

substance: WO₃

property: transport properties (general)

The complexity of the crystallographic transitions in WO₃ is reflected in the behaviour of the resistivity (see Figs. 1, 2). Throughout the region 0...200 K the material behaves like a semiconductor but anomalies at 40, 70, 130 and 185 K have been observed. In the higher temperature region, about RT, there are several anomalies (Fig. 3). The discontinuous decrease of the resistivity on passing from the low temperature monoclinic phase to the triclinic phase at $\approx -50^{\circ}\text{C}$ is due to a change of a factor of 200 in the carrier-concentration [70B]. The ac resistivity also shows a strong anomaly at $\approx -50^{\circ}\text{C}$ (Fig. 4).

activation energies for conductivity

E_A	0.10 eV	$T = 187\ldots 260\text{ K}$	75L
	0.19 eV	$T = 140\ldots 185\text{ K}$	
	0.052 eV	$T = 81\ldots 110\text{ K}$	
	0.028 eV	$T = 38\ldots 68\text{ K}$	
	0.006 eV	$T = 14\ldots 34\text{ K}$	
	0 eV	$T = 4.2\ldots 14\text{ K}$	80H
	0.19...0.10 eV	below $T = 223\text{ K}$	
	0.4 eV	below $T = 223\text{ K}$	
	0.23 eV	below $T = 223\text{ K}$	
	0.039 eV	triclinic phase, $T = 233\text{ K}\ldots\text{RT}$	

Above RT the resistivity of the monoclinic phase rises with T (Fig. 5). Further studies of both the Hall and Seebeck coefficients of the monoclinic and triclinic phases have been reported [70B]

References:

- 70B Berak, J. M., Sienko, M. J.: J. Solid State Chem. 2 (1970) 109.
- 75L Lelkowitz, M., Dowell, M. B., Shields, M. A.: J. Solid State Chem. 15 (1975) 24.
- 77B Bonnet, J. P., Marquastant, E., Onillon, M.: Mater. Res. Bull. 12 (1977) 361.
- 80H Hirose, T.: J. Phys. Soc. Jpn. 49 (1980) 562.

Fig. 1.

WO_{3-x} . Resistivity vs. oxygen partial pressure at 750°C for both single crystal (left hand scale) and sintered discs. Values of x in the range 0...0.04 [77B]. Orientation for single crystals not specified.

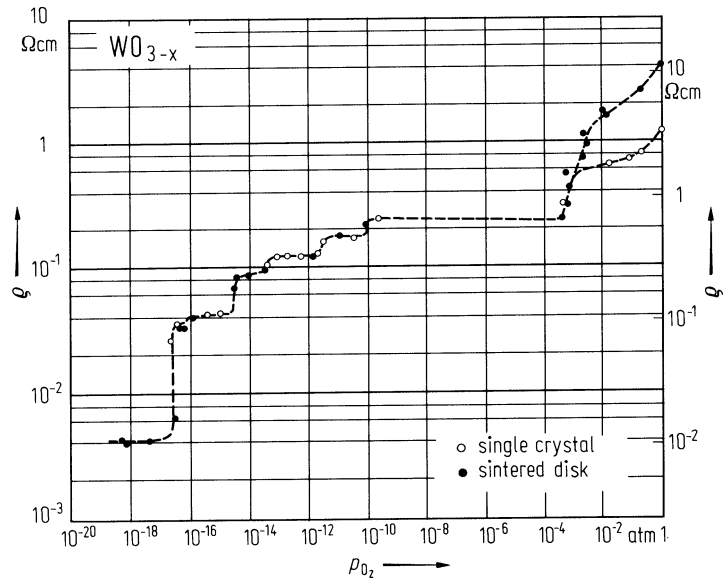


Fig. 2.

WO₃. dc resistivity vs. temperature for a stoichiometric crystal [75L]. Bulk volume ρ measured between (001) faces of a single crystal during cooling.

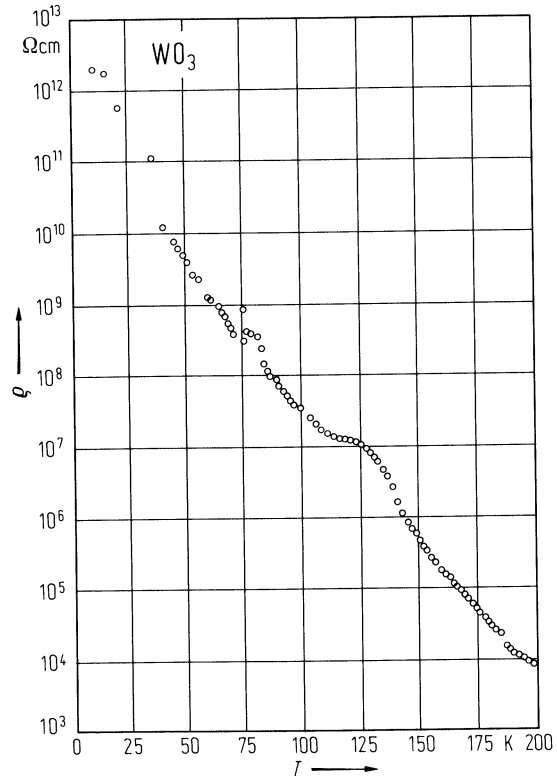


Fig. 3.

WO₃. Resistivity vs. (reciprocal) temperature [80H].

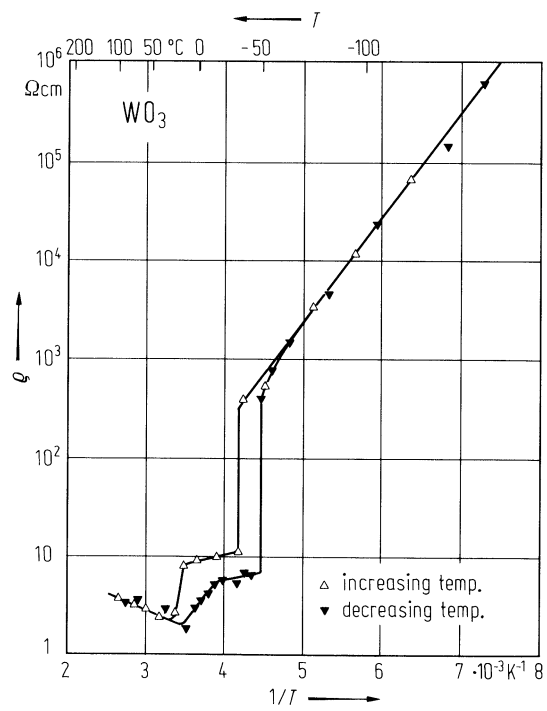


Fig. 4.

WO_{3-x} . ac resistivity vs. temperature for a single crystal sample prepared by heating WO_3 in vacuum for 36 h at 1090 K [75L]. ρ measured by 4-point probe method, points are collinear in an arb. direction on the (001) face.

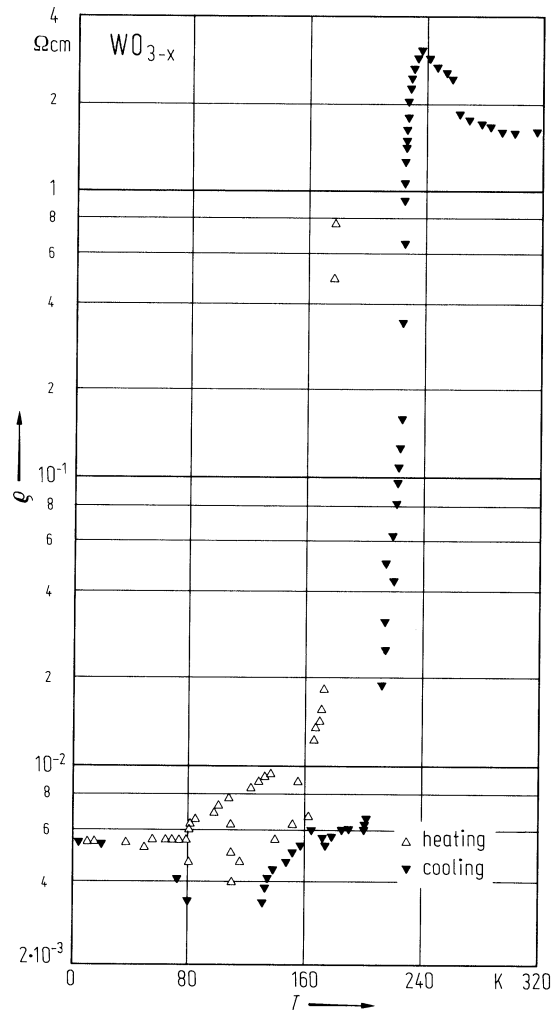


Fig. 5.

WO₃. Resistivity along *a* axis vs. reciprocal temperature for $T > 300$ K [70B].

