

## TOPICAL REVIEW

**Tetrathiapentalene-based organic conductors**Yohji Misaki 2009 *Sci. Technol. Adv. Mater.* **10** 024301 (22pp) doi: [10.1088/1468-6996/10/2/024301](https://doi.org/10.1088/1468-6996/10/2/024301)[Help](#)[Full text](#) | [PDF \(4.01 MB\)](#) | [References](#)[Yohji Misaki](#)

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**Abstract.** The synthesis, structure and properties of tetrathiapentalene-based (TTP) organic conductors are reviewed. Among various TTP-type donors, bis-fused tetrathiafulvalene, 2,5-bis(1,3-dithiol-2-ylidene)-1,3,4,6-tetrathiapentalene (BDT-TTP) and its derivatives afford many metallic radical cation salts stable down to low temperatures, regardless of the size and shape of the counter anions. Most BDT-TTP conductors have a  $\beta$ -type donor arrangement with almost uniform stacks. Introduction of appropriate substituents results in molecular packing that differs from the  $\beta$ -type. A vinyllogous TTP, 2-(1,3-dithiol-2-ylidene)-5-(2-ethanediylydene-1,3-dithiole)-1,3,4,6-tetrathiapentalene (DTEDT) has yielded an organic superconductor (DTEDT)<sub>3</sub>Au(CN)<sub>2</sub> as well as metallic radical cation salts, regardless of the counter anions. (Thio)pyran analogs of TTP, namely (T)PDT-TTP and its derivatives produce molecular conductors with novel molecular arrangements. A TTP analog with reduced  $\pi$ -electron system 2,5-bis(1,3-dithian-2-ylidene)-1,3,4,6-tetrathiapentalene (BDA-TTP) has afforded several organic superconductors. Highly conducting molecular metals with unusual oxidation states (+1, +5/3 and neutral) have been developed on the basis of 2,5-bis(1,3-dithiol-2-ylidene)-1,3,4,6-tetrathiapentalene (BDT-TTP) derivatives and analogous metal derivatives  $M(dt)_2$  ( $M = Ni, Au$ ).

**Keywords:** molecular conductor, tetrathiapentalene, cyclic voltammetry, x-ray structure analysis, band calculation

Print publication: Issue 2 (April 2009)

Received 14 January 2009, accepted for publication 17 March 2009

Published 6 July 2009

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