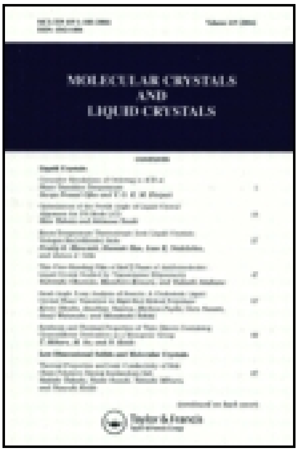

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New Pt Complex Oxides $R_2Ba_2CuPtO_8$(R = Er, Ho, Y), $R_2Ba_3Cu_2PtO_{10}$(R = Er, Ho, Y) and $Ba_4CuPt_2O_9$

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New Pt Complex Oxides $R_2Ba_2CuPtO_8$(R=Er,Ho,Y), $R_2Ba_3Cu_2PtO_{10}$(R=Er,Ho,Y) and $Ba_4CuPt_2O_9$

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Abstract Three types of new Pt complex oxides have been found out. $R_2Ba_2CuPtO_8$(R=Er, Ho, Y) are orthorhombic (space group Pcmn). These compounds posses a characteristic one-dimensional zig-zag chain $-\!\!(Cu^{2+}-O-Pt^{4+}-O-\!\!)$ structure. $R_2Ba_3Cu_2PtO_{10}$ (R=Er, Ho, Y) are monoclinic (space group C2/m). $Ba_4CuPt_2O_9$ without R elements is trigonal P^{P321}. The crystal growth, crystal structure and physical properties are described.

Single crystals of the new compounds were grown using a sintered oxides $RBa_2Cu_3O_{7-x}$ as a solute, and CuO as a flux in a platinum crucible. Growth procedure were consisted of four steps: (1) heating the mixture of the solute and the flux at a rate of 400°Ch^{-1}; (2) keeping it at 1100°C for 1h; (3) slowly cooling down to 900°C at a rate of 10°Ch^{-1}; (4) furnace cooling down to room temperature.

Platy single crystals were obtained in the solidified mass away from the inner wall of the Pt crucible: these were of $RBa_2Cu_3O_{7-x}$, well established ternary oxide superconductor. On the other hand, following three types of new Pt complex oxides were coagulated on the wall of the Pt crucible.

$R_2Ba_2CuPtO_8$ (R=Er^{1-3},Ho^{4},Y^{5-6})

Rectangular prism crystals of black luster were obtained. Results of the chemical analysis (ICP method) and EDX analysis showed that the crystals were of the $R_2Ba_2CuPtO_8$ (R=Er, Ho, Y). Crystallographic investigations revealed an orthorhombic symmetry (space group:Pcmn). These compounds possess a characteristic onedimensional, zig-zag chain $(Cu^{2+}-O-Pt^{4+}-O)$ structure (Fig.1).

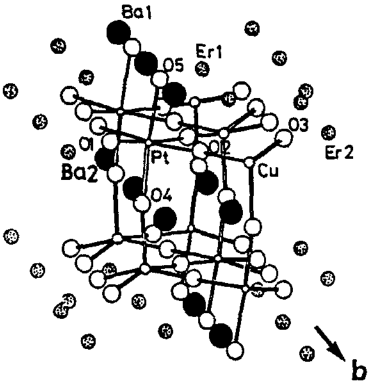

Fig. 1. Crystal structure of $Er_2Ba_2CuPtO_8$

The temperature-dependent conductivity of the crystals with different rare earth ions are shown in Fig.2. All compounds were clarified to be semiconductors with conductivity proportional to $\exp(T^{-1/2})$. These results are explained by a usual activation-type mechanism with a thermal lattice-vibration effect in the Mott-Hubbard model for $(Cu^{2+}-O-Pt^{4+}-O)$ zig-zag chains.[7] $Er_2Ba_2CuPtO_8$ shows successive anti-ferromagnetic orderings at 60K and 7K, while $Ho_2Ba_2CuPtO_8$ shows an antiferromagnetic one at 2K, and $Y_2Ba_2CuPtO_8$ shows the anti-

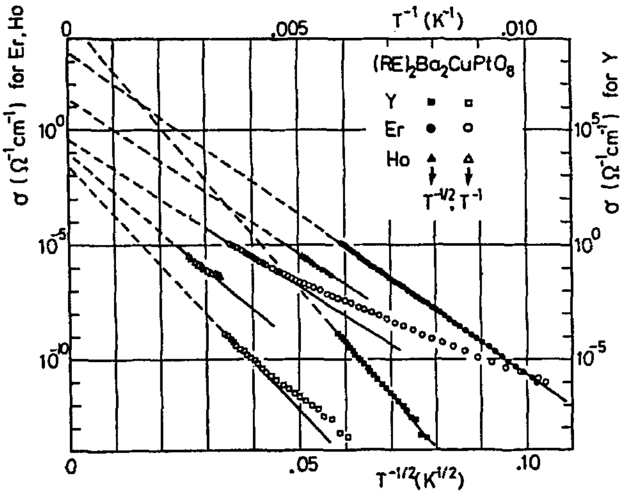

Fig. 2. Logarythmic conductivity as a function of inverse of temperature for $R_2Ba_2CuPtO_8$(R=Er,Ho,Y).

ferromagnetic ordering. As an example, Fig.3 shows these strong anisotropy in susceptibility peaks centered around 7K, which is explained by the crystal field anisotropy of Er^{3+} localized moment. Properties are summarized in Table 1.[8]

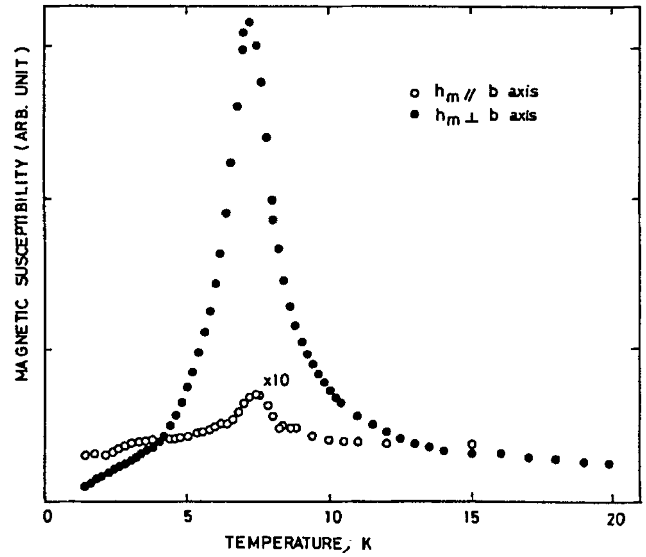

Fig. 3. Magnetic susceptibility as a function of temperature for $Er_2Ba_2CuPtO_8$.

$R_2Ba_3Cu_2PtO_{10}$ (R=Er[9],Ho[10],Y[10-13])

These compounds were black luster platelets. Crystallographic investigations showed monoclinic symmetry (space group C2/m). Crystallographic data are summarized in Table 2. Measurement of the physical properties are in progress.

$Ba_4CuPt_2O_9$[14]

This compound of transparent green was obtained as rectangular prism crystals and was free from R elements. Satellite reflections typical for a modulated structure were observed in the X-ray diffraction experiments: trigonal, $P^{P321}_{1\bar{1}1}$, a=10.081(3) Å, c_0=4.224(5) Å, q=0.519c_0^*, V=371.7

Å^3, Z=1.5. The structure is built of columns parallel to the c axis consisting of Pt_2O_9 and Cu linked alternatively. There are two variants of the position of the column related by vector shifts c_0. A superlattice is formed by a periodic alternation of the two variants in one dimension. Ba ions are located between the columns. Further characterization of this compound is currently under way.

Table 1 Crystallographic data and Physical properties of $R_2Ba_2CuPtO_8$ (R=Er, Ho, Y).

R	crystal structure	electrical properties	Eg	magnetic ordering
Er	orthorhombic a=10.287(3)Å b=5.659(1)Å c=13.157(3)Å V=765.9Å^3 Z=4 Pcmn	Semi-con $\sigma \propto \exp(-\frac{1}{\sqrt{T}})$ non-ohmic	~0.1ev	AF at 60K(Cu^{2+}) only in H//b AF(CAF) at 7K(Er^{3+})
Ho	orthorhombic a=10.303(2)Å b=5.668(1)Å c=13.178(3)Å V=769.6(3)Å^3 Z=4 Pcmn	Semi-con $\sigma \exp(-\frac{1}{\sqrt{T}})$ non-ohmic	~0.1ev	AF at 2K(Ho^{3+})
Y	orthorhombic a=10.321(2)Å b=5.680(2)Å c=13.201(2)Å V=774Å^3 Z=4 Pcmn	Semi-con $\sigma \exp(-\frac{1}{\sqrt{T}})$ non-ohmic	~0.15ev	

Table 2 Crystallographic data of $R_2Ba_3Cu_2PtO_{10}$ (R=Er, Ho, Y).

Formula	$Er_2Ba_3Cu_2PtO_{10}$	$Ho_2Ba_3Cu_2PtO_{10}$	$Y_2Ba_3Cu_2PtO_{10}$
C. S.	monoclinic	monoclinic	monoclinic
S. G.	C2/m	C2/m	C2/m
a/Å	12.465(3)	12.516(3)	12.520(3)
b/Å	5.795(1)	5.813(1)	5.817(1)
c/Å	7.326(1)	7.350(3)	7.357(1)
β (°)	105.54(2)	105.54(2)	105.53(2)

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