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## Key indicators

Single-crystal X-ray study  
 $T = 263$  K  
Mean  $\sigma(\text{C}-\text{C}) = 0.004$  Å  
 $R$  factor = 0.033  
 $wR$  factor = 0.079  
Data-to-parameter ratio = 15.4For details of how these key indicators were  
automatically derived from the article, see  
<http://journals.iucr.org/e>.Tetra- $\mu$ -methacrylato- $\kappa^8\text{O}:\text{O}'$ -bis[(pyridine- $\kappa\text{N}$ )-  
copper(II)]

In the title carboxylate-bridged binuclear copper complex,  $[\text{Cu}_2\{\text{CH}_2\text{C}(\text{CH}_3)\text{COO}\}_4(\text{C}_5\text{H}_5\text{N})_2]$ , the Cu atoms are bridged by four bidentate methacrylate groups. The asymmetric unit consists of two half-molecules, each molecule having inversion symmetry. The Cu $\cdots$ Cu separations are 2.6181 (8) and 2.6442 (10) Å. All bond lengths and angles are normal.

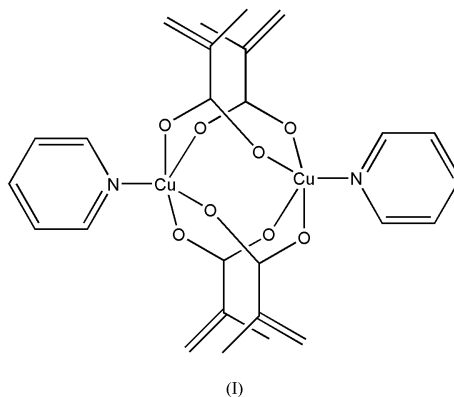
Received 25 October 2004

Accepted 28 October 2004

Online 6 November 2004

## Comment

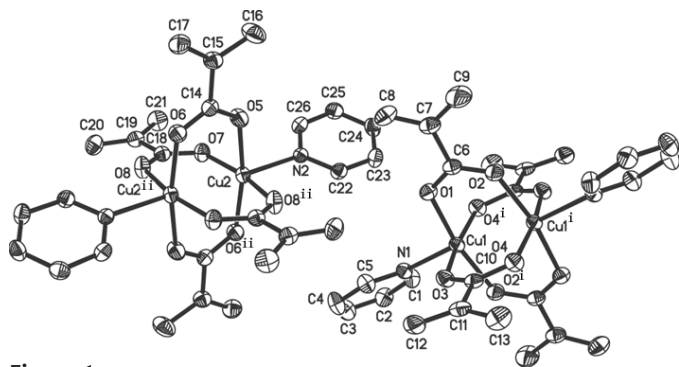
Copper complexes with organic acids and other donor ligands exist extensively in living things, playing an important role in a vast range of chemical and biochemical catalytic systems (King, 1994). Numerous papers dealing with copper carboxylate complexes have been published (Du *et al.*, 2004; Hu *et al.*, 2004; Li & Xiao, 2004). We present here a new binuclear copper  $\alpha$ -methacrylate complex with pyridine, (I).



The crystal structure of (I) contains two independent binuclear cage complexes, each with inversion symmetry. In each dimer, two Cu atoms are bridged by four  $\mu_2\text{-O}:\text{O}'$   $\alpha$ -methacrylate groups, forming a cage structure, and the pyridine ligands are bonded through their N atoms to the Cu atoms in the terminal positions (Fig. 1). All bond lengths and angles in (I) are normal (Table 1). The coordination geometry of each Cu atom is distorted square-based pyramidal. Atom Cu1 is displaced by 0.1960 (19) Å out of the mean plane of atoms O1, O2<sup>i</sup>, O3 and O4<sup>i</sup> towards the axial pyridine ligand (symmetry codes as in Table 1). Atom Cu2 is displaced by 0.2082 (19) Å out of the mean plane of atoms O5, O6<sup>ii</sup>, O7 and O8<sup>ii</sup> towards the axial pyridine ligand. The Cu1 $\cdots$ Cu1<sup>i</sup> and Cu2 $\cdots$ Cu2<sup>ii</sup> separations are 2.6181 (8) and 2.6442 (10) Å, respectively.

## Experimental

HL ( $\alpha$ -methylacrylic acid; 0.5 ml, 6.0 mmol) and  $\text{Cu}(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O}$  (240 mg, 1.0 mmol) were dissolved in  $\text{H}_2\text{O}$  (50 ml), and the pH



**Figure 1**

View of the title molecule showing the atom-labelling scheme. Displacement ellipsoids are drawn at the 30% probability level. All H atoms have been omitted for clarity. [Symmetry codes are as in Table 1.]

adjusted to 4.0 using 0.5 M NaOH. Pyridine (0.5 M, 2 ml) was added to the mixed solution with stirring. After filtration, the filtrate was allowed to stand at room temperature and single crystals suitable for X-ray work were obtained after one week. Analysis calculated: C 49.91, H 4.83, N 4.48%; found: C 49.69, H 4.74, N 4.51%. IR (KBr,  $\nu$   $\text{cm}^{-1}$ ): 699, 830, 936, 1036, 1214, 1243, 1369, 1415, 1597, 1650.

#### Crystal data

[Cu<sub>2</sub>(C<sub>4</sub>H<sub>5</sub>O<sub>2</sub>)<sub>4</sub>(C<sub>5</sub>H<sub>5</sub>N)<sub>2</sub>]  
 $M_r = 625.60$   
 Triclinic,  $P\bar{1}$   
 $a = 8.8214$  (18) Å  
 $b = 9.936$  (2) Å  
 $c = 16.392$  (3) Å  
 $\alpha = 100.57$  (3)°  
 $\beta = 92.76$  (3)°  
 $\gamma = 95.88$  (3)°  
 $V = 1401.6$  (5) Å<sup>3</sup>

$Z = 2$   
 $D_x = 1.482$  Mg m<sup>-3</sup>  
 Mo  $K\alpha$  radiation  
 Cell parameters from 7999 reflections  
 $\theta = 1.3$ – $27.4$ °  
 $\mu = 1.57$  mm<sup>-1</sup>  
 $T = 263$  (2) K  
 Prism, green  
 $0.28 \times 0.25 \times 0.24$  mm

#### Data collection

Rigaku R-AXIS RAPID diffractometer  
 $\omega$  scans  
 Absorption correction: multi-scan (ABSCOR; Higashi, 1995)  
 $T_{\min} = 0.651$ ,  $T_{\max} = 0.687$   
 11 151 measured reflections

5342 independent reflections  
 4326 reflections with  $I > 2\sigma(I)$   
 $R_{\text{int}} = 0.027$   
 $\theta_{\max} = 25.8$ °  
 $h = -10 \rightarrow 10$   
 $k = -12 \rightarrow 12$   
 $l = -20 \rightarrow 20$

#### Refinement

Refinement on  $F^2$   
 $R[F^2 > 2\sigma(F^2)] = 0.033$   
 $wR(F^2) = 0.079$   
 $S = 1.03$   
 5342 reflections  
 347 parameters  
 H-atom parameters constrained

$w = 1/[\sigma^2(F_o^2) + (0.0412P)^2 + 0.4712P]$   
 where  $P = (F_o^2 + 2F_c^2)/3$   
 $(\Delta/\sigma)_{\max} = 0.002$   
 $\Delta\rho_{\max} = 0.47$  e Å<sup>-3</sup>  
 $\Delta\rho_{\min} = -0.33$  e Å<sup>-3</sup>

**Table 1**

Selected geometric parameters (Å, °).

Cu1—O1	1.9735 (19)	Cu2—O5	1.9757 (19)
Cu1—O2 <sup>i</sup>	1.9875 (19)	Cu2—O6 <sup>ii</sup>	1.9710 (19)
Cu1—O3	1.9672 (18)	Cu2—O7	1.9784 (18)
Cu1—O4 <sup>i</sup>	1.9794 (18)	Cu2—O8 <sup>ii</sup>	1.9717 (19)
Cu1—N1	2.147 (2)	Cu2—N2	2.165 (2)
O1—Cu1—O2 <sup>i</sup>	168.63 (8)	O5—Cu2—O7	89.42 (9)
O1—Cu1—O3	87.96 (8)	O5—Cu2—N2	91.80 (8)
O1—Cu1—O4 <sup>i</sup>	89.68 (8)	O6 <sup>ii</sup> —Cu2—O5	167.97 (8)
O1—Cu1—N1	101.92 (8)	O6 <sup>ii</sup> —Cu2—O7	88.84 (8)
O2 <sup>i</sup> —Cu1—N1	89.42 (8)	O6 <sup>ii</sup> —Cu2—N2	100.23 (8)
O3—Cu1—O2 <sup>i</sup>	91.55 (8)	O7—Cu2—N2	97.60 (8)
O3—Cu1—O4 <sup>i</sup>	168.53 (8)	O8 <sup>ii</sup> —Cu2—O5	89.88 (9)
O3—Cu1—N1	97.32 (8)	O8 <sup>ii</sup> —Cu2—O6 <sup>ii</sup>	89.31 (9)
O4 <sup>i</sup> —Cu1—O2 <sup>i</sup>	88.55 (8)	O8 <sup>ii</sup> —Cu2—O7	167.79 (7)
O4 <sup>i</sup> —Cu1—N1	94.15 (8)	O8 <sup>ii</sup> —Cu2—N2	94.61 (8)

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

All H atoms were initially located in a difference Fourier map. All methyl H atoms were then constrained to an ideal geometry, with C—H distances of 0.96 Å and  $U_{\text{iso}}(\text{H}) = 1.5U_{\text{eq}}(\text{C})$ , but each group was allowed to rotate freely about its C—C bond. The =CH<sub>2</sub> H atoms and aromatic H atoms were placed in geometrically idealized positions and constrained to ride on their parent atoms, with C—H distances of 0.93 Å and  $U_{\text{iso}}(\text{H}) = 1.2U_{\text{eq}}(\text{C})$ .

Data collection: *RAPID-AUTO* (Rigaku, 1998); cell refinement: *RAPID-AUTO*; data reduction: *CrystalStructure* (Rigaku/MS, 2002); program(s) used to solve structure: *SHELXS97* (Sheldrick, 1997); program(s) used to refine structure: *SHELXL97* (Sheldrick, 1997); molecular graphics: *ORTEP-3* (Farrugia, 1997); software used to prepare material for publication: *SHELXL97*.

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