平成 11 年度 基盤研究(C) 企画調査
分子性合成金属・超伝導体の化学と物理

12. TTP 系 構造・物性

担当と調査範囲
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手元にある文献を調査範囲とした。但し、TTP 骨格自身が還元された形の化合物は対象外とした。

Table 1. Crystal structure and electrical property of TTP type conductors

	Donor array	σ_{rt}	Conducting behavior	Ref.
$(TTP)_2ClO_4$	Uniform β–type	140	M'	1
$(TTP)_2BF_4$	Uniform β–type	400	M'	1
$(TTP)(ReO_4)_{0.36}$	Uniform β–type	160	M'	1
$(TTP)_2SbF_6$	β–type	48	M	2,3
$(TTP)_2AsF_6$	β–type	880	M	3
$(TTP)_2PF_6$	β–type	500	M	3
$(TTP)_2NO_3$	β–type	38	T_{MI}=50K	3,4
$(TTP)_2Cu(NCS)_2$	θ–type	7	I	3,4
$(TTP)_6Re_6S_6Cl_8(TCE)_2$	β–type	285	M	5
$(TTP)_6Mo_6Cl_{14}(TCE)_2$	β–type	83	M	5
$(ST\text{-}TTP)_2ClO_4$	Uniform β–type	200	M'	3,6
$(ST\text{-}TTP)_2BF_4$	Uniform β–type	130	M'	3
$(ST\text{-}TTP)_2ReO_4$	Uniform β–type	200	M'	3
$(ST\text{-}TTP)_2PF_6$	β–type	380	M	3
$(ST\text{-}TTP)_2AsF_6$	β–type	200	M	3,6,7
$(ST\text{-}TTP)_2SbF_6$	β–type	330	M	3
$(ST\text{-}TTP)_2TaF_6$	β–type	60	M	3
$(ST\text{-}TTP)_3Au(CN)_2$	β–type	110	M	3,6
$(ST\text{-}TTP)_3Br$	$(MT)_3PF_6$(DCE)-type	800	M'	3
$(BDS\text{-}TTP)_2AsF_6$	β–type	70	M	3,8
$(TTM\text{-}TTP)_2I_3$	Trimerized column	0.03	I	9
$(TTM\text{-}TTP)I_3$	Uniform column	700	T_{MI}=160K	9
$(TTM\text{-}TTP)(I_3)_{5/3}$	Uniform column	200	T_{MI}=20K	10
$(TTM\text{-}TTP)AuI_2$	Dimerized column	10	I	11
$(TTM\text{-}TTP)AuBr_2$	Dimerized column	40	I	11
$(TTM\text{-}TTP)C(CN)_3$	Uniform column	140	T_{MI}=70K	12
$(TTM\text{-}TTP)(PF_6)_{0.267}(THF)_{0.6}$	Pentamerized column	0.003	I	13
$(TSM\text{-}TTP)_3(I_3)_2$	Trimerized column	0.03	I	14
$(TSM\text{-}TTP)(I_3)_{5/3}$	Uniform column	200	T_{MI}=20K	14
$(TMET\text{-}TTP)(ReO_4)_{0.34}$	θ–type	30	I	15
$(TMET\text{-}TTP)(PF_6)_{0.27}$	θ–type	45	I	15
$(TMET\text{-}TTP)_4AuI_2$	θ–type	23	I	15
$(TMES\text{-}TTP)_4I_3$	θ–type	13	I	16
$(TMEO\text{-}TTP)_2Au(CN)_2$	β"-type	200	M'	17
$(TMEO\text{-}TTP)_3SbF_6$	Trimerized β'-type	9	I	18
$(TMEO\text{-}TTP)AuBr_2(THF)$	Dimerized column	0.12	I	19
(TMEO-ST-TTP)(TCNQ)(PhCl)	mixed stack	$5x10^{-5}$	I	20
$(TMEO\text{-}ST\text{-}TTP)_2ClO_4$(DCE)**	β–type	0.07	I	20
$(TMEO\text{-}ST\text{-}TTP)_2AsF_6$	β–type	40	M	21
$(TMEO\text{-}ST\text{-}TTP)_2PF_6$	β–type	30	M	22
$(TMEO\text{-}ST\text{-}TTP)_2TaF_6$	β–type	5	M	22
$(TMEO\text{-}ST\text{-}TTP)Au(CN)_2$	Dimerized column	$1x10^{-3}$	I'	22

(DTM-TTP)(TCNQ)(TCE)**	Uniform column	220	T_{MI}=100K	23
$(EO\text{-}TTP)_2PF_6$	β–type	1300	M	24
$(EO\text{-}TTP)_2AsF_6$	β–type	600	M	25
$(EO\text{-}TS\text{-}TTP)_2TaF_6$	β–type	880	M	26
$(EOET\text{-}TTP)_3AsF_6$	κ–type	600	M	27
$(BEDT\text{-}TTP)_2I_3$	β–type	900	M	28
$(EP\text{-}TTP)_2Au(CN)_2$	β–type	400	M	29
$(CPTM\text{-}TTP)_4PF_6$	λ–type	110	M'	30, 31
$(CPTM\text{-}TTP)_4AsF_6$	λ–type	70	M'	31,32
$(CPTM\text{-}TTP)_4SbF_6$	λ–type	7	T_{MI}=50K	31
$(DM\text{-}TS\text{-}TTP)_2PF_6$	β–type	55	M	33
$(ChTM\text{-}TTP)_2Au(CN)_2$	β–type	150	T_{MI}=120K	34
$(CPEO\text{-}TTP)(SbF_6)_{0.40}$	κ–type	60	M	35
$(CH\text{-}TTP)(I_3)_{0.31}$	κ–type	38	M	36
$(CH\text{-}TTP)_2ClO_4$	κ–type	9	M	37
$(CH\text{-}TS\text{-}TTP)_2AsF_6$	κ–type	-	-	37,38
$(CH\text{-}TS\text{-}TTP)_2Au(CN)_2$	κ–type	40	M	37,39
$(CHEO\text{-}TTP)_3TaF_6$	κ–type	50	M	40,41
$(CHEO\text{-}TTP)(ReO_4)_{0.38}$	κ–type	10	M	41
$(DTEDT)_3Au(CN)_2$	Uniform β–type	15	T_{SC}=4K	42
$(DSEDS)_3TaF_6$	Uniform β–type	9	M	43
(ET-PDT)$_4PF_6$(cn)**	λ–type	50	M	44
$(TM\text{-}TPDS)_2AsF_6$	$(TTF)I_x$-type	240	T_{MI}=100K	45

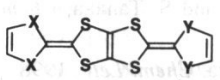
*M: Metallic (≥4.2 K). M': The resisitivity increased a little at low temperature, but is not semiconductive even at 4.2 K. I: semiconductor. T_{MI}: The temperature at metal to semiconductior transition. T_{SC}: Critical temperature of superconductive transition. **DCE = 1,2-dichloroethane, TCE = 1,1,2-trichloroethane, cn = 1-chloronaphthalene.

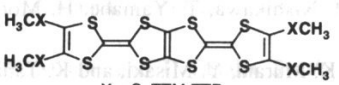
Table 2. References for the other physical properties of TTP type conductors

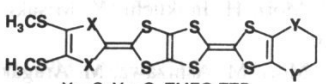
$(TTP)_2ClO_4$	High pressure conductivity,[46] TEP,[1] EPR,[1] Magnetic susceptibility,[46] Reflection[47]
$(TTP)_2BF_4$	High pressure conductivity,[46] TEP,[1] EPR,[1] Magnetic susceptibility,[46]
$(TTP)(ReO_4)_{0.36}$	High pressure conductivity,[46] TEP,[1] EPR,[1] Magnetic susceptibility,[46]
$(TTP)_2AsF_6$	Magnetoresistance anisotropy,[48] Reflection[47,49]
$(TTP)_2SbF_6$	Magnetoresistance anisotropy,[48] Reflection[47,49]
(TTM-TTP)I_3	High pressure conductivity,[50] TEP,[9] EPR,[50,51] Magnetic susceptibility,[50,52] Reflection,[53] Raman,[54] Low temperature X-ray[51,52]
$(TTM\text{-}TTP)(I_3)_{5/3}$	High pressure conductivity,[55] TEP,[9] EPR,[55] Raman,[56] Reflection[56]
$(TTM\text{-}TTP)AuI_2$	TEP[11]
$(TTM\text{-}TTP)AuBr_2$	TEP[11]
$(TTM\text{-}TTP)C(CN)_3$	TEP[12]

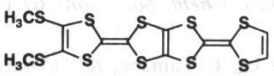
$(TSM\text{-}TTP)(I_3)_{5/3}$	High pressure conductivity,[55,57] EPR,[57] Magnetic susceptibility,[57] Raman,[56] Reflection[56]
$(TMET\text{-}TTP)(ReO_4)_{0.34}$	TEP,[58] EPR[58]
$(TMET\text{-}TTP)(PF_6)_{0.27}$	TEP,[58] EPR,[58] STM[59]
$(TMET\text{-}TTP)_4AuI_2$	TEP,[58] EPR[58]
$(TMEO\text{-}TTP)_2Au(CN)_2$	TEP,[17] EPR[17]
(DTM-TTP)(TCNQ)(TCE)	TEP,[23] Magnetic susceptibility[23]
$(EO\text{-}TTP)_2AsF_6$	TEP[25]
$(BEDT\text{-}TTP)_2I_3$	TEP,[28] EPR,[28] Angle dependent magnetoresistance[60]
$(EP\text{-}TTP)_2Au(CN)_2$	TEP,[29] EPR[29]
$(CPTM\text{-}TTP)_4PF_6$	High pressure conductivity[30]
$(ChTM\text{-}TTP)_2Au(CN)_2$	TEP,[61] EPR[61]
$(DTEDT)_3Au(CN)_2$	TEP[42b]
$(ET\text{-}PDT)_4PF_6(cn)$	EPR,[44] Magnetic susceptibility[44]

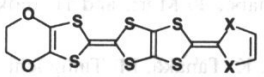
TTP donors and their abbreviation

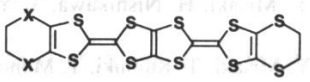


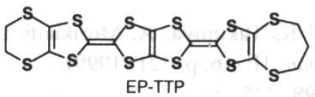


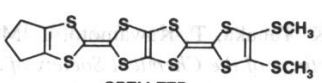


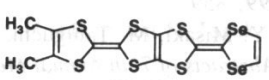


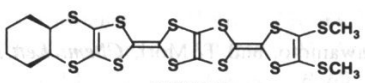


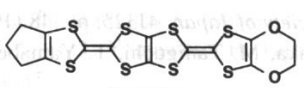


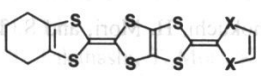


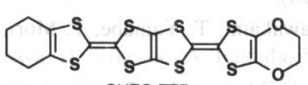


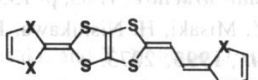


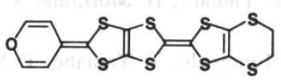


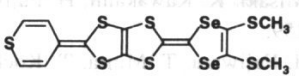












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