

substance: WO₃

property: transport properties, reduced WO₃

Substantial qualitative changes occur in behaviour on reduction to WO_{3-x}: (a) The monoclinic-triclinic transformation at ca. -10°C is suppressed for $x \geq 10^{-4}$ (Fig. 1). (b) As x increases, the activation energy for conduction in the triclinic phase increases. (c) As the monoclinic-triclinic transition is lost, the conductivity in the high-temperature monoclinic phase becomes activated (Fig. 2). (d) In the low-temperature monoclinic phase (α -WO₃) the activation energy decreases with increasing x (Fig. 1). (e) The change in resistivity around the γ -WO₃-triclinic transition is mimicked by the carrier concentration (Fig. 3). As x increases the activation energy for the carrier concentration in the (low- T) monoclinic region increases from 0.01...0.016 eV in the stoichiometric material to 0.03...0.05 eV in the range $0.0002 \leq x \leq 0.0005$. (f) The Hall mobility in the high-temperature monoclinic phase also becomes activated as x increases (Fig. 4) and the distinct change at the high-temperature monoclinic-triclinic transition is lost. This activation has been ascribed to impurity scattering, though a quantitative fit to the theory could not be obtained. (g) The Seebeck coefficient decreases strongly with increasing x in the high-temperature monoclinic region (Fig. 5) and becomes temperature independent. Below 300 K the behaviour is complex (Fig. 6).

References:

70B Berak, J. M., Sienko, M. J.: J. Solid State Chem. 2 (1970) 109.

Fig. 1.

WO_x . Resistivity vs. reciprocal temperature for various reduced samples near the monoclinic-triclinic transition [70B]. $\rho \parallel a$

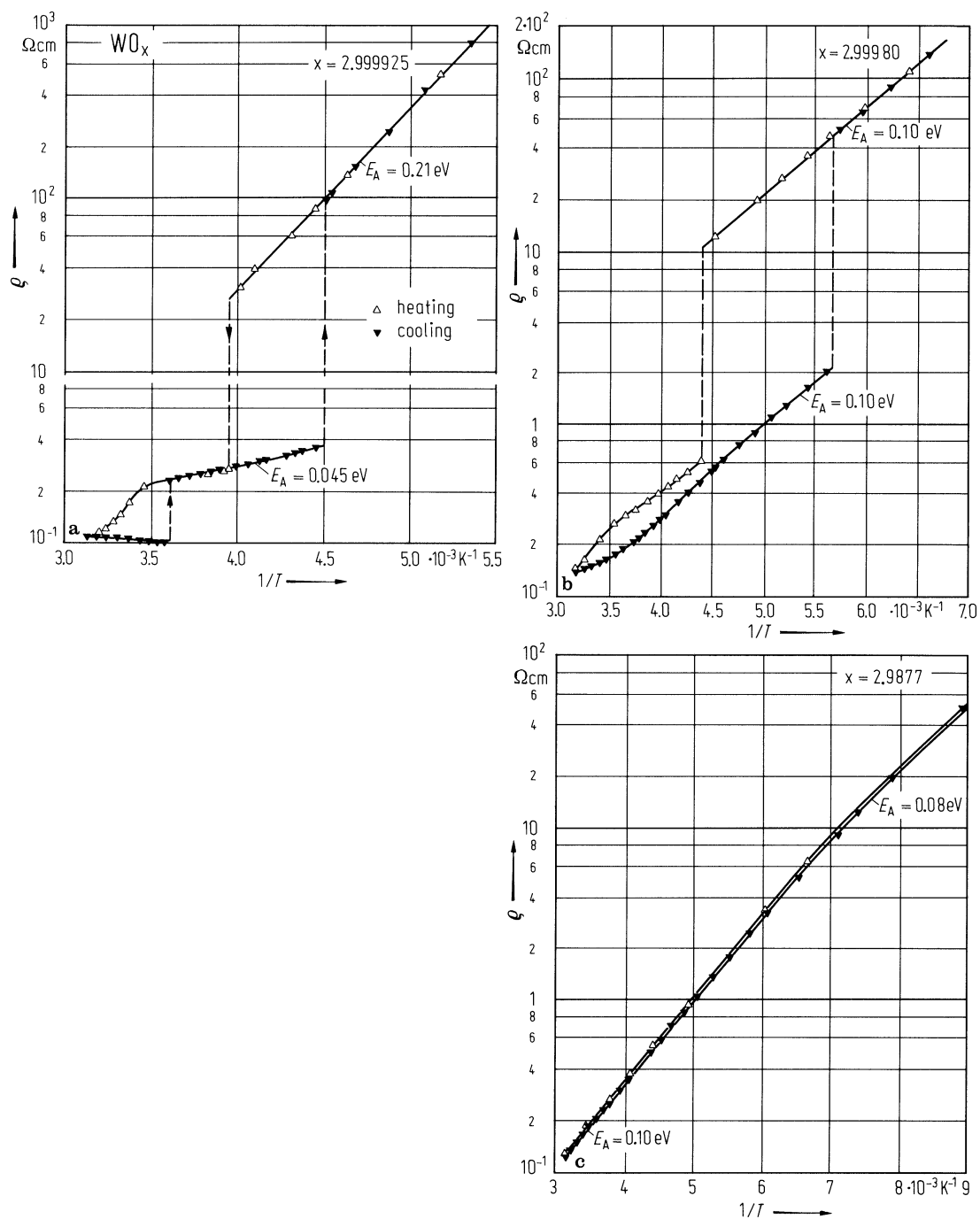


Fig. 2.

WO_x . Resistivity vs. reciprocal temperature above 300 K for various reduced samples; numbers 1...4 refer to successive heating or cooling parts of the cycle [70B]. $\rho \parallel a$

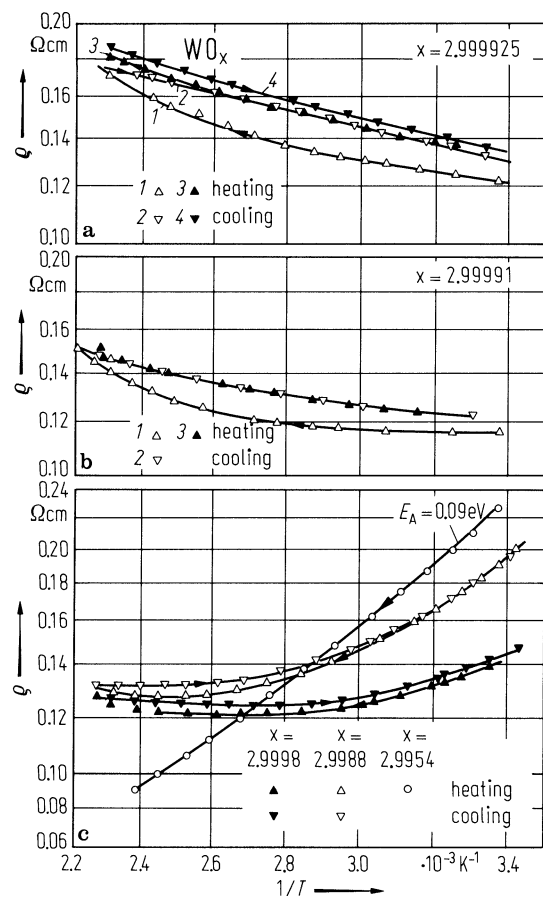


Fig. 3.

WO_x . Hall carrier concentration vs. reciprocal temperature below 300 K for various reduced samples [70B].

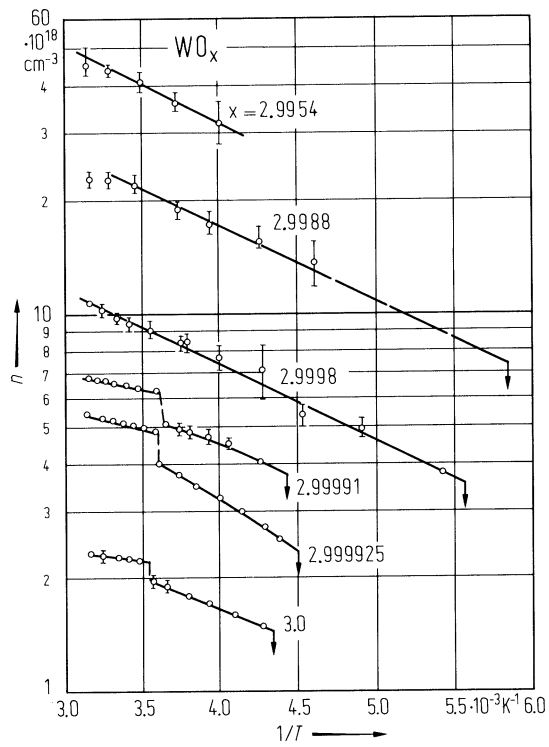


Fig. 4.

WO_x. Hall mobility vs. reciprocal temperature above 300 K for various reduced samples [70B]. Slope of WO₃ is shown for comparison. $\mu \parallel a$.

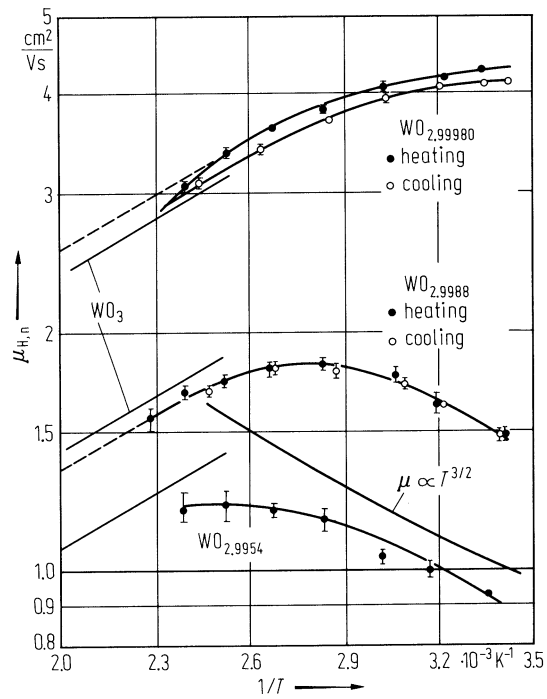


Fig. 5.

WO_x . Seebeck coefficient vs. temperature above 300 K for various reduced samples [70B]. $S \parallel a$.

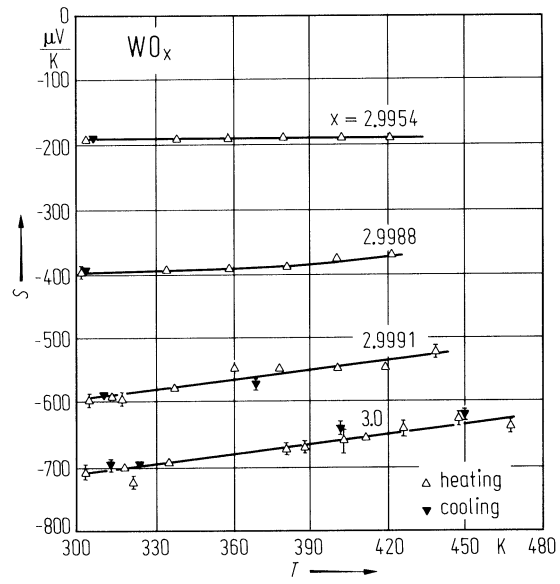


Fig. 6.

WO_x . Seebeck coefficient vs. temperature below 300 K for various reduced samples [70B]. $S \parallel a$.

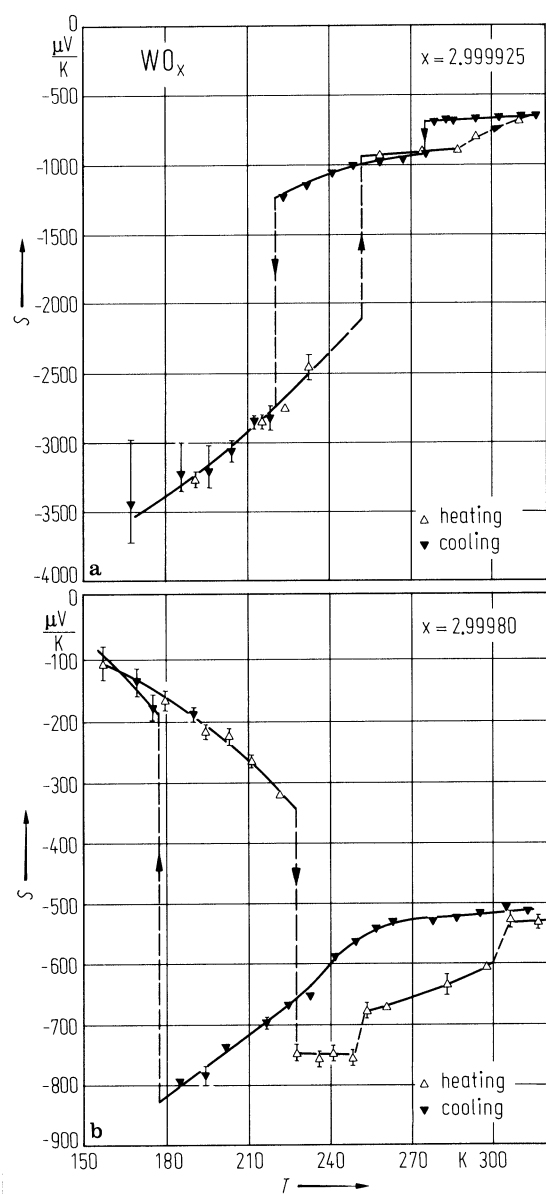


Fig. 38. WO_x . Seebeck coefficient vs. temperature below 300 K for various reduced samples [70B1]. $S \parallel a$.