

substance: MoO₃

property: electronic and ionic conductivity

At high temperatures the conductivity of MoO₃ appears to be partially ionic.

ionic conductivity parameters

$t_+ + t_-$	0.58	$T = 800 \text{ K},$ 0.00025 atm $< p_{\text{O}_2} < 0.21 \text{ atm}$	t_+ and t_- are transport numbers for cation (t_+) and anion (t_-)	74Z
	0.44	$T = 950 \text{ K}$		
	0.72	$T = 700...950 \text{ K}$		71E
D_0	$9.1 \cdot 10^{-8} \text{ cm}^2 \text{ s}^{-1}$		parameters in the relation $D = D_0 \exp(-E/RT)$ where	
E	$20.3 \text{ kcal mol}^{-1}$		$D = kT(t_+ + t_-) \sigma / N_i z_i^2 e^2$ and N_i is the number concentration of ions of charge $z_i e$	

activation energy of electronic conductivity

1.7 eV	$p_{\text{O}_2} = 0.21 \text{ atm},$ $T = 560$ $...739 \text{ }^\circ\text{C}$	typical data for a crystal grown and measured in Ar is given in Fig. 1; at temperatures below $\approx 500 \text{ }^\circ\text{C}$ reproducibility is found for samples pre-sintered at various temperatures: Fig. 2	74Z
2.3 eV	$2 \cdot 10^{-4} \text{ atm}$		
3.6 eV	$< 10^{-4} \text{ atm}$		
0.60(5) eV	$T < 500^\circ\text{C}$		69I
0.29...0.70 eV	$T < 500^\circ\text{C}$		68D
1.83(10) eV	$T > 500^\circ\text{C}$		68D
0.30 eV	$T \approx 25^\circ\text{C}$		78S

Seebeck coefficient: little reproducibility (Fig. 3), considerable hysteresis.

ac conductivity: proportional to ω^s , where s is a temperature dependent number near 0.8, Fig. 4. The ac conductivity can be written $\sigma \propto BT \omega^s \exp(-E_A/kT)$ with $E_A \approx 0.015...0.020 \text{ eV}$ ($T = 90...183 \text{ K}$) [78S].

References:

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Fig. 1.

MoO₃. Conductivity vs. reciprocal temperature for a single crystal grown and measured in argon; crystal heated from RT to 650 K, held for 20 h and then cooled as shown (orientation not given) [69I].

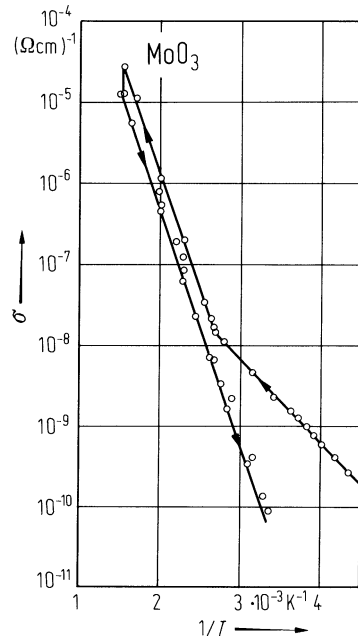


Fig. 2.

MoO_3 . Conductivity vs. reciprocal temperature for an unoriented single crystal sintered at (1) 715 K, (2) 710 K, (3) 649 K, (4) 629 K, (5) 653 K [69I].

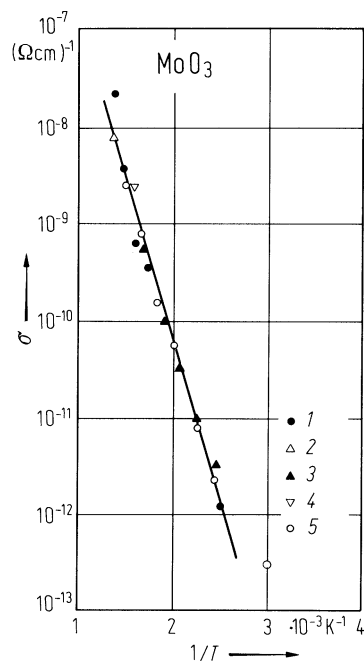


Fig. 3.

MoO_3 . Seebeck coefficient vs. temperature for an unoriented single crystal grown and measured in argon. Sample held between 1 and 2 for 17 h and between 3 and 4 for 23 h [69I].

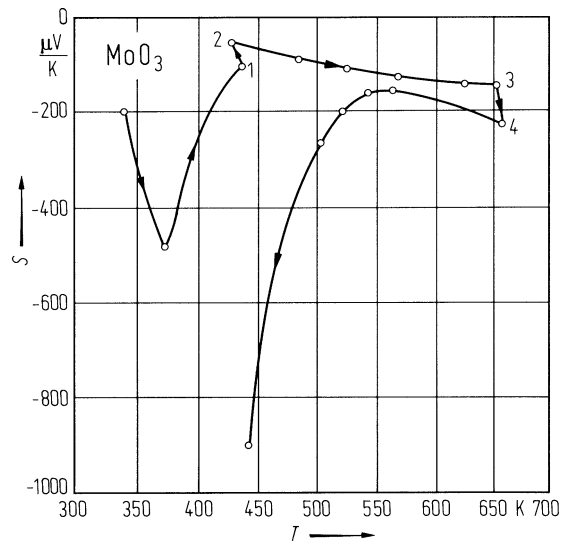


Fig. 4.

MoO₃. (a) Conductance and (b) capacitance vs. frequency for a single crystal. At 366 K the dashed line in Fig. (a) was obtained by subtracting the dc conductance from the solid curve [78S]. s is a temperature dependent number in $\sigma_{ac} \propto \omega^s$.

