

**catena-Poly[silver(I)- $\mu_3$ -5-phenyl-1,2,3,4-tetrazolato- $\kappa^3 N^1:N^2:N^3$ ]**Xiu-Ling Zhang,<sup>a</sup> Yue Qiu<sup>a</sup> and Seik Weng Ng<sup>b\*</sup><sup>a</sup>Department of Chemistry, Dezhou University, Dezhou 253011, People's Republic of China, and <sup>b</sup>Department of Chemistry, University of Malaya, Kuala Lumpur 50603, Malaysia

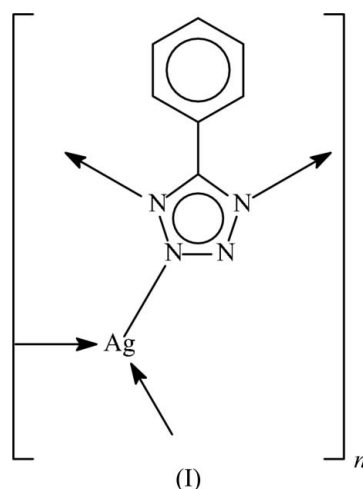
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**Key indicators**Single-crystal X-ray study  
 $T = 294$  K  
Mean  $\sigma(C-C) = 0.007$  Å  
 $R$  factor = 0.036  
 $wR$  factor = 0.092  
Data-to-parameter ratio = 13.4For details of how these key indicators were automatically derived from the article, see <http://journals.iucr.org/e>.

The 5-phenyltetrazolate anion in the title compound,  $[Ag(C_7H_5N_4)]_n$ , uses three of its four N atoms to link silver cations into a linear ribbon structure; the Ag atom shows a trigonal planar coordination.

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Although metal tetrazolates are now emerging as a class of useful materials (Gaponik *et al.*, 2006), there are few crystal structure reports of such compounds in the literature. Among the organic tetrazolates, the crystal structure is known only for dimethylammonium 5-phenyltetrazolate (Guzei & Bikzhanova, 2002). The 5-phenyltetrazolate anion is monodentate in the titanium and niobium (Yelamos *et al.*, 2001) complexes. In the potassium derivative, it binds as a bidentate chelate (Zheng *et al.*, 2003), whereas in the copper derivative it functions as a bridging ligand (Shao *et al.*, 2004). The dicyclopentadienyllanthanum derivative has the ligand binding in a bridging mode (Zhou *et al.*, 2000); other lanthanide complexes show similar bonding features (Zhou *et al.*, 1998). On the other hand, the diphenylthallium derivative has a complex composition (Bhandari *et al.*, 2000), as does the dicyclopentadienylholonium derivative (Huang *et al.*, 1998). The zinc derivative is known to be SHG-active (Ye *et al.*, 2005); the only other inorganic main-group compound appears to be the aluminium derivative (Munoz-Hernandez *et al.*, 1998).



Silver 5-phenyltetrazolate, (I), was first mentioned in the context of the photolysis of 2-alkenyl-5-phenyl-substituted tetrazoles (Padwa *et al.*, 1978). In (I), the anion uses three of its four Lewis basic sites to bind to three different Ag atoms; the metal atom shows a trigonal planar coordination (Fig. 1

and Table 1). The binding mode gives rise to the formation of a ribbon motif; the backbone of the ribbon, which propagates along the *b* axis, is essentially flat.

### Experimental

Silver perchlorate (41 mg, 0.2 mmol) and 5-phenyltetrazole (30 mg, 0.2 mmol) were dissolved in 10% aqueous ammonia (10 ml). The solution was filtered and then allowed to stand in the dark for three weeks. Crystals were isolated in 60% yield.

#### Crystal data

[Ag(C <sub>7</sub> H <sub>5</sub> N <sub>4</sub> )]	<i>Z</i> = 4
<i>M<sub>r</sub></i> = 253.02	<i>D<sub>x</sub></i> = 2.303 Mg m <sup>-3</sup>
Monoclinic, <i>P</i> 2 <sub>1</sub> / <i>c</i>	Mo <i>K</i> α radiation
<i>a</i> = 10.433 (2) Å	<i>μ</i> = 2.70 mm <sup>-1</sup>
<i>b</i> = 6.275 (1) Å	<i>T</i> = 294 (2) K
<i>c</i> = 11.894 (2) Å	Block, colorless
<i>β</i> = 110.388 (2)°	0.20 × 0.18 × 0.10 mm
<i>V</i> = 729.9 (2) Å <sup>3</sup>	

#### Data collection

Bruker SMART 1K area-detector diffractometer	3709 measured reflections
<i>φ</i> and <i>ω</i> scans	1459 independent reflections
Absorption correction: multi-scan (SADABS; Sheldrick, 1996)	1138 reflections with <i>I</i> > 2σ( <i>I</i> )
<i>T<sub>min</sub></i> = 0.446, <i>T<sub>max</sub></i> = 0.774	<i>R<sub>int</sub></i> = 0.047
	<i>θ<sub>max</sub></i> = 26.4°

#### Refinement

Refinement on <i>F</i> <sup>2</sup>	H-atom parameters constrained
<i>R</i> [ <i>F</i> <sup>2</sup> > 2σ( <i>F</i> <sup>2</sup> )] = 0.036	<i>w</i> = 1/[σ <sup>2</sup> ( <i>F<sub>o</sub></i> <sup>2</sup> ) + (0.0544 <i>P</i> ) <sup>2</sup> ]
<i>wR</i> ( <i>F</i> <sup>2</sup> ) = 0.092	where <i>P</i> = ( <i>F<sub>o</sub></i> <sup>2</sup> + 2 <i>F<sub>c</sub></i> <sup>2</sup> )/3
<i>S</i> = 0.98	(Δ/σ) <sub>max</sub> = 0.001
1459 reflections	Δρ <sub>max</sub> = 1.16 e Å <sup>-3</sup>
109 parameters	Δρ <sub>min</sub> = -1.37 e Å <sup>-3</sup>

**Table 1**

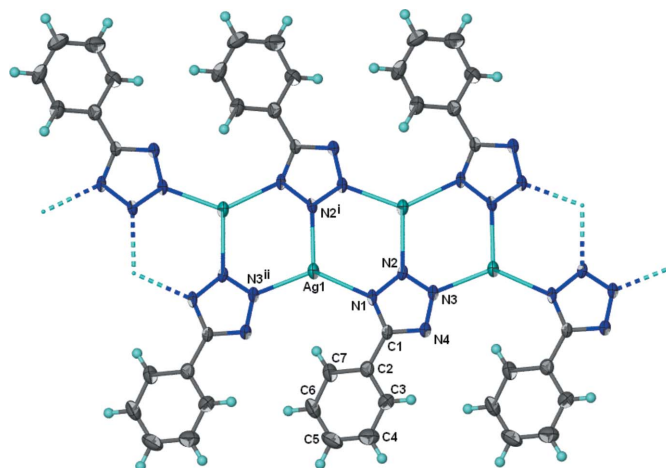
Selected geometric parameters (Å, °).

Ag1—N1	2.251 (3)	Ag1—N3 <sup>ii</sup>	2.256 (3)
Ag1—N2 <sup>i</sup>	2.299 (3)		
N1—Ag1—N2 <sup>i</sup>	114.4 (1)	N2 <sup>i</sup> —Ag1—N3 <sup>ii</sup>	110.4 (1)
N1—Ag1—N3 <sup>ii</sup>	134.5 (1)		

Symmetry codes: (i)  $-x + 1, y - \frac{1}{2}, -z + \frac{3}{2}$ ; (ii)  $x, y - 1, z$ .

H atoms were positioned geometrically (C—H = 0.93 Å) and were included in the refinement in the riding-model approximation, with *U*<sub>iso</sub>(H) = 1.2*U*<sub>eq</sub>(C). The final difference Fourier map had a large peak/hole at about 1 Å from Ag1.

Data collection: SMART (Bruker, 1998); cell refinement: SAINT (Bruker, 1998); data reduction: SAINT; program(s) used to solve structure: SHELXS97 (Sheldrick, 1997); program(s) used to refine structure: SHELXL97 (Sheldrick, 1997); molecular graphics: X-



**Figure 1**

A fragment of the ribbon structure of (I). Displacement ellipsoids are drawn at the 70% probability level and H atoms are drawn as spheres of arbitrary radii. Symmetry codes are as given in Table 1.

SEED (Barbour, 2001); software used to prepare material for publication: publCIF (Westrip, 2006).

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