6 Anhang

6.1 Thermodynamische Datenbank

Mit Ausnahme der in dieser Arbeit gewonnenen Daten für $CuGaSe_2$ und Ga_2Se_3 (markiert durch *) wurden die Angaben dem Handbuch von Kubaschewski entnommen [69]. T_{max} gibt die Grenze an, oberhalb derer die Daten ihre Gültigkeit verlieren. Bei Stoffen mit mehreren Phasen ist die Übergangsenthalpie angegeben. Die molare Wärme wird entwickelt gemäß $C_p = a + b\,T + c\,T^2 + d\,T^{-2}$.

GAS	T_{max}	ΔH_{298}	ΔS_{298}	a	b	c	d
	K	J mol^{-1}	J K^{-1} mol^{-1}	J K^{-1} mol^{-1}	10^{-3} J K^{-2} mol^{-1}	10^{6} J K mol^{-1}	10^{-6} J K^{-3} mol^{-1}
Cl (g)	2000	121264	165,146	23,73	-1,285	-0,126	0
Cl_2 (g)	2000	0	223,022	36,60	1,080	-0,272	0
Cu (g)	3000	339066	166,477	22,47	-3,014	-0,086	1,285
Cu_2 (g)	3000	485576	241,809	37,44	0,688	-0,094	0,017
CuCl (g)	2000	91211	237,191	37,29	0,540	-0,218	0
Cu_3Cl_3 (g)	2000	-263734	429,504	132,88	0,084	-0,766	0
CuI (g)	2000	142240	255,748	37,40	0,502	-0,100	0
CuH (g)	2000	274853	196,558	30,83	3,763	-0,456	0
$(CuI)_3$ (g)	2000	-16731	464,546	133,16	-0,084	-0,360	0
CuSe (g)	2000	309555	264,790	37,35	0,033	-0,113	0
Ga (g)	3000	270541	169,014	24,86	-1,381	0,251	0
GaCl (g)	2000	-80826	240,216	37,22	0,661	-0,151	0
$GaCl_2$ (g)	2000	-241249	301,022	57,59	0,435	-0,406	0
$GaCl_3$ (g)	2000	-422881	325,147	82,43	0,444	-0,678	0
Ga_2Cl_6 (g)	351	-951579	500,524	181,46	0,904	-1,490	0
	2000	0		181,46	1,092	-1,490	0
GaI (g)	2000	17234	259,641	37,98	0,661	-0,151	0
GaI_3 (g)	2000	-137510	386,016	82,76	0,209	-0,569	0
Ga_2I_6 (g)	2000	-324038	667,692	182,38	0,264	-1,021	0
Ga_2Se (g)	2000	96194	315,524	58,06	0,054	-0,285	0
H (g)	6000	217923	114,797	20,80	0	0	0
H_2 (g)	3000	0	130,754	26,87	3,585	0,105	0
HCl (g)	2000	-92301	186,863	26,52	4,600	0,109	0
HI (g)	2000	26456	206,650	26,35	3,826	0,172	0
H_2Se (g)	2000	29302	219,037	31,77	14,651	-0,130	0
I (g)	2000	106755	180,856	20,39	0,402	0,029	0
I_2 (g)	2000	62179	260,220	37,25	0,778	-0,050	0
Se (g)	2000	235463	176,800	21,47	1,507	-0,092	0
Se_2 (g)	2000	136464	243,734	44,62	-2,658	-0,250	0
Se_3 (g)	2000	173300	315,189	58,17	3,039	-0,221	0
Se_4 (g)	2000	180584	379,402	83,12	0,032	-0,251	0
Se_5 (g)	2000	135417	385,556	107,98	0,086	-0,592	0
Se_6 (g)	2000	132487	433,820	132,97	0,067	-0,593	0
Se_7 (g)	2000	141278	486,690	157,84	0,112	-0,828	0
Se_8 (g)	2000	152161	531,522	182,83	0,093	-0,788	0
$SeCl_2$ (g)	2000	-33488	295,741	57,98	0,134	-0,395	0
Se_2Cl_2 (g)	1000	-21767	353,968	82,42	1,536	-0,453	0

FEST	T_{max}	ΔH_{298}	ΔS_{298}	a	b	c	d
	K	J mol^{-1}	J K^{-1} mol^{-1}	J K^{-1} mol^{-1}	10^{-3} J K^{-2} mol^{-1}	10^{6} J K mol^{-1}	10^{-6} J K^{-3} mol^{-1}
Cu	1357	0	33,124	24,12	5,371	-0,107	-0,823
	2846	13270		31,40	0	0	0
CuCl	683	-136816	87,446	51,09	17,656	-0,268	0
	709	5773		62,76	0	0	0
	1482	6903		64,43	0	0	0
$CuCl_2$	862	-217957	108,043	78,87	2,929	-0,711	0
CuI	642	-68023	96,571	62,62	-6,400	-0,578	0
	680	7112		58,60	0	0	0
	868	3219		59,40	0	0	0
	1675	9619		64,84	0	0	0
$CuGaSe_2$	1373 *	-264300 *	154,810 *	116,55 *	4,211 *	-1,675 *	0 *
CuSe	326	-41831	78,236	54,79	0	0	0
	650	1381		62,75	0	0	0
Cu_2Se	395	-65260	129,682	58,56	77,399	0	0
	800	6819		84,10	0	0	0
Ga	303	0	40,818	26,19	0	0	0
	700	5588		24,38	2,294	0,310	0
	2478	0		26,56	0	0	0
$GaCl_3$	351	-524673	135,143	118,41	0	0	0
	474	11506		128,03	0	0	0
GaI_3	486	-239439	203,858	117,21	0	0	0
	618	22186		128,51	0	0	0
GaN	1773	-109673	29,721	38,09	9,000	0	0
GaSe	1233	-159068	70,325	44,66	12,977	0	0
Ga_2Se_3	1278	-419100 *	179,872	105,70	35,305	0	0
I_2	387	0	116,111	30,12	81,614	0	0
	458	15643		81,99	0	0	0
Se	493	0	42,279	17,90	25,116	0	0
	957	5860		35,16	0	0	0
$SeCl_4$	578	-188698	194,556	133,89	0	0	0

6.2 Symbolverzeichnis

α	Absorptionskoeffizient [cm^{-1}]
A	Diodenidealitätsfaktor
η	Wirkungsgrad [%]
E_C	Leitungsband
E_F	Fermi-Niveau
E_g	Bandlücke [eV]
E_V	Valenzband
ff	Füllfaktor [%]
F	Fläche [cm^2]
G	Gibbs'sche Energie [J]
g	Aggregatszustand: gasförmig
I_{sc}	Kurzschlußstrom [mA]
l	Aggregatszustand: flüssig
I	Strom (mA)
I_0	Sperrsättigungsstrom [mA]
I_D(V)	Diodenstrom
J	Stromdichte [mA/cm^2]
n	Stoffmenge [mol]
m	Masse [g]
P	Leistung [Watt]
p	Druck [bar]
p^D	Gleichgewichtsdampfdruck [bar]
p_{I_2}	Partialdruck von I_2 [bar]
Q	Gasfluß [ml/min]
Q_{I_2}	Gasfluß I_2 [ml/min]
RH	Relative Feuchte [%]
R_P	Parallelwiderstand [Ω]
R_S	Serienwiderstand [Ω]
s	Aggregatszustand: fest
SQRT(x)	Wurzelfunktion
t	Depositionszeit HCVD-Prozeß [min]
T	Temperatur [°C bzw. K]
T_{JQ}	Temperatur der Jodquelle [°C]
V	Spannung [V]
V_{oc}	Offene Klemmenspannung [mV]

6.3 Abkürzungen

CSVT	Close Spaced Vapor Transport (Kurzreichweitiger Gasphasentransport)
CVD	Chemical Vapor Deposition (Chemischer Gasphasentransport)
EDX	Energy Dispersive X-Ray (Energiedispersive Röntgenanalyse)
DR	Druckregler
HCVD	Halogen-supported Chemical Vapor Deposition (Halogenunterstützte Gasphasenabscheidung)
MPP	Maximum Power Point (Arbeitspunkt)
MW	Mittelwert
OEG	Obere Eingriffsgrenze
QE	Quantum efficiency (Quantenausbeute)
QMS	Quadrupolmassenspektrometer
UEG	Untere Eingriffsgrenze
Wkl. E.	Willkürliche Einheiten
XRD	X-ray Diffraction (Röntgenbeugung)

7 Literaturverzeichnis

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