ni2—Ni2^{viii}	120.33 (5)
Ni4^{iii}—Ni2—Ni2^{viii}	59.67 (5)
Ni3^{iv}—Ni2—Ni2^{viii}	120.17 (5)
Ni3^{iii}—Ni2—Ni2^{viii}	59.83 (5)
Ni2^{xiv}—Ni2—Ni2^{viii}	180.0
Ni4^{iv}—Ni2—Ni2^{x}	59.67 (5)
Ni4^{iii}—Ni2—Ni2^{x}	120.33 (5)
Ni3^{iv}—Ni2—Ni2^{x}	59.83 (5)
Ni3^{iii}—Ni2—Ni2^{x}	120.17 (5)
Ni2^{xiv}—Ni2—Ni2^{x}	60.0
Ni2^{viii}—Ni2—Ni2^{x}	120.0
Ni1^{xxxiii}—Ni5—Ni1^{xxxi}	180.000 (1)
Ni1^{xxvi}—Ni5—Ni1^{xxxiv}	59.24 (10)
Ni1^{xxix}—Ni5—Ni1^{xxxiv}	120.76 (10)
Ni1^{xxxiii}—Ni5—Ni1^{xxxiv}	59.24 (10)
Ni1^{xxxi}—Ni5—Ni1^{xxxiv}	120.76 (11)
Ni1^{xxvi}—Ni5—Ni1^{xxx}	120.76 (10)
Ni1^{xxix}—Ni5—Ni1^{xxx}	59.24 (10)
Ni1^{xxxiii}—Ni5—Ni1^{xxx}	120.76 (11)
Ni1^{xxxi}—Ni5—Ni1^{xxx}	59.24 (10)
Ni1^{xxxiv}—Ni5—Ni1^{xxx}	180.000 (1)
Ni1^{xxvi}—Ni5—Dy2^{xxvi}	61.98 (3)
Ni1^{xxix}—Ni5—Dy2^{xxvi}	118.02 (3)
Ni1^{xxxiii}—Ni5—Dy2^{xxvi}	61.98 (3)
Ni1^{xxxi}—Ni5—Dy2^{xxvi}	118.02 (3)
Ni1^{xxxiv}—Ni5—Dy2^{xxvi}	111.25 (7)
Ni1^{xxx}—Ni5—Dy2^{xxvi}	68.75 (7)
Ni1^{xxvi}—Ni5—Dy2^{xxix}	118.02 (3)
Ni1^{xxix}—Ni5—Dy2^{xxix}	61.98 (3)
Ni1^{xxxiii}—Ni5—Dy2^{xxix}	118.03 (3)
Ni1^{xxxi}—Ni5—Dy2^{xxix}	61.97 (3)
Ni1^{xxxiv}—Ni5—Dy2^{xxix}	68.75 (7)
Ni1^{xxx}—Ni5—Dy2^{xxix}	111.25 (7)
Dy2^{xxvi}—Ni5—Dy2^{xxix}	180.0
Ni1^{xxvi}—Ni5—Dy2^{xxvii}	61.98 (3)
Ni1^{xxix}—Ni5—Dy2^{xxvii}	118.02 (3)
Ni1^{xxxiii}—Ni5—Dy2^{xxvii}	111.25 (7)
Ni1^{xxxi}—Ni5—Dy2^{xxvii}	68.75 (7)
Ni1^{xxxiv}—Ni5—Dy2^{xxvii}	61.98 (3)
Ni1^{xxx}—Ni5—Dy2^{xxvii}	118.02 (3)
Dy2^{xxvi}—Ni5—Dy2^{xxvii}	114.68 (3)
Dy2^{xxix}—Ni5—Dy2^{xxvii}	65.32 (3)
Ni1^{xxvi}—Ni5—Dy2^{xxxii}	118.02 (3)
Ni1^{xxix}—Ni5—Dy2^{xxxii}	61.98 (3)
Ni1^{xxxiii}—Ni5—Dy2^{xxxii}	68.75 (7)
Ni1^{xxxi}—Ni5—Dy2^{xxxii}	111.25 (7)
Ni1^{xxxiv}—Ni5—Dy2^{xxxii}	118.03 (3)
Ni1^{xxx}—Ni5—Dy2^{xxxii}	61.97 (3)
Dy2^{xxvi}—Ni5—Dy2^{xxxii}	65.32 (3)
Dy2^{xxix}—Ni5—Dy2^{xxxii}	114.68 (3)
Dy2^{xxvii}—Ni5—Dy2^{xxxii}	180.00 (7)
Ni1^{xxvi}—Ni5—Dy2^{xxviii}	111.24 (7)
Ni1^{xxix}—Ni5—Dy2^{xxviii}	68.76 (7)
Ni1^{xxxiii}—Ni5—Dy2^{xxviii}	61.97 (3)
Ni1^{xxxi}—Ni5—Dy2^{xxviii}	118.03 (3)
Ni1^{xxxiv}—Ni5—Dy2^{xxviii}	61.97 (3)
Ni1^{xxx}—Ni5—Dy2^{xxviii}	118.03 (3)
Dy2^{xxvi}—Ni5—Dy2^{xxviii}	114.68 (3)
Dy2^{xxix}—Ni5—Dy2^{xxviii}	65.32 (3)
Dy2^{xxvii}—Ni5—Dy2^{xxviii}	114.68 (3)

Ni4^{iv}—Ni2—Ni2^{xix}	120.33 (5)	Dy2^{xxxii}—Ni5—Dy2^{xxviii}	65.32 (3)
Ni4^{iii}—Ni2—Ni2^{xix}	59.67 (5)	Ni1^{xxvi}—Ni5—Dy2^{xxiv}	68.76 (7)
Ni3^{iv}—Ni2—Ni2^{xix}	120.17 (5)	Ni1^{xxix}—Ni5—Dy2^{xxiv}	111.24 (7)
Ni3^{iii}—Ni2—Ni2^{xix}	59.83 (5)	Ni1^{xxxiii}—Ni5—Dy2^{xxiv}	118.03 (3)
Ni2^{xiv}—Ni2—Ni2^{xix}	120.0	Ni1^{xxxi}—Ni5—Dy2^{xxiv}	61.97 (3)
Ni2^{viii}—Ni2—Ni2^{xix}	60.0	Ni1^{xxxiv}—Ni5—Dy2^{xxiv}	118.03 (3)
Ni2^{x}—Ni2—Ni2^{xix}	180.0	Ni1^{xxx}—Ni5—Dy2^{xxiv}	61.97 (3)
Ni4^{iv}—Ni2—Dy1^{xx}	119.00 (3)	Dy2^{xxvi}—Ni5—Dy2^{xxiv}	65.32 (3)
Ni4^{iii}—Ni2—Dy1^{xx}	61.00 (3)	Dy2^{xxix}—Ni5—Dy2^{xxiv}	114.68 (3)
Ni3^{iv}—Ni2—Dy1^{xx}	60.92 (3)	Dy2^{xxvii}—Ni5—Dy2^{xxiv}	65.32 (3)
Ni3^{iii}—Ni2—Dy1^{xx}	119.08 (3)	Dy2^{xxxii}—Ni5—Dy2^{xxiv}	114.68 (3)
Ni2^{xiv}—Ni2—Dy1^{xx}	66.348 (8)	Dy2^{xxviii}—Ni5—Dy2^{xxiv}	180.00 (7)

Symmetry codes: (i) *x*+1/3, *y*+2/3, *z*−1/3; (ii) *x*−2/3, *y*−1/3, *z*−1/3; (iii) *x*+1/3, *y*−1/3, *z*−1/3; (iv) −*x*+2/3, −*y*+1/3, −*z*+1/3; (v) −*x*−1/3, −*y*−2/3, −*z*+1/3; (vi) −*x*−1/3, −*y*+1/3, −*z*+1/3; (vii) −*x*+*y*, −*x*, *z*; (viii) −*y*, *x*−*y*−1, *z*; (ix) *x*−1, *y*, *z*; (x) −*x*+*y*+1, −*x*+1, *z*; (xi) −*y*, *x*−*y*, *z*; (xii) *x*−1, *y*−1, *z*; (xiii) −*x*+*y*, −*x*+1, *z*; (xiv) −*y*+1, *x*−*y*, *z*; (xv) *y*−1/3, −*x*+*y*+1/3, −*z*+1/3; (xvi) *x*−*y*−1/3, *x*−2/3, −*z*+1/3; (xvii) −*y*+1, *x*−*y*+1, *z*; (xviii) *x*+1, *y*+1, *z*; (xix) −*x*+*y*+1, −*x*, *z*; (xx) *x*+1, *y*, *z*; (xxi) −*x*, −*y*, −*z*; (xxii) −*x*+1, −*y*, −*z*; (xxiii) −*x*+*y*+2/3, −*x*+1/3, *z*+1/3; (xxiv) *x*−1/3, *y*+1/3, *z*+1/3; (xxv) −*y*−1/3, *x*−*y*−2/3, *z*+1/3; (xxvi) −*x*+1/3, −*y*+2/3, −*z*+2/3; (xxvii) −*x*−2/3, −*y*−1/3, −*z*+2/3; (xxviii) −*x*+1/3, −*y*−1/3, −*z*+2/3; (xxix) *x*−1/3, *y*−2/3, *z*+1/3; (xxx) −*y*+2/3, *x*−*y*+1/3, *z*+1/3; (xxxi) −*x*+*y*−1/3, −*x*+1/3, *z*+1/3; (xxxii) *x*+2/3, *y*+1/3, *z*+1/3; (xxxiii) *x*−*y*+1/3, *x*−1/3, −*z*+2/3; (xxxiv) *y*−2/3, −*x*+*y*−1/3, −*z*+2/3.