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# Poly[tetrakis($\mu_4$-4,6-dimethyl-5-nitrobenzene-1,3-dicarboxylato-$\kappa^2O^1:O^{1'}:O^3:O^{3'}$)bis(pyridine-$\kappa N$)dizinc]

**Qing-Yu Ma,* Rui-Fang Guan and Guo-Zhong Li**

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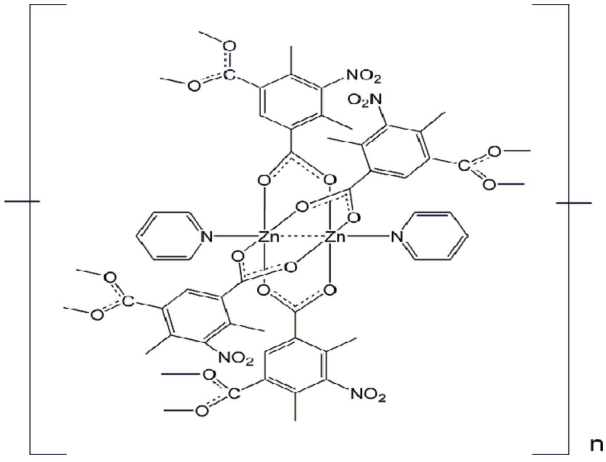
Key indicators: single-crystal X-ray study; $T$ = 298 K; mean $\sigma$(C–C) = 0.004 Å; $R$ factor = 0.033; $wR$ factor = 0.081; data-to-parameter ratio = 16.2.

In the title complex, $[Zn_2(C_{10}H_7NO_6)_2(C_5H_5N)_2]_n$, the repeat unit is a centrosymmetic tetra-carboxylato-$O,O'$-bridged dimer in which each $Zn^{II}$ atom is five-coordinated by four O atoms from different dianionic 4,6-dimethyl-5-nitroisophthalate ligands [Zn—O = 2.0283 (18)–2.0540 (19) Å] and one N atom from a pyridine molecule [Zn—N = 2.030 (2) Å] in the axial site of a slightly distorted square-pyramidal coordination sphere. The Zn···Zn separation is 2.9750 (6) Å. The complex dimers are extended into a two-dimensional polymeric structure parallel to (100) through bridges provided by the second carboxylate group of the ligand.

## Related literature

For the structure of a similar but discrete tetra-carboxylato-bridged $Zn_2$ dimer, see: Yu *et al.* (2011).




## Experimental

### Crystal data

$[Zn(C_{10}H_7NO_6)(C_5H_5N)]$
$M_r$ = 381.64
Monoclinic, $P2_1/c$
$a$ = 10.2947 (9) Å
$b$ = 11.8526 (10) Å
$c$ = 12.8501 (11) Å
$\beta$ = 97.933 (2)°
$V$ = 1553.0 (2) Å$^3$
$Z$ = 4
Mo $K\alpha$ radiation
$\mu$ = 1.62 mm$^{-1}$
$T$ = 298 K
0.12 × 0.10 × 0.08 mm

### Data collection

Bruker APEXII CCD area-detector diffractometer
Absorption correction: multi-scan (*SADABS*; Sheldrick, 1996)
$T_{min}$ = 0.824, $T_{max}$ = 0.879
8899 measured reflections
3525 independent reflections
2750 reflections with $I > 2\sigma(I)$
$R_{int}$ = 0.029

### Refinement

$R[F^2 > 2\sigma(F^2)]$ = 0.033
$wR(F^2)$ = 0.081
$S$ = 1.03
3525 reflections
217 parameters
H-atom parameters constrained
$\Delta\rho_{max}$ = 0.43 e Å$^{-3}$
$\Delta\rho_{min}$ = −0.43 e Å$^{-3}$

Data collection: *APEX2* (Bruker, 2007); cell refinement: *SAINT-Plus* (Bruker, 2007); data reduction: *SAINT-Plus*; 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*.

This work was supported by the Scientific and Technological Project of Shandong Province (2008SGG0809) and Doctoral Foundation of Shandong Province (2009SBS0913).

Supplementary data and figures for this paper are available from the IUCr electronic archives (Reference: ZS2089).

## References

Bruker (2007). *APEX2* and *SAINT-Plus*. Bruker AXS Inc., Madison, Wisconsin, USA.
Sheldrick, G. M. (1996). *SADABS*. University of Göttingen, Germany.
Sheldrick, G. M. (2008). *Acta Cryst.* A**64**, 112–122.
Yu, Z.-Y., Lin, K.-H., Zhang, F.-F., Shao, M. & Li, M. (2011). *Acta Cryst.* E**67**, m206.

# supporting information

*Acta Cryst.* (2011). E**67**, m586 [doi:10.1107/S1600536811013092]

# Poly[tetrakis($\mu_4$-4,6-dimethyl-5-nitrobenzene-1,3-dicarboxylato-$\kappa^2O^1:O^{1'}:O^3:O^{3'}$)bis(pyridine-$\kappa N$)dizinc]

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## S1. Comment

The title complex $[Zn_2(C_{10}H_7NO_6)_2(C_5H_5N)_2]_n$ (I) was obtained by chance when we were attempting to prepare some porous metal-organic framework materials by the reaction of 4,6-dimethyl-5-nitroisophthalic acid with $Zn(NO_3)_2$. In (I), the repeating unit is a centrosymmetic tetra-carboxylato *O,O′* bridged dimer (Fig. 1) in which each $Zn^{II}$ is five-coordinated by four O atoms from different dianionic 4,6-dimethyl-5-nitroisophthalate ligands [Zn—O, 2.0283 (18)–2.0540 (19) Å] and one N atom from a pyridine molecule [Zn—N, 2.030 (2) Å] in the axial site of a slightly distorted square pyramidal coordination sphere. Each of the Zn atoms has an approximately square-pyramidal environment, with four O atoms in a plane and the pyridine N atom at the apical site. The Zn—Zn separation in the dimer is 2.9750 (6) Å. This dimeric unit is similar to that found in the structure of the tetra-benzoato-bridged but discrete $Zn_2$ dimer with 4-(dimethylamino)pyridine (Yu *et al.*, 2011). The complex dimers in (I) are extended into a two-dimensional polymer structure through bridges provided by the second carboxylate group of the ligand (Figs. 2, 3).

## S2. Experimental

4,6-Dimethyl-5-nitroisophthalic acid (2 mg, 0.0046 mmol) and $Zn(NO_3)_2$ (4 mg, 0.0137 mmol) were dissolved in 1 ml of a mixed DMSO–$H_2O$ solvent (2:1) and 2 drops pyridine were added. This solution was sealed in a Pyrex glass tube and heated to 120° C over a period of 10 h, and then maintained at this temperature for 50 h, after which it was cooled to room temperature over 17 h. Colourless rod crystals were obtained, which were filtered, washed with water and dried in air.

## S3. Refinement

All H atoms were placed in calculated positions (C—H = 0.93–0.96 Å) and refined in a riding mode with $U_{iso}$(H) = 1.2$U_{eq}$(C). The methyl H atoms are rotationally disordered over six equal half-occupancy sites.

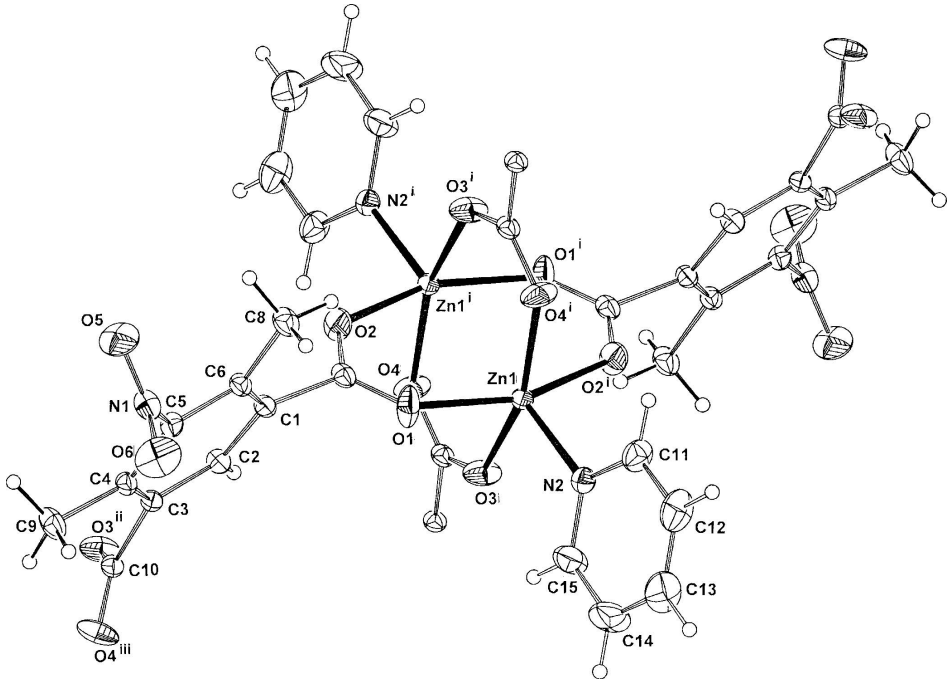


**Figure 1**

The atom numbering scheme for the centrosymmetric dimeric unit in the title compound with displacement ellipsoids drawn at the 30% probability level. Symmetry codes are: (i) -*x*+1, -*y*, -*z* + 1; (ii) -*x* + 1, *y* - 1/2, -*z* - 3/2; (iii) *x*, -*y* + 1/2, *z* + 1/2. The second set of hydrogen atoms on the 50% rotationally-disordered methyl groups (C8 and C9) are omitted.

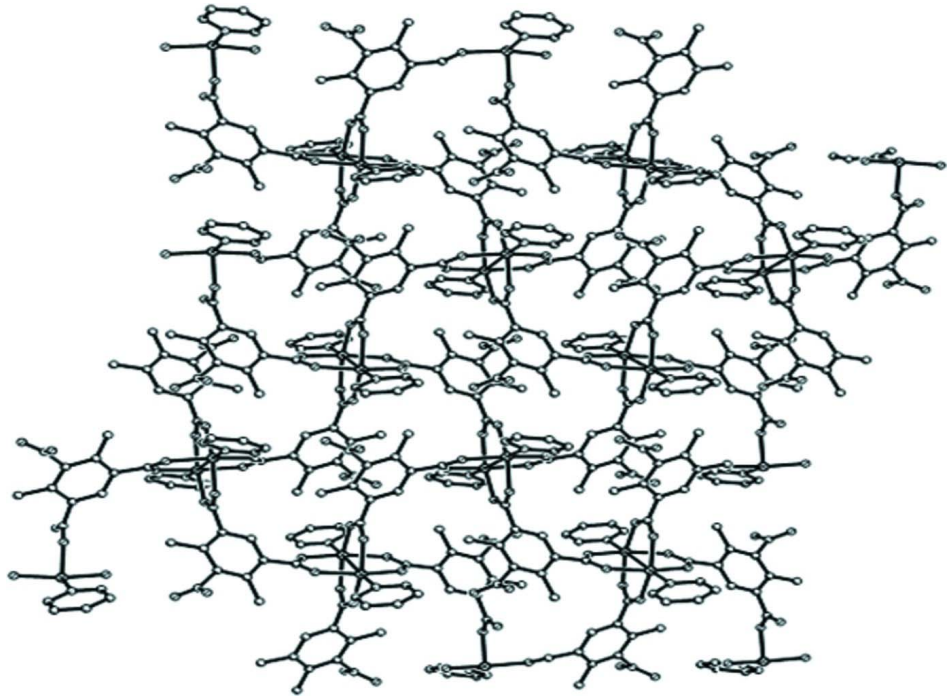

**Figure 2**

The two-dimensional polymeric extension of the title compound viewed down the *a* axial direction.

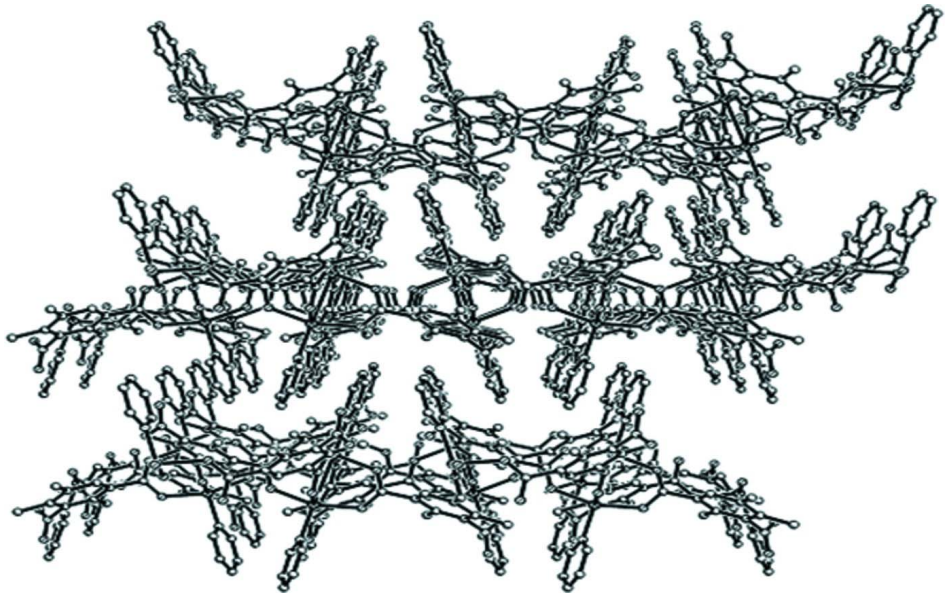

**Figure 3**

The packed structure of the title compound viewed down the *c* axial direction.

**Poly[tetrakis($\mu_4$-4,6-dimethyl-5-nitrobenzene-1,3-dicarboxylato-$\kappa^2O^1$:$O^{1'}$:$O^3$:$O^{3'}$)bis(pyridine-$\kappa N$)dizinc]**

*Crystal data*

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Hall symbol: -P 2ybc
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$c$ = 12.8501 (11) Å
$\beta$ = 97.933 (2)°
$V$ = 1553.0 (2) Å$^3$
$Z$ = 4
$F(000)$ = 776
$D_x$ = 1.632 Mg m$^{-3}$
Mo $K\alpha$ radiation, $\lambda$ = 0.71073 Å
Cell parameters from 2968 reflections
$\theta$ = 2.3–26.1°
$\mu$ = 1.62 mm$^{-1}$
$T$ = 298 K
Rod, colourless
0.12 × 0.10 × 0.08 mm

*Data collection*

Bruker APEXII CCD area-detector diffractometer
Radiation source: fine-focus sealed tube
Graphite monochromator
$\varphi$ and $\omega$ scans
Absorption correction: multi-scan (*SADABS*; Sheldrick, 1996)
$T_{min}$ = 0.824, $T_{max}$ = 0.879
8899 measured reflections
3525 independent reflections
2750 reflections with $I > 2\sigma(I)$
$R_{int}$ = 0.029
$\theta_{max}$ = 27.7°, $\theta_{min}$ = 2.0°
$h$ = −8→13
$k$ = −15→15
$l$ = −16→16

*Refinement*

Refinement on $F^2$
Least-squares matrix: full
$R[F^2 > 2\sigma(F^2)]$ = 0.033
$wR(F^2)$ = 0.081
$S$ = 1.03
3525 reflections
217 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
$w = 1/[\sigma^2(F_o^2) + (0.0353P)^2 + 0.6981P]$ where $P = (F_o^2 + 2F_c^2)/3$

$(\Delta/\sigma)_{max} = 0.001$
$\Delta\rho_{max} = 0.43$ e Å$^{-3}$
$\Delta\rho_{min} = -0.43$ e Å$^{-3}$

*Special details*

**Geometry**. Bond distances, angles etc. have been calculated using the rounded fractional coordinates. All su's are estimated from the variances of the (full) variance-covariance matrix. The cell esds are taken into account in the estimation of distances, angles and torsion angles

**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 (Å²)*

| | *x* | *y* | *z* | $U_{iso}$*/$U_{eq}$ | Occ. (<1) |
|---|---|---|---|---|---|
| Zn1 | 0.63668 (3) | −0.03544 (2) | 0.53898 (2) | 0.0233 (1) | |
| O1 | 0.65410 (19) | 0.13708 (16) | 0.54695 (18) | 0.0546 (8) | |
| O2 | 0.4496 (2) | 0.18909 (15) | 0.49411 (17) | 0.0508 (7) | |
| O3 | 0.55390 (18) | −0.03094 (18) | 0.67374 (14) | 0.0454 (7) | |
| O4 | 0.6491 (2) | −0.02213 (19) | 0.38329 (14) | 0.0499 (7) | |
| O5 | 0.7497 (2) | 0.62087 (19) | 0.42547 (16) | 0.0600 (8) | |
| O6 | 0.9095 (2) | 0.5865 (2) | 0.5453 (2) | 0.0703 (10) | |
| N1 | 0.7959 (2) | 0.57613 (18) | 0.50579 (17) | 0.0352 (7) | |
| N2 | 0.8232 (2) | −0.07998 (17) | 0.59645 (16) | 0.0298 (6) | |
| C1 | 0.5998 (2) | 0.32743 (18) | 0.56737 (17) | 0.0245 (7) | |
| C2 | 0.6751 (2) | 0.39863 (19) | 0.51257 (17) | 0.0253 (7) | |
| C3 | 0.7112 (2) | 0.50127 (19) | 0.56086 (18) | 0.0258 (7) | |
| C4 | 0.6795 (2) | 0.53868 (18) | 0.65714 (17) | 0.0253 (7) | |
| C5 | 0.5997 (2) | 0.46553 (19) | 0.70674 (17) | 0.0235 (6) | |
| C6 | 0.5600 (2) | 0.36307 (19) | 0.66100 (17) | 0.0260 (7) | |
| C7 | 0.5647 (3) | 0.2080 (2) | 0.53197 (18) | 0.0283 (7) | |
| C8 | 0.7134 (3) | 0.3664 (2) | 0.4076 (2) | 0.0382 (9) | |
| C9 | 0.7241 (3) | 0.6519 (2) | 0.7019 (2) | 0.0416 (9) | |
| C10 | 0.5618 (2) | 0.48883 (19) | 0.81384 (17) | 0.0259 (7) | |
| C11 | 0.9056 (3) | −0.1198 (3) | 0.5336 (2) | 0.0455 (10) | |
| C12 | 1.0338 (3) | −0.1460 (3) | 0.5712 (3) | 0.0625 (14) | |
| C13 | 1.0764 (3) | −0.1350 (3) | 0.6760 (3) | 0.0739 (15) | |
| C14 | 0.9916 (4) | −0.0970 (4) | 0.7408 (3) | 0.0817 (14) | |
| C15 | 0.8655 (3) | −0.0695 (3) | 0.6982 (2) | 0.0559 (11) | |
| H6A | 0.50520 | 0.31680 | 0.69400 | 0.0310* | |
| H8A | 0.67890 | 0.29300 | 0.38790 | 0.0570* | 0.500 |
| H8B | 0.80720 | 0.36510 | 0.41230 | 0.0570* | 0.500 |
| H8C | 0.67830 | 0.42060 | 0.35570 | 0.0570* | 0.500 |
| H8D | 0.76410 | 0.42610 | 0.38270 | 0.0570* | 0.500 |
| H8E | 0.63580 | 0.35410 | 0.35830 | 0.0570* | 0.500 |
| H8F | 0.76460 | 0.29850 | 0.41490 | 0.0570* | 0.500 |
| H9A | 0.69250 | 0.66260 | 0.76810 | 0.0620* | 0.500 |
| H9B | 0.69000 | 0.71040 | 0.65410 | 0.0620* | 0.500 |

| | | | | | |
|---|---|---|---|---|---|
| H9C | 0.81820 | 0.65490 | 0.71220 | 0.0620* | 0.500 |
| H9D | 0.77470 | 0.68930 | 0.65480 | 0.0620* | 0.500 |
| H9E | 0.77710 | 0.64150 | 0.76880 | 0.0620* | 0.500 |
| H9F | 0.64890 | 0.69700 | 0.71080 | 0.0620* | 0.500 |
| H11A | 0.87570 | −0.13000 | 0.46260 | 0.0550* | |
| H12A | 1.09060 | −0.17090 | 0.52580 | 0.0750* | |
| H13A | 1.16230 | −0.15320 | 0.70300 | 0.0890* | |
| H14A | 1.01850 | −0.08980 | 0.81260 | 0.0980* | |
| H15A | 0.80810 | −0.04270 | 0.74230 | 0.0670* | |

*Atomic displacement parameters (Å²)*

| | $U^{11}$ | $U^{22}$ | $U^{33}$ | $U^{12}$ | $U^{13}$ | $U^{23}$ |
|---|---|---|---|---|---|---|
| Zn1 | 0.0253 (2) | 0.0240 (2) | 0.0210 (1) | 0.0011 (1) | 0.0044 (1) | 0.0003 (1) |
| O1 | 0.0406 (12) | 0.0231 (10) | 0.0991 (18) | 0.0015 (9) | 0.0057 (12) | −0.0082 (10) |
| O2 | 0.0471 (12) | 0.0278 (10) | 0.0708 (14) | −0.0077 (9) | −0.0156 (10) | −0.0060 (9) |
| O3 | 0.0346 (10) | 0.0791 (15) | 0.0245 (9) | 0.0051 (10) | 0.0108 (8) | 0.0017 (9) |
| O4 | 0.0510 (12) | 0.0788 (15) | 0.0218 (9) | 0.0216 (11) | 0.0114 (9) | 0.0125 (9) |
| O5 | 0.0789 (16) | 0.0588 (14) | 0.0439 (12) | −0.0111 (12) | 0.0142 (11) | 0.0230 (11) |
| O6 | 0.0460 (14) | 0.0838 (18) | 0.0819 (18) | −0.0243 (13) | 0.0113 (13) | 0.0200 (15) |
| N1 | 0.0456 (14) | 0.0298 (11) | 0.0338 (12) | −0.0076 (10) | 0.0185 (10) | −0.0013 (9) |
| N2 | 0.0285 (11) | 0.0286 (10) | 0.0324 (11) | 0.0014 (9) | 0.0047 (9) | −0.0001 (9) |
| C1 | 0.0281 (12) | 0.0225 (11) | 0.0229 (11) | −0.0012 (9) | 0.0036 (9) | −0.0028 (9) |
| C2 | 0.0302 (12) | 0.0246 (12) | 0.0220 (11) | 0.0007 (10) | 0.0064 (9) | −0.0024 (9) |
| C3 | 0.0298 (13) | 0.0227 (11) | 0.0261 (12) | −0.0020 (9) | 0.0077 (10) | 0.0036 (9) |
| C4 | 0.0317 (13) | 0.0204 (11) | 0.0239 (11) | −0.0007 (10) | 0.0043 (9) | −0.0005 (9) |
| C5 | 0.0278 (12) | 0.0243 (11) | 0.0189 (10) | 0.0017 (10) | 0.0047 (9) | −0.0002 (9) |
| C6 | 0.0303 (13) | 0.0243 (12) | 0.0244 (12) | −0.0048 (9) | 0.0079 (10) | 0.0010 (9) |
| C7 | 0.0412 (15) | 0.0237 (12) | 0.0215 (11) | −0.0049 (11) | 0.0100 (10) | −0.0010 (9) |
| C8 | 0.0552 (18) | 0.0334 (14) | 0.0293 (13) | 0.0001 (12) | 0.0171 (12) | −0.0026 (11) |
| C9 | 0.0616 (19) | 0.0268 (13) | 0.0390 (15) | −0.0123 (13) | 0.0160 (14) | −0.0078 (11) |
| C10 | 0.0355 (14) | 0.0236 (12) | 0.0195 (11) | 0.0024 (10) | 0.0075 (10) | 0.0011 (9) |
| C11 | 0.0412 (17) | 0.0514 (18) | 0.0456 (16) | 0.0133 (14) | 0.0122 (13) | 0.0050 (14) |
| C12 | 0.0423 (19) | 0.066 (2) | 0.083 (3) | 0.0198 (16) | 0.0219 (18) | 0.004 (2) |
| C13 | 0.0309 (18) | 0.073 (3) | 0.111 (3) | 0.0081 (17) | −0.0148 (19) | −0.020 (2) |
| C14 | 0.053 (2) | 0.110 (3) | 0.071 (2) | 0.023 (2) | −0.0308 (19) | −0.039 (2) |
| C15 | 0.0443 (18) | 0.074 (2) | 0.0458 (18) | 0.0131 (16) | −0.0064 (14) | −0.0239 (16) |

*Geometric parameters (Å, º)*

| | | | |
|---|---|---|---|
| Zn1—O1 | 2.0540 (19) | C5—C10 | 1.507 (3) |
| Zn1—O3 | 2.0336 (18) | C11—C12 | 1.377 (4) |
| Zn1—O4 | 2.0283 (18) | C12—C13 | 1.364 (5) |
| Zn1—N2 | 2.030 (2) | C13—C14 | 1.363 (5) |
| Zn1—O2$^{i}$ | 2.0450 (19) | C14—C15 | 1.377 (5) |
| O1—C7 | 1.242 (3) | C6—H6A | 0.9300 |
| O2—C7 | 1.238 (4) | C8—H8A | 0.9600 |
| O3—C10$^{ii}$ | 1.246 (3) | C8—H8B | 0.9600 |

| | | | |
|---|---|---|---|
| O4—C10$^{iii}$ | 1.240 (3) | C8—H8C | 0.9600 |
| O5—N1 | 1.199 (3) | C8—H8D | 0.9600 |
| O6—N1 | 1.215 (3) | C8—H8E | 0.9600 |
| N1—C3 | 1.490 (3) | C8—H8F | 0.9600 |
| N2—C11 | 1.336 (4) | C9—H9A | 0.9600 |
| N2—C15 | 1.326 (3) | C9—H9B | 0.9600 |
| C1—C2 | 1.400 (3) | C9—H9C | 0.9600 |
| C1—C6 | 1.389 (3) | C9—H9D | 0.9600 |
| C1—C7 | 1.515 (3) | C9—H9E | 0.9600 |
| C2—C3 | 1.393 (3) | C9—H9F | 0.9600 |
| C2—C8 | 1.506 (3) | C11—H11A | 0.9300 |
| C3—C4 | 1.395 (3) | C12—H12A | 0.9300 |
| C4—C5 | 1.406 (3) | C13—H13A | 0.9300 |
| C4—C9 | 1.507 (3) | C14—H14A | 0.9300 |
| C5—C6 | 1.386 (3) | C15—H15A | 0.9300 |

| | | | |
|---|---|---|---|
| O1—Zn1—O3 | 88.59 (9) | N2—C11—C12 | 121.7 (3) |
| O1—Zn1—O4 | 87.41 (9) | C11—C12—C13 | 119.1 (3) |
| O1—Zn1—N2 | 99.73 (8) | C12—C13—C14 | 119.3 (3) |
| O1—Zn1—O2$^{i}$ | 158.34 (8) | C13—C14—C15 | 118.9 (3) |
| O3—Zn1—O4 | 158.24 (8) | N2—C15—C14 | 122.2 (3) |
| O3—Zn1—N2 | 100.58 (8) | C1—C6—H6A | 119.00 |
| O2$^{i}$—Zn1—O3 | 88.82 (8) | C5—C6—H6A | 119.00 |
| O4—Zn1—N2 | 101.18 (8) | C2—C8—H8A | 109.00 |
| O2$^{i}$—Zn1—O4 | 87.07 (9) | C2—C8—H8B | 109.00 |
| O2$^{i}$—Zn1—N2 | 101.89 (8) | C2—C8—H8C | 109.00 |
| Zn1—O1—C7 | 127.48 (18) | C2—C8—H8D | 109.00 |
| Zn1$^{i}$—O2—C7 | 127.43 (17) | C2—C8—H8E | 109.00 |
| Zn1—O3—C10$^{ii}$ | 129.39 (16) | C2—C8—H8F | 109.00 |
| Zn1—O4—C10$^{iii}$ | 126.61 (17) | H8A—C8—H8B | 110.00 |
| O5—N1—O6 | 124.0 (2) | H8A—C8—H8C | 109.00 |
| O5—N1—C3 | 118.9 (2) | H8B—C8—H8C | 109.00 |
| O6—N1—C3 | 117.0 (2) | H8D—C8—H8E | 109.00 |
| Zn1—N2—C11 | 121.32 (17) | H8D—C8—H8F | 110.00 |
| Zn1—N2—C15 | 120.00 (19) | H8E—C8—H8F | 109.00 |
| C11—N2—C15 | 118.7 (2) | C4—C9—H9A | 109.00 |
| C2—C1—C6 | 120.2 (2) | C4—C9—H9B | 109.00 |
| C2—C1—C7 | 122.5 (2) | C4—C9—H9C | 110.00 |
| C6—C1—C7 | 117.2 (2) | C4—C9—H9D | 110.00 |
| C1—C2—C3 | 115.8 (2) | C4—C9—H9E | 109.00 |
| C1—C2—C8 | 122.0 (2) | C4—C9—H9F | 109.00 |
| C3—C2—C8 | 122.3 (2) | H9A—C9—H9B | 109.00 |
| N1—C3—C2 | 116.51 (19) | H9A—C9—H9C | 109.00 |
| N1—C3—C4 | 117.13 (19) | H9B—C9—H9C | 110.00 |
| C2—C3—C4 | 126.3 (2) | H9D—C9—H9E | 109.00 |
| C3—C4—C5 | 115.4 (2) | H9D—C9—H9F | 110.00 |
| C3—C4—C9 | 121.7 (2) | H9E—C9—H9F | 109.00 |
| C5—C4—C9 | 122.9 (2) | N2—C11—H11A | 119.00 |

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| C4—C5—C6 | 120.3 (2) | C12—C11—H11A | 119.00 |
| C4—C5—C10 | 122.8 (2) | C11—C12—H12A | 120.00 |
| C6—C5—C10 | 116.71 (19) | C13—C12—H12A | 120.00 |
| C1—C6—C5 | 121.9 (2) | C12—C13—H13A | 120.00 |
| O1—C7—O2 | 126.0 (2) | C14—C13—H13A | 120.00 |
| O1—C7—C1 | 116.4 (2) | C13—C14—H14A | 121.00 |
| O2—C7—C1 | 117.6 (2) | C15—C14—H14A | 121.00 |
| O3$^{iv}$—C10—C5 | 117.08 (19) | N2—C15—H15A | 119.00 |
| O4$^{v}$—C10—C5 | 117.53 (19) | C14—C15—H15A | 119.00 |
| O3$^{iv}$—C10—O4$^{v}$ | 125.3 (2) | | |

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| O3—Zn1—O1—C7 | −70.9 (2) | C15—N2—C11—C12 | −2.4 (5) |
| O4—Zn1—O1—C7 | 87.7 (2) | C11—N2—C15—C14 | 0.8 (5) |
| N2—Zn1—O1—C7 | −171.4 (2) | Zn1—N2—C11—C12 | 177.4 (3) |
| O2$^{i}$—Zn1—O1—C7 | 12.3 (4) | Zn1—N2—C15—C14 | −179.1 (3) |
| O1—Zn1—O3—C10$^{ii}$ | 82.6 (2) | C2—C1—C6—C5 | −4.3 (3) |
| O4—Zn1—O3—C10$^{ii}$ | 3.2 (4) | C2—C1—C7—O1 | 74.4 (3) |
| N2—Zn1—O3—C10$^{ii}$ | −177.8 (2) | C7—C1—C2—C8 | 7.3 (3) |
| O2$^{i}$—Zn1—O3—C10$^{ii}$ | −75.9 (2) | C7—C1—C6—C5 | 172.4 (2) |
| O1—Zn1—O4—C10$^{iii}$ | −75.2 (2) | C6—C1—C2—C3 | 3.3 (3) |
| O3—Zn1—O4—C10$^{iii}$ | 4.4 (4) | C6—C1—C7—O2 | 75.5 (3) |
| N2—Zn1—O4—C10$^{iii}$ | −174.7 (2) | C7—C1—C2—C3 | −173.3 (2) |
| O2$^{i}$—Zn1—O4—C10$^{iii}$ | 83.8 (2) | C6—C1—C2—C8 | −176.2 (2) |
| O1—Zn1—N2—C11 | −106.3 (2) | C6—C1—C7—O1 | −102.3 (3) |
| O1—Zn1—N2—C15 | 73.6 (2) | C2—C1—C7—O2 | −107.9 (3) |
| O3—Zn1—N2—C11 | 163.4 (2) | C8—C2—C3—C4 | 179.4 (2) |
| O3—Zn1—N2—C15 | −16.8 (2) | C8—C2—C3—N1 | −2.9 (3) |
| O4—Zn1—N2—C11 | −17.0 (2) | C1—C2—C3—C4 | 0.0 (3) |
| O4—Zn1—N2—C15 | 162.8 (2) | C1—C2—C3—N1 | 177.59 (19) |
| O2$^{i}$—Zn1—N2—C11 | 72.3 (2) | N1—C3—C4—C9 | 2.4 (3) |
| O2$^{i}$—Zn1—N2—C15 | −107.8 (2) | C2—C3—C4—C5 | −2.2 (3) |
| O1—Zn1—O2$^{i}$—C7$^{i}$ | −3.3 (4) | C2—C3—C4—C9 | −180.0 (2) |
| O3—Zn1—O2$^{i}$—C7$^{i}$ | 79.9 (2) | N1—C3—C4—C5 | −179.84 (19) |
| O4—Zn1—O2$^{i}$—C7$^{i}$ | −78.7 (2) | C3—C4—C5—C6 | 1.3 (3) |
| N2—Zn1—O2$^{i}$—C7$^{i}$ | −179.5 (2) | C9—C4—C5—C6 | 179.0 (2) |
| Zn1—O1—C7—O2 | −11.5 (4) | C3—C4—C5—C10 | 176.5 (2) |
| Zn1—O1—C7—C1 | 166.09 (17) | C9—C4—C5—C10 | −5.8 (3) |
| Zn1$^{i}$—O2—C7—O1 | 8.2 (4) | C10—C5—C6—C1 | −173.6 (2) |
| Zn1$^{i}$—O2—C7—C1 | −169.35 (16) | C4—C5—C10—O3$^{iv}$ | 138.0 (2) |
| Zn1—O3—C10$^{ii}$—C5$^{ii}$ | 169.14 (16) | C4—C5—C10—O4$^{v}$ | −44.5 (3) |
| Zn1—O3—C10$^{ii}$—O4$^{i}$ | −8.1 (4) | C6—C5—C10—O3$^{iv}$ | −46.6 (3) |
| Zn1—O4—C10$^{iii}$—O3$^{i}$ | −8.2 (4) | C6—C5—C10—O4$^{v}$ | 130.9 (2) |
| Zn1—O4—C10$^{iii}$—C5$^{iii}$ | 169.07 (16) | C4—C5—C6—C1 | 1.9 (3) |
| O6—N1—C3—C2 | −108.6 (3) | N2—C11—C12—C13 | 2.5 (5) |
| O5—N1—C3—C4 | −111.8 (3) | C11—C12—C13—C14 | −0.8 (6) |

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| O6—N1—C3—C4 | 69.3 (3) | C12—C13—C14—C15 | −0.8 (6) |
| O5—N1—C3—C2 | 70.4 (3) | C13—C14—C15—N2 | 0.8 (6) |

Symmetry codes: (i) −*x*+1, −*y*, −*z*+1; (ii) −*x*+1, *y*−1/2, −*z*+3/2; (iii) *x*, −*y*+1/2, *z*−1/2; (iv) −*x*+1, *y*+1/2, −*z*+3/2; (v) *x*, −*y*+1/2, *z*+1/2.