**substance: CoO**
**property: electrical conductivity, Seebeck coefficient**

**activation energies for conductivity**

| | | | | |
|---|---|---|---|---|
| $E_A$ | 0.22...0.57 eV | $T$ = 220...290 K | quenched samples in which $\delta$ of $Co_{1-\delta}O$ varies from 0.012...0.001 | 66F |
| | 0.24...0.5 eV | $T$ = 200...300 K | quenched samples: $\delta$ = 0.012...0.002 | 67B |
| | 0.29...0.43 eV | $T$ = 150...300 K | Li doped samples; smaller energies correspond to larger lithium content | 69B |
| | 0.41...0.49 eV | $T$ = 290...420 K | Li doped single crystal | 67A |
| | 0.58 eV | $T$ = 1270...1670 K | region A | 66F |
| | 0.70 eV | $T$ = 1270...1670 K | region B | 66F |
| | 0.48 eV | $T$ = 1270...1470 K | | 68E |
| | 0.742 eV | $T$ = 300...500 K | single crystal | 80J |

Conductivity dependence on oxygen partial pressure: Fig. 1, on Li addition: Figs. 5, 6, 8. The deviation from linearity at low values of Li dopant is due to Co vacancies dominating the conductivity. This is borne out by the Seebeck data (Fig. 7).

**activation energy for Seebeck coefficient**

| | | | | |
|---|---|---|---|---|
| $E_A$ | 0.54 eV | $T$ = 1270...1670 K | region A | 66F |
| | 0.94 eV | $T$ = 1270...1670 K | region B | 66F |
| | 0.27...0.42 eV | $T$ = 290...420 K | Li-doped single crystal | 67A |
| | 0.306 eV | $T$ = 300...1000 K | single crystal | 80J |

Positive sign of Seebeck coefficient (Fig. 2, 3) supports conduction by holes. Sign inversion at high temperatures near Co/CoO boundary [70G, 72G]. For lithium doped samples the similarity of the slopes for the thermopower and conductivity suggests that conduction is of the band or large-polaron type [71B, 67A, 67B, 65Z] (see also Fig. 4), but results on single crystals that have been annealed at high temperature suggest the possibility of activated conductivity [77D, 66F, 80J]. For Seebeck coefficient of Li doped samples, see also Fig. 7.

## References:


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**Fig. 1.**

$Co_{1-\delta}O$. Electrical conductivity vs. oxygen activity at various temperatures. Data from [68E, 66S, 36W, 75M, 72G, 66F]. [77D].

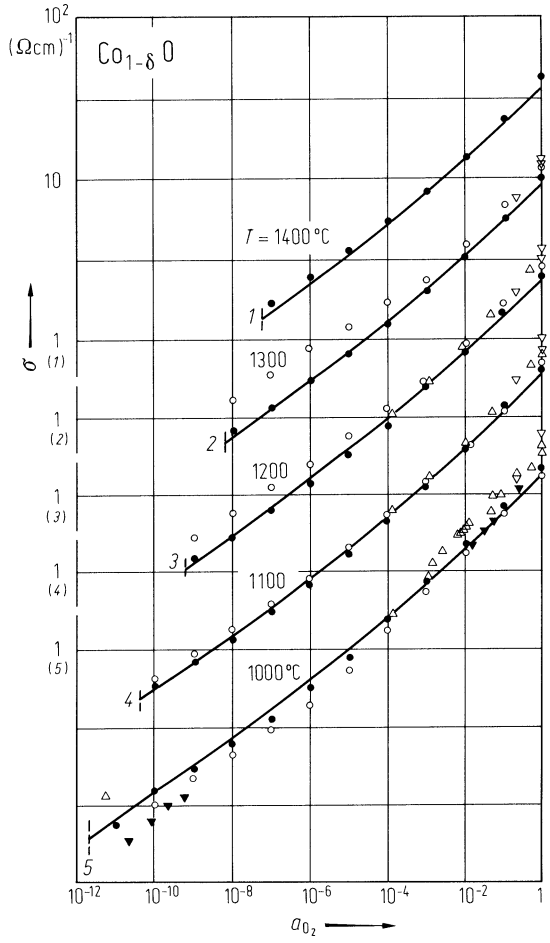


**Fig. 2.**

CoO. Conductance and reduced Seebeck coefficient vs. reciprocal temperature for a single crystal [71B].

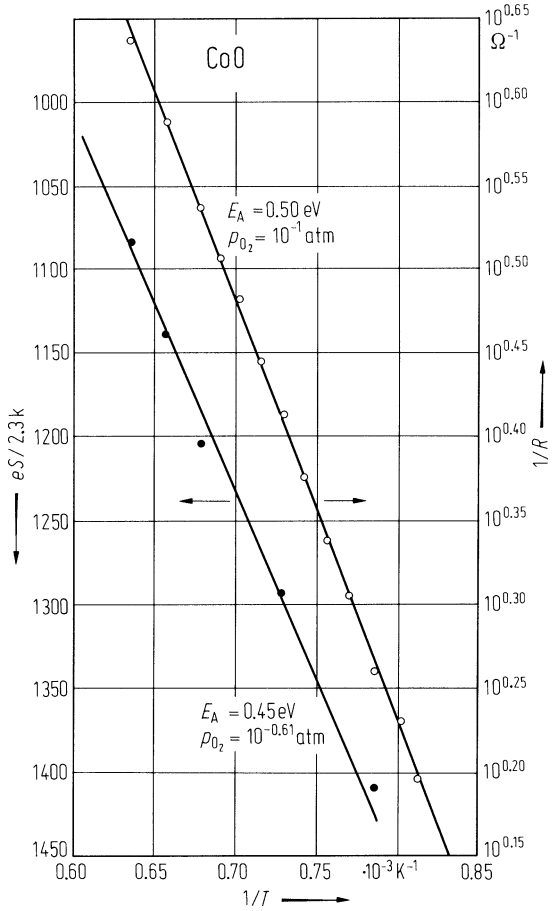


**Fig. 3.**

CoO. (a) Resistivity and (b) Seebeck coefficient vs. reciprocal temperature for various pure single crystals. *1* data from [80J], *2* data from [67B].

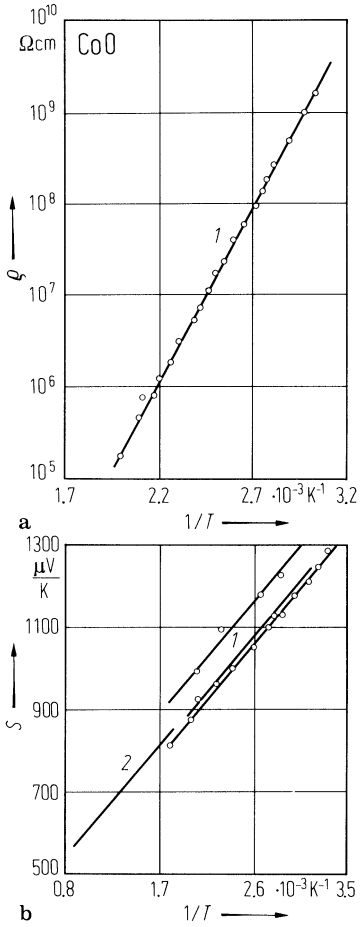


**Fig. 4.**

CoO. Hall mobility for holes vs. (reciprocal) temperature for a non-stoichiometric and a Li doped sample [67N].

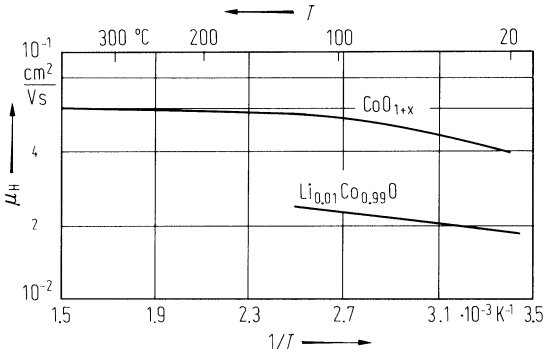


**Fig. 5.**

$Li_xCo_{1-x}O$. Resistivity vs. reciprocal temperature for various Li doped samples. Open symbols: from dc measurements, full symbols: from ac measurements [69B].

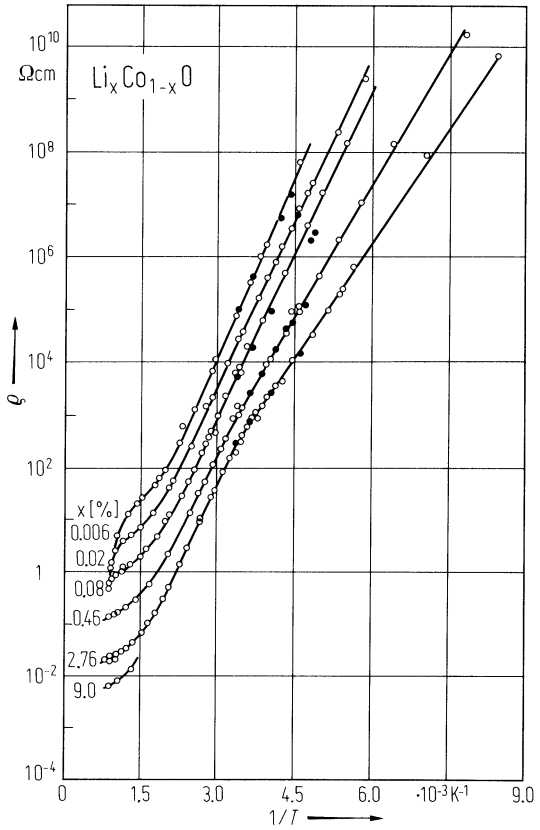
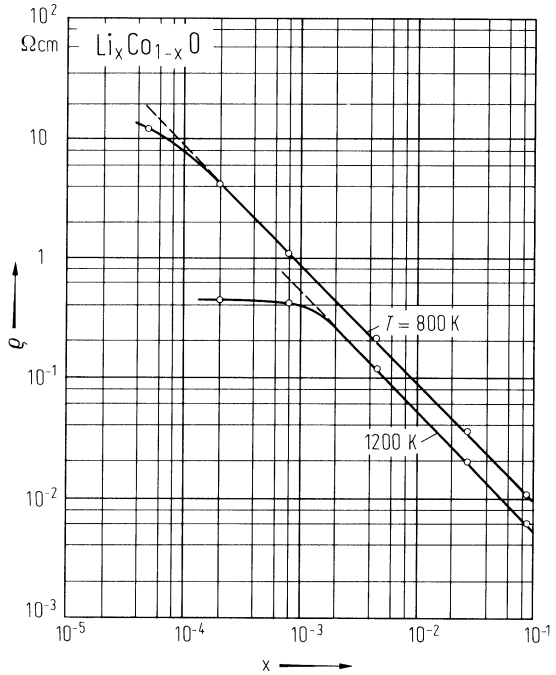


**Fig. 6.**

$Li_xCo_{1-x}O$. Resistivity vs. Li content at 800 K and 1200 K [69B].



## Fig. 7.

$Li_xCo_{1-x}O$. Seebeck coefficient vs. temperature for 0.08 at% Li doped CoO (a). (b) shows the high temperature region expanded together with results for 0.006 at% Li doped material [69B].

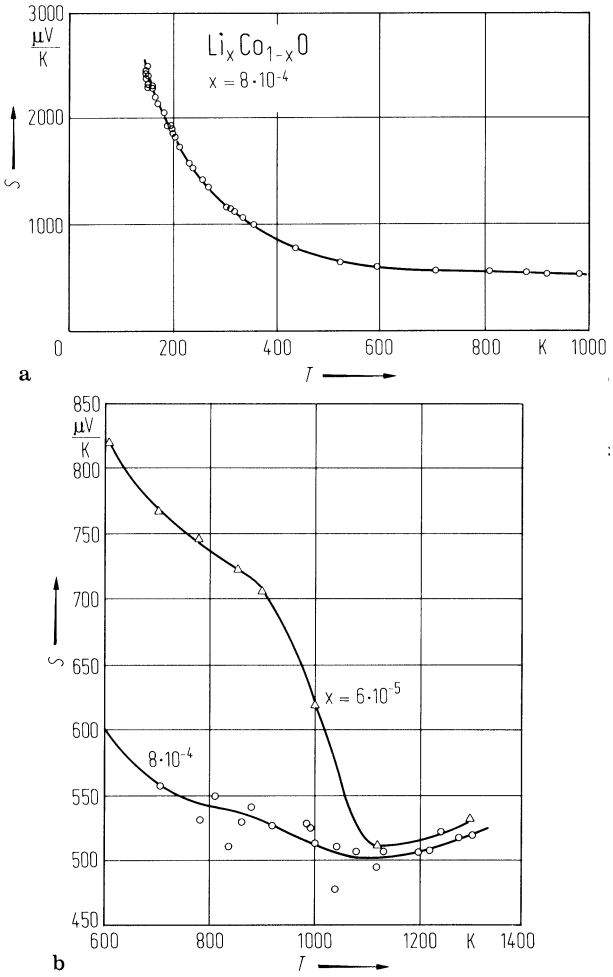


**Fig. 8.**

CoO:Li. Hall mobility, Hall coefficient and resistivity vs. (reciprocal) temperature for p-type Li doped ceramic samples measured in nitrogen ($N_2$) or oxygen ($O_2$) atmosphere [67D].