substance: boron compounds with lanthanides
property: properties of lanthanide borides of the type MB_{66}: GdB_{66}

Electronic properties

energy gaps and activation energies
(in eV)

E_g	0.87		el. cond.	86G1
	0.68		Seebeck coeff.	87G2
E_A	0.2			87G2

See also [81G].

critical points of GdB_{62} in the interband transition range
(E in eV)

E_{crit}	1.43	T = 300 K	YB_{62} used for reference, obtained from structure-modulated reflectivity spectra	99W
	1.51			
	1.58			
	2.45			
	2.64			
	2.80			
	3.08			
	3.34			
	3.62			
	3.79			
	4.01			
	4.26			
	4.61			
	4.84			
	4.92			
	5.19			
	5.85			

X-ray emission spectrum in [91G1].

Transport properties

electrical conductivity
(in Ω^{-1} cm^{-1})

σ	$2 \cdot 10^{-3}$	T = 300 K		87G2 86G1
	$1 \cdot 10^{-3}$...$7 \cdot 10^{-2}$	T = 300 K	GdB_x (x = 72 ... 80)	91G2

Temperature dependence of conductivity in Fig. 1 [81G, 87G2, 86G1, 91G2].

Electrical conductivity of GdB_{80}, $GdB_{78.5}$, GdB_{72} in Fig. 2 [94G].

carrier concentration *p*, Seebeck coefficient *S*, and Hall mobility μ_H (at *T* = 300 K)

p	$1.5 \cdot 10^{15}$ cm^{-3}		derived from Hall effect (Fig. 10)	81G
S	+ 390 µV K^{-1}			
$\mu_{H,p}$	15 cm^2/V s			
p	$1 \cdot 10^{15}$ cm^{-3}			86G1
S	390 µV K^{-1}	*T* = 300 K		86G2
	375 µV K^{-1}	*T* = 300 K	$GdB_{78.5}$	94G
	220 µV K^{-1}	*T* = 300 K	GdB_{80}	
$\mu_{H, p}$	5 cm^{2}V^{-1} s^{-1}			87G2
	15 cm^{2}V^{-1} s^{-1}			86G1

Thermoelectric power of GdB_{80} and $GdB_{78.5}$ in Fig. 3 [94G].

For temperature dependence of the electrical conductivity and the thermoelectric power see also [80G, 81G, 87G1, 89G1].

characteristic parameter
(T_0 (in K): parameter in Mott´s law of variable-range hopping $\sigma \propto \exp (T_0/T)^{1/4}$)

T_0	$4 \cdot 10^6$		86G1
	$1.8...7.4 \cdot 10^7$	GdB_x (x = 72 ... 80)	91G2
	$4.0 \cdot 10^7$	$GdB_{78.5}$	94G
	$1.0 \cdot 10^7$	GdB_{80}	

Optical properties

Urbach tail of the absorption edge in Fig. 4 [91G1, 91G2].

IR reflectivity spectrum of GdB_{62} in Fig. 5 [98S, 99S].

Raman spectrum of GdB_{66} in Fig. 6 [89G1, 91G2].

For IR absorption spectrum, see [91G2].

Further properties

density

d	2.813 g cm^{-3}	*T* = 300 K	$GdB_{62.5}$	94M

sound velocity

v_t	$7.77 \cdot 10^5$ cm s^{-1}	*T* = 300 K		94M

thermal conductivity

κ	3.15 W cm^{-1}K^{-1}	*T* = 300 K	independent of composition (Fig. 7)	94G
	$3 \cdot 10^{-2}$ W cm^{-1}K^{-1}		independent of composition	91G2

Thermal conductivity in [89C].

Temperature dependence of the thermal conductivity of $GdB_{62.5}$ and GdB_{66} in Fig. 8 [86G1, 94M].

Internal friction depending on temperature in Fig. 9 [94M].

microhardness

H	$2.5 \cdot 10^{-8}$ N m^{-2}	T = 300 K	method not specified	91G2

Microhardness depending on the composition in Fig. 7 [94G].

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Fig. 1.

SmB_{66}, GdB_{66}, YbB_{66}. Electrical conductivity and carrier concentration (derived from Hall effect) vs. reciprocal temperature [81G].

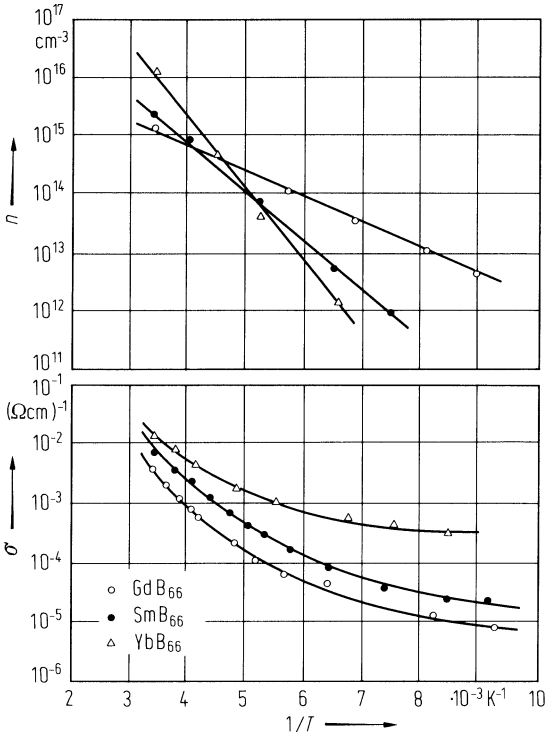

Fig. 2.

$GdB_{\sim 66}$. Temperature dependence of the electrical conductivity; σ vs. reciprocal T for GdB_{80}, $GdB_{79.5}$, $GdB_{78.5}$, GdB_{72} [94G].

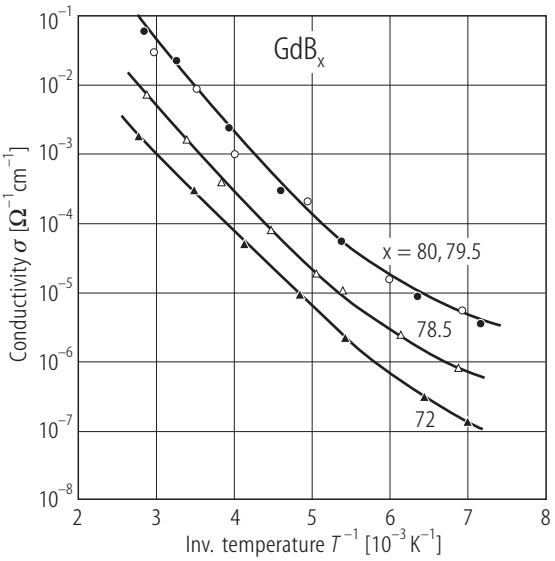

Fig. 3.

$GdB_{\sim 66}$. Temperature dependence of the thermoelectric power for GdB_{80} and $GdB_{78.5}$ [94G].

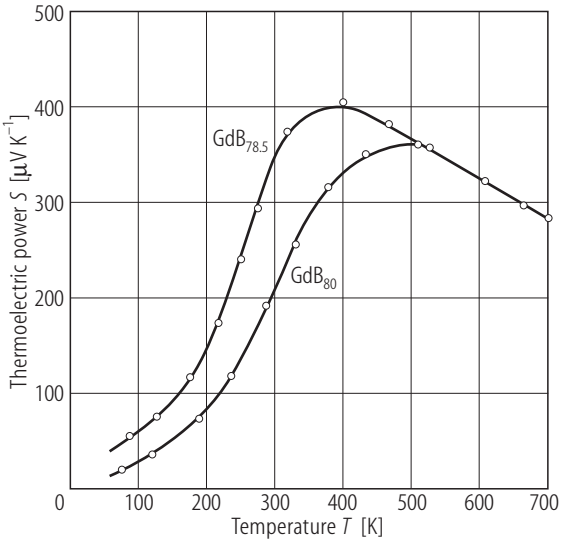

Fig. 4.

GdB_{66}. Absorption coefficient α vs. photon energy showing an Urbach-type behavior [91G1, 91G2].

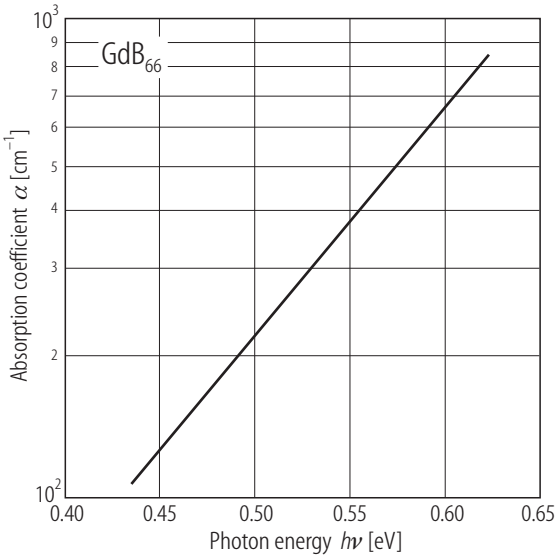

Fig. 5.

GdB_{62}. Reflectivity vs. wavenumber for 90, 300 and 450 K [98S, 99S].

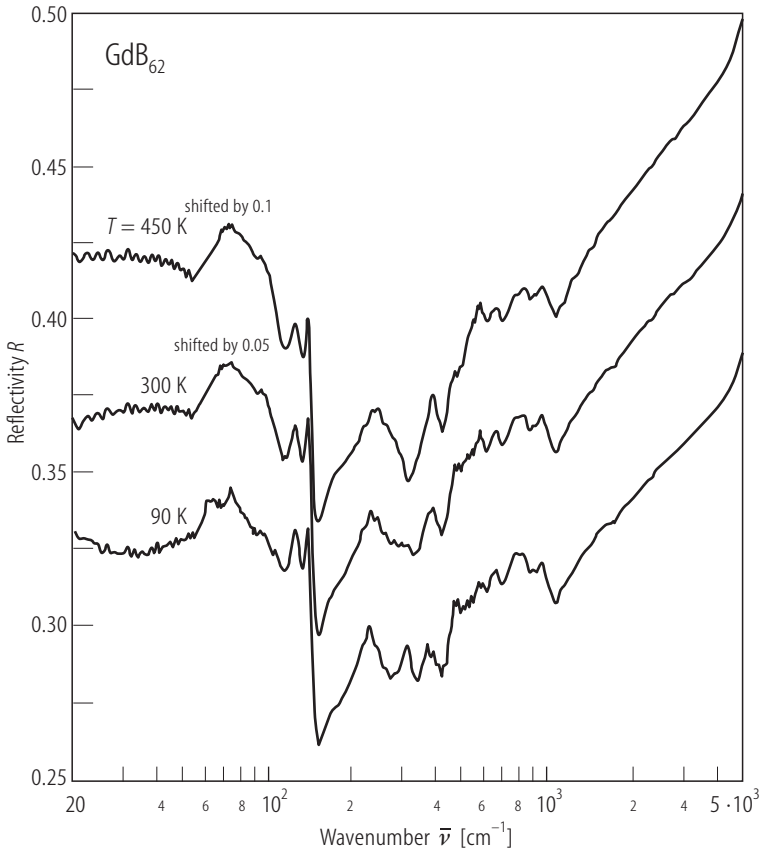

Fig. 6.

GdB_{66}. Raman intensity vs. Raman shift in wavenumbers [89G2, 91G3].

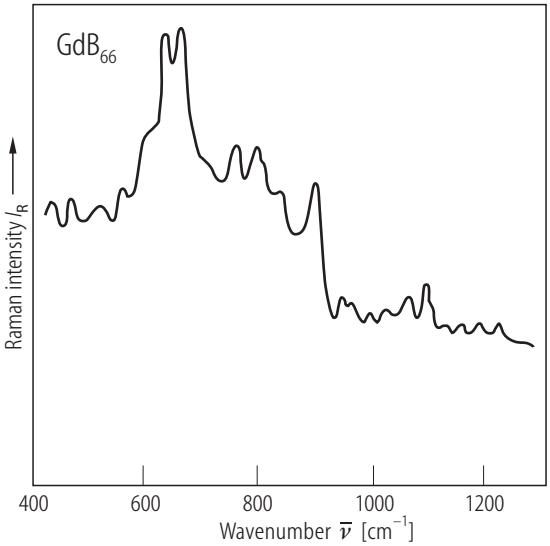

Fig. 7.

$GdB_{\sim 66}$. Hardness and thermal conductivity vs. composition for GdB_x (x = 70...80) at T = 300 K [94G]. Type of hardness not specified.

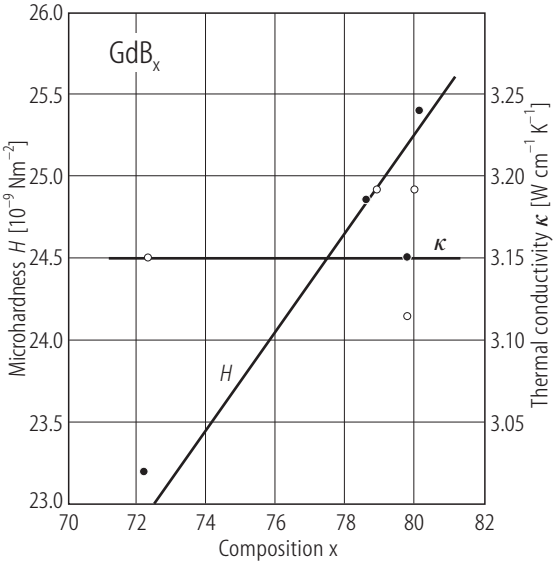

Fig. 8.

YB_{66} structure group. Temperature dependence of thermal conductivity. Open symbols: $YB_{66\pm X}$ (squares, $YB_{61.7}$ [92R, 94M]; triangles, YB_{66} [71S, 94M], circles, YB_{66} [87C, 89C, 94M], diamonds, YB_{66} [77S, 94M]); closed symbols: $GdB_{66\pm X}$ (circles, GdB_{66} [86G1], triangles down, $GdB_{62.5}$ [94M]).

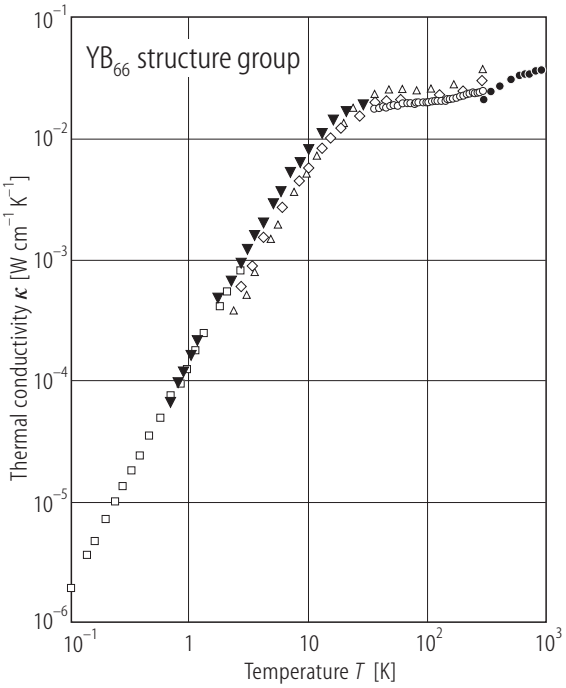

Fig. 9.

$GdB_{62.5}$. Internal friction Q^{-1} vs. T [94M].

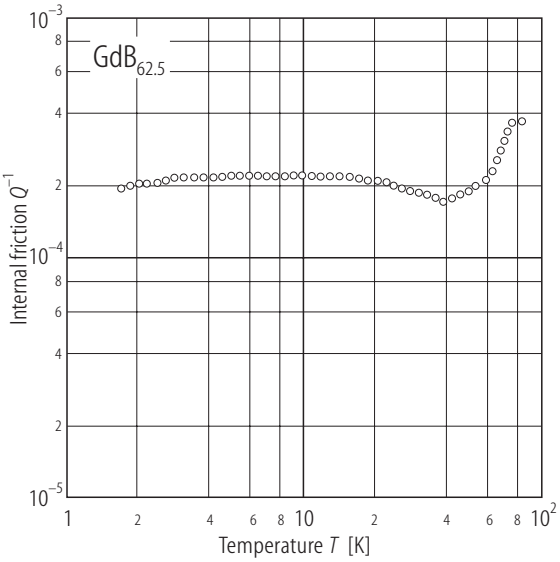

Fig. 10.

SmB_{66}, GdB_{66}, $Yb_{B6}6$. Electrical conductivity and thermoelectric power vs. carrier concentration [81G].