

Supplemental Material for

“Estimation of grain boundary segregation enthalpy and its role in stable nanocrystalline alloy design”

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	Miedema model			RKM model			Source
	ΔH^{mix}	ΔH^{seg}	ΔH^{int}	ΔH^{mix}	ΔH^{seg}	ΔH^{int}	
Ag-Ag	0	0	0	0	0	0	
Ag-Al	-	-	-	99	99	10.5454 - 0.0058 T	[1]
Ag-As	-	-	-	0	0	0	
Ag-Au	-	-	-	-15599	-7889	-16	[1]
Ag-Ba	-	-	-	0	0	0	
Ag-Be	-	-	-	0	0	0	
Ag-Bi	-	-	-	11976	25074	-18.5568 - 0.0160 T	[2]
Ag-Ca	-	-	-	0	0	0	
Ag-Cd	-	-	-	0	0	0	
Ag-Co	112335	9638	69	77000	19920	76	[3]
Ag-Cr	133669	7220	98	0	0	0	
Ag-Cs	-	-	-	0	0	0	
Ag-Cu	-	-	-	25696	12170	23.5277 - 0.0094 T	[1]
Ag-Fe	140903	11015	103	0	0	0	
Ag-Ga	-	-	-	0	0	0	
Ag-Ge	-	-	-	14126	99	19.1808 + 0.0111 T	[1]
Ag-Hf	-28921	-24196	-53	0	0	0	
Ag-In	-	-	-	99	99	-2.5331 - 0.0020 T	[2]
Ag-Ir	83405	-24308	62	0	0	0	
Ag-K	-	-	-	0	0	0	
Ag-La	-56831	25961	-143	0	0	0	
Ag-Li	-	-	-	0	0	0	
Ag-Mg	-	-	-	1607	15192	-2.2256 - 0.0040 T	[4]
Ag-Mn	68971	15096	46	0	0	0	
Ag-Mo	151614	-20987	147	0	0	0	
Ag-Na	-	-	-	0	0	0	
Ag-Nb	67112	-30569	66	0	0	0	
Ag-Ni	100650	10361	56	57720	16142	23.2292 + 0.0031 T	[5]
Ag-Os	132862	-27065	111	0	0	0	
Ag-P	-	-	-	0	0	0	
Ag-Pb	-	-	-	32469	19622	-32.7331 + 0.0303 T	[1]

Ag-Pd	-20000	-16402	-29	0	0	0	
Ag-Pt	8093	-25026	-3	0	0	0	
Ag-Rb	-	-	-	0	0	0	
Ag-Re	165051	-29982	151	0	0	0	
Ag-Rh	57296	-17732	37	0	0	0	
Ag-Ru	115647	-18333	91	0	0	0	
Ag-Sb	-	-	-	99	99	-99.3336 + 0.0837 T	[2]
Ag-Sc	-89913	-6552	-119	0	0	0	
Ag-Si	-	-	-	0	0	0	
Ag-Sn	-	-	-	99	99	-2.6560 + 0.0087 T	[6]
Ag-Sr	-	-	-	0	0	0	
Ag-Ta	61885	-42062	61	0	0	0	
Ag-Tc	112124	-23413	96	0	0	0	
Ag-Th	-	-	-	0	0	0	
Ag-Ti	-5301	-22780	-6	0	0	0	
Ag-Tl	-	-	-	0	0	0	
Ag-V	73839	-13872	63	0	0	0	
Ag-W	175584	-35824	172	0	0	0	
Ag-Y	-54585	10456	-136	0	0	0	
Ag-Zn	-	-	-	-23700	7938	-26.0733 + 0.0008 T	[7]
Ag-Zr	-59694	-29437	-87	0	0	0	
Al-Ag	-	-	-	99	99	10.7354 - 0.0058 T	[1]
Al-Al	0	0	-	0	0	0	
Al-As	-	-	-	0	0	0	
Al-Au	-	-	-	-68204	-20862	-151.0210 + 0.0469 T	[1]
Al-Ba	-	-	-	0	0	0	
Al-Be	-	-	-	0	0	0	
Al-Bi	-	-	-	0	0	0	
Al-Ca	-	-	-	0	0	0	
Al-Cd	-	-	-	0	0	0	
Al-Co	-85043	-16631	-105	0	0	0	
Al-Cr	-60442	-17810	-74	0	0	0	
Al-Cs	-	-	-	0	0	0	
Al-Cu	-	-	-	-51353	-7886	-101.6454 + 0.0001 T	[8]
Al-Fe	-62118	-15899	-79	-47330	-10094	-103.0999 + 0.0267 T	[9]
Al-Ga	-	-	-	17383	1080	13.8820 + 0.0082 T	[10]
Al-Ge	-	-	-	10460	7152	10	[1]
Al-Hf	-180709	-45388	-215	0	0	0	
Al-In	-	-	-	0	0	0	
Al-Ir	-144273	-54706	-163	0	0	0	
Al-K	-	-	-	0	0	0	

Al-La	-125023	13202	-231	0	0	0	
Al-Li	-	-	-	0	0	0	
Al-Mg	-	-	-	1607	12744	-3.4082 - 0.0040 T	[4]
Al-Mn	-102012	-7256	-106	0	0	0	
Al-Mo	-62427	-49362	-65	0	0	0	
Al-Na	-	-	-	0	0	0	
Al-Nb	-117205	-55130	-121	0	0	0	
Al-Ni	-96829	-15887	-118	0	0	0	
Al-Os	-98844	-57774	-115	0	0	0	
Al-P	-	-	-	0	0	0	
Al-Pb	-	45717	-	100000	23455	50	[1]
Al-Pd	-217306	-43708	-230	0	0	0	
Al-Pt	-210397	-55059	-229	0	0	0	
Al-Rb	-	-	-	0	0	0	
Al-Re	-68470	-60813	-79	0	0	0	
Al-Rh	-153982	-46178	-169	0	0	0	
Al-Ru	-109210	-48114	-126	0	0	0	
Al-Sb	-	-	-	0	0	0	
Al-Sc	-158288	-17560	-195	-107000	-6026	-131.3042 + 0.0025 T	[8]
Al-Si	-	-	-	-6340	5321	-7.7724 - 0.0026 T	[9]
Al-Sn	-	-	-	0	0	0	
Al-Sr	-	-	-	0	0	0	
Al-Ta	-69329	-66238	-124	0	0	0	
Al-Tc	-111444	-53361	-124	0	0	0	
Al-Th	-	-	-	99	99	-96.0958 - 0.0083 T	[11]
Al-Ti	-161647	-43698	-162	0	0	0	
Al-Tl	-	-	-	0	0	0	
Al-V	-102059	-36921	-101	0	0	0	
Al-W	-50679	-65599	-54	0	0	0	
Al-Y	-124700	-1831	-221	0	0	0	
Al-Zn	-	7092	-	7802	7859	-1.1631 + 0.0062 T	[1]
Al-Zr	-201005	-49546	-240	0	0	0	
Au-Ag	-	-	-	-15599	4472	-16	[1]
Au-Al	-	-	-	-68204	-3030	-151.2387 + 0.0468 T	[1]
Au-As	-	-	-	0	0	0	
Au-Au	0	0	0	0	0	0	
Au-Ba	-	-	-	0	0	0	
Au-Be	-	-	-	0	0	0	
Au-Bi	-	-	-	48000	36008	18	[12]
Au-Ca	-	-	-	0	0	0	
Au-Cd	-	-	-	0	0	0	

Au-Co	62781	14206	25	27766	35139	9.3331 + 0.0051 T	[13]
Au-Cr	25752	4467	-1	0	0	0	
Au-Cs	-	-	-	0	0	0	
Au-Cu	-	-	-	-18278	19794	-51.4656 + 0.0788 T - 0.0100 T Log[T]	[1]
Au-Fe	58397	11681	28	16677	29864	1.5948 - 0.0081 T	[14]
Au-Ga	-	-	-	-61363	-767	-25.4244 - 0.0551 T	[15]
Au-Ge	-	-	-	-12915	16764	9.4825 - 0.0231 T	[16]
Au-Hf	-240702	-45640	-257	-85110	-8470	-10.9738 - 0.0160 T	[17]
Au-In	-	-	-	0	0	0	
Au-Ir	62129	-17911	48	0	0	0	
Au-K	-	-	-	0	0	0	
Au-La	-127920	4799	-328	0	0	0	
Au-Li	-	-	-	0	0	0	
Au-Mg	-	-	-	0	0	0	
Au-Mn	-23626	13615	-39	0	0	0	
Au-Mo	14535	-29433	13	0	0	0	
Au-Na	-	-	-	0	0	0	
Au-Nb	-127832	-47304	-124	0	0	0	
Au-Ni	64918	16451	25	18378	35253	17.0636 - 0.0176 T	[18]
Au-Os	83846	-23873	68	0	0	0	
Au-P	-	-	-	0	0	0	
Au-Pb	-	-	-	30000	25535	4	[19]
Au-Pd	3759	-5259	0	0	0	0	
Au-Pt	21216	-15246	17	0	0	0	
Au-Rb	-	-	-	0	0	0	
Au-Re	85828	-30996	76	0	0	0	
Au-Rh	41090	-10537	27	0	0	0	
Au-Ru	74589	-14053	56	0	0	0	
Au-Sb	-	-	-	49513	28279	0.0604 + 0.0250 T	[20]
Au-Sc	-285142	-24138	-291	0	0	0	
Au-Si	-	-	-	2000	22076	-3	[20]
Au-Sn	-	-	-	-34325	16832	-65.6840 + 0.0076 T	[12]
Au-Sr	-	-	-	0	0	0	
Au-Ta	-128502	-58766	-125	0	0	0	
Au-Tc	63243	-20407	52	0	0	0	
Au-Th	-	-	-	0	0	0	
Au-Ti	-191555	-37580	-180	0	0	0	
Au-Tl	-	-	-	0	0	0	
Au-V	-70788	-21633	-69	0	0	0	
Au-W	46703	-43951	44	0	0	0	
Au-Y	-256456	-9853	-318	0	0	0	

Au-Zn	-	-	-	0	0	0	
Au-Zr	-285377	-51640	-303	0	0	0	
Ba-Ag	-	-	-	0	0	0	
Ba-Al	-	-	-	0	0	0	
Ba-As	-	-	-	0	0	0	
Ba-Au	-	-	-	0	0	0	
Ba-Ba	0	0	-	0	0	0	
Ba-Be	-	-	-	0	0	0	
Ba-Bi	-	-	-	0	0	0	
Ba-Ca	-	-	-	0	0	0	
Ba-Cd	-	-	-	0	0	0	
Ba-Co	200605	123986	32	0	0	0	
Ba-Cr	334628	124915	141	0	0	0	
Ba-Cs	-	-	-	0	0	0	
Ba-Cu	-	-	-	-3828	92697	-121.3380 + 0.0034 T	[21]
Ba-Fe	290225	128081	104	0	0	0	
Ba-Ga	-	-	-	0	0	0	
Ba-Ge	-	-	-	0	0	0	
Ba-Hf	301739	32357	169	0	0	0	
Ba-In	-	-	-	0	0	0	
Ba-Ir	118878	68874	-43	0	0	0	
Ba-K	-	-	-	0	0	0	
Ba-La	96619	153	57	0	0	0	
Ba-Li	-	-	-	0	0	0	
Ba-Mg	-	-	-	0	0	0	
Ba-Mn	248639	124467	81	0	0	0	
Ba-Mo	413221	86024	216	0	0	0	
Ba-Na	-	-	-	0	0	0	
Ba-Nb	426531	68527	244	0	0	0	
Ba-Ni	162765	122445	1	341686	144262	320	[22]
Ba-Os	220094	72871	44	0	0	0	
Ba-P	-	-	-	0	0	0	
Ba-Pb	-	-	-	0	0	0	
Ba-Pd	-60419	65981	-185	0	0	0	
Ba-Pt	-8747	56269	-152	0	0	0	
Ba-Rb	-	-	-	0	0	0	
Ba-Re	311710	70696	124	0	0	0	
Ba-Rh	87860	78586	-63	0	0	0	
Ba-Ru	189496	81930	19	0	0	0	
Ba-Sb	-	-	-	0	0	0	
Ba-Sc	179744	37959	89	0	0	0	

Ba-Si	-	-	-	0	0	0	
Ba-Sn	-	-	-	0	0	0	
Ba-Sr	-	-	-	0	0	0	
Ba-Ta	413959	51593	233	0	0	0	
Ba-Tc	203847	76050	34	0	0	0	
Ba-Th	-	-	-	0	0	0	
Ba-Ti	330416	73251	170	403506	96059	356	[22]
Ba-Tl	-	-	-	0	0	0	
Ba-V	348346	99981	163	0	0	0	
Ba-W	283628	41581	22	0	0	0	
Ba-Y	124654	12449	68	0	0	0	
Ba-Zn	-	-	-	0	0	0	
Ba-Zr	286081	36846	163	0	0	0	
Be-Ag	-	-	-	0	0	0	
Be-Al	-	-	-	0	0	0	
Be-As	-	-	-	0	0	0	
Be-Au	-	-	-	0	0	0	
Be-Ba	-	-	-	0	0	0	
Be-Be	0	0	-	0	0	0	
Be-Bi	-	-	-	0	0	0	
Be-Ca	-	-	-	0	0	0	
Be-Cd	-	-	-	0	0	0	
Be-Co	-3155	11802	-26	0	0	0	
Be-Cr	2856	33002	-41	0	0	0	
Be-Cs	-	-	-	0	0	0	
Be-Cu	-	-	-	0	0	0	
Be-Fe	7020	13560	-25	0	0	0	
Be-Ga	-	-	-	0	0	0	
Be-Ge	-	-	-	0	0	0	
Be-Hf	49285	226231	-209	0	0	0	
Be-In	-	-	-	0	0	0	
Be-Ir	61080	67216	-38	0	0	0	
Be-K	-	-	-	0	0	0	
Be-La	-8550	223070	-184	0	0	0	
Be-Li	-	-	-	0	0	0	
Be-Mg	-	-	-	0	0	0	
Be-Mn	-248462	17165	-54	0	0	0	
Be-Mo	109568	78317	-43	0	0	0	
Be-Na	-	-	-	0	0	0	
Be-Nb	45080	115688	-134	0	0	0	
Be-Ni	-6972	13763	-27	0	0	0	

Be-Os	79969	55979	-20	0	0	0	
Be-P	-	-	-	0	0	0	
Be-Pb	-	-	-	0	0	0	
Be-Pd	31592	70093	-50	0	0	0	
Be-Pt	41307	90751	-61	0	0	0	
Be-Rb	-	-	-	0	0	0	
Be-Re	109390	64974	-11	0	0	0	
Be-Rh	44161	51802	-39	0	0	0	
Be-Ru	54578	50915	-25	0	0	0	
Be-Sb	-	-	-	0	0	0	
Be-Sc	-28353	188061	-191	0	0	0	
Be-Si	-	-	-	0	0	0	
Be-Sn	-	-	-	0	0	0	
Be-Sr	-	-	-	0	0	0	
Be-Ta	83256	137301	-132	0	0	0	
Be-Tc	73191	51628	-25	0	0	0	
Be-Th	-	-	-	0	0	0	
Be-Ti	-27436	93639	-158	0	0	0	
Be-Tl	-	-	-	0	0	0	
Be-V	-12028	46533	-84	0	0	0	
Be-W	144692	89107	-27	0	0	0	
Be-Y	15504	221933	-190	0	0	0	
Be-Zn	-	-	-	0	0	0	
Be-Zr	-16441	166075	-239	0	0	0	
Bi-Ag	-	-	-	0	0	0	
Bi-Al	-	-	-	0	0	0	
Bi-As	-	-	-	0	0	0	
Bi-Au	-	-	-	8000	-5775	-36	[12]
Bi-Ba	-	-	-	0	0	0	
Bi-Be	-	-	-	0	0	0	
Bi-Bi	0	0	-	0	0	0	
Bi-Ca	-	-	-	0	0	0	
Bi-Cd	-	-	-	0	0	0	
Bi-Co	111133	30670	4	0	0	0	
Bi-Cr	136838	24210	33	0	0	0	
Bi-Cs	-	-	-	0	0	0	
Bi-Cu	-	-	-	0	0	0	
Bi-Fe	148850	31022	39	0	0	0	
Bi-Ga	-	-	-	0	0	0	
Bi-Ge	-	-	-	0	0	0	
Bi-Hf	-89635	-45923	-15	0	0	0	

Bi-In	-	-	-	0	0	0	
Bi-Ir	91641	-12174	-3	0	0	0	
Bi-K	-	-	-	0	0	0	
Bi-La	-272577	-50687	-276	0	0	0	
Bi-Li	-	-	-	0	0	0	
Bi-Mg	-	-	-	0	0	0	
Bi-Mn	43161	27055	-31	0	0	0	
Bi-Mo	156617	-14114	74	0	0	0	
Bi-Na	-	-	-	0	0	0	
Bi-Nb	21796	-37219	-12	0	0	0	
Bi-Ni	97928	31428	-8	0	0	0	
Bi-Os	151556	-13367	47	0	0	0	
Bi-P	-	-	-	0	0	0	
Bi-Pb	-	-	-	0	0	0	
Bi-Pd	-64797	-9850	-118	0	0	0	
Bi-Pt	-6096	-17995	-75	0	0	0	
Bi-Rb	-	-	-	0	0	0	
Bi-Re	187015	-19247	84	0	0	0	
Bi-Rh	48262	-4763	-36	0	0	0	
Bi-Ru	128924	-3944	27	0	0	0	
Bi-Sb	-	-	-	16450	4945	7.9735 + 0.0063 T	[23]
Bi-Sc	-218814	-45241	-197	0	0	0	
Bi-Si	-	-	-	0	0	0	
Bi-Sn	-	-	-	99	99	99	[23]
Bi-Sr	-	-	-	0	0	0	
Bi-Ta	16020	-52189	-19	0	0	0	
Bi-Tc	120447	-10898	27	0	0	0	
Bi-Th	-	-	-	0	0	0	
Bi-Ti	-77967	-31398	-93	0	0	0	
Bi-Tl	-	-	-	0	0	0	
Bi-V	54096	-4583	-10	0	0	0	
Bi-W	190037	-31222	101	0	0	0	
Bi-Y	-260105	-53208	-249	0	0	0	
Bi-Zn	-	-	-	0	0	0	
Bi-Zr	-213843	-63557	-196	0	0	0	
Ca-Ag	-	-	-	0	0	0	
Ca-Al	-	-	-	0	0	0	
Ca-As	-	-	-	0	0	0	
Ca-Au	-	-	-	0	0	0	
Ca-Ba	-	-	-	0	0	0	
Ca-Be	-	-	-	0	0	0	

Ca-Bi	-	-	-	0	0	0	
Ca-Ca	0	0	-	0	0	0	
Ca-Cd	-	-	-	0	0	0	
Ca-Co	146516	80903	8	0	0	0	
Ca-Cr	266073	82029	114	0	0	0	
Ca-Cs	-	-	-	0	0	0	
Ca-Cu	-	-	-	0	0	0	
Ca-Fe	226060	84810	77	120705	76252	11	[9]
Ca-Ga	-	-	-	0	0	0	
Ca-Ge	-	-	-	0	0	0	
Ca-Hf	207487	-1781	133	0	0	0	
Ca-In	-	-	-	0	0	0	
Ca-Ir	62526	26205	-73	0	0	0	
Ca-K	-	-	-	0	0	0	
Ca-La	37538	-15301	32	0	0	0	
Ca-Li	-	-	-	0	0	0	
Ca-Mg	-	-	-	0	0	0	
Ca-Mn	187280	83298	58	0	0	0	
Ca-Mo	325943	43597	182	0	0	0	
Ca-Na	-	-	-	0	0	0	
Ca-Nb	326665	28163	207	0	0	0	
Ca-Ni	112607	79493	-22	0	0	0	
Ca-Os	155715	29851	13	0	0	0	
Ca-P	-	-	-	0	0	0	
Ca-Pb	-	-	-	0	0	0	
Ca-Pd	-101777	24763	-208	0	0	0	
Ca-Pt	-58803	14302	-182	0	0	0	
Ca-Rb	-	-	-	0	0	0	
Ca-Re	238101	27950	92	0	0	0	
Ca-Rh	36062	36068	-90	0	0	0	
Ca-Ru	128459	38973	-11	0	0	0	
Ca-Sb	-	-	-	0	0	0	
Ca-Sc	102915	7566	61	56572	7223	27	[24]
Ca-Si	-	-	-	0	0	0	
Ca-Sn	-	-	-	0	0	0	
Ca-Sr	-	-	-	0	0	0	
Ca-Ta	316233	11657	196	0	0	0	
Ca-Tc	140301	33292	4	0	0	0	
Ca-Th	-	-	-	0	0	0	
Ca-Ti	242449	34191	138	0	0	0	
Ca-Tl	-	-	-	0	0	0	

Ca-V	270729	58084	135	0	0	0	
Ca-W	333330	23037	187	0	0	0	
Ca-Y	56726	-9898	42	0	0	0	
Ca-Zn	-	-	-	0	0	0	
Ca-Zr	191470	2405	127	0	0	0	
Cd-Ag	-	-	-	0	0	0	
Cd-Al	-	-	-	0	0	0	
Cd-As	-	-	-	0	0	0	
Cd-Au	-	-	-	0	0	0	
Cd-Ba	-	-	-	0	0	0	
Cd-Be	-	-	-	0	0	0	
Cd-Bi	-	-	-	0	0	0	
Cd-Ca	-	-	-	0	0	0	
Cd-Cd	0	0	-	0	0	0	
Cd-Co	61538	12229	-4	0	0	0	
Cd-Cr	91769	6997	34	0	0	0	
Cd-Cs	-	-	-	0	0	0	
Cd-Cu	-	-	-	0	0	0	
Cd-Fe	93846	12663	32	0	0	0	
Cd-Ga	-	-	-	0	0	0	
Cd-Ge	-	-	-	0	0	0	
Cd-Hf	-110022	-53053	-109	0	0	0	
Cd-In	-	-	-	0	0	0	
Cd-Ir	22733	-31882	-30	0	0	0	
Cd-K	-	-	-	0	0	0	
Cd-La	-133976	-13108	-192	0	0	0	
Cd-Li	-	-	-	0	0	0	
Cd-Mg	-	-	-	0	0	0	
Cd-Mn	20736	12231	-18	0	0	0	
Cd-Mo	101524	-29659	72	0	0	0	
Cd-Na	-	-	-	0	0	0	
Cd-Nb	14510	-45097	9	0	0	0	
Cd-Ni	48425	12744	-18	0	0	0	
Cd-Os	75527	-33168	22	0	0	0	
Cd-P	-	-	-	0	0	0	
Cd-Pb	-	-	-	0	0	0	
Cd-Pd	-97279	-26819	-129	0	0	0	
Cd-Pt	-61285	-36515	-102	0	0	0	
Cd-Rb	-	-	-	0	0	0	
Cd-Re	109794	-37852	64	0	0	0	
Cd-Rh	-5412	-23639	-53	0	0	0	

Cd-Ru	58411	-23618	4	0	0	0	
Cd-Sb	-	-	-	0	0	0	
Cd-Sc	-142160	-32123	-144	0	0	0	
Cd-Si	-	-	-	0	0	0	
Cd-Sn	-	-	-	0	0	0	
Cd-Sr	-	-	-	0	0	0	
Cd-Ta	8644	-58660	3	0	0	0	
Cd-Tc	53044	-29947	7	0	0	0	
Cd-Th	-	-	-	0	0	0	
Cd-Ti	-58371	-36883	-58	0	0	0	
Cd-Tl	-	-	-	0	0	0	
Cd-V	32263	-18683	5	0	0	0	
Cd-W	122988	-46844	92	0	0	0	
Cd-Y	-133719	-24752	-177	0	0	0	
Cd-Zn	-	-	-	0	0	0	
Cd-Zr	-137615	-54932	-138	0	0	0	
Co-Ag	95264	54567	84	0	0	0	
Co-Al	-99335	25977	-124	0	0	0	
Co-As	-95970	15622	-149	0	0	0	
Co-Au	63040	56984	33	0	0	0	
Co-Ba	-23686	240619	65	0	0	0	
Co-Be	-2601	15749	-21	0	0	0	
Co-Bi	72255	117008	8	0	0	0	
Co-Ca	-236893	169473	13	0	0	0	
Co-Cd	25387	69775	-5	0	0	0	
Co-Co	0	0	0	0	0	0	
Co-Cr	-16450	2720	-18	8045	99	-11.0298 + 0.0194 T	[25]
Co-Cs	97766	200456	353	0	0	0	
Co-Cu	25520	15989	25	30543	16643	32	[1]
Co-Fe	-1231	-527	-2	0	0	0	
Co-Ga	-52909	20804	-96	0	0	0	
Co-Ge	-61624	22670	-89	0	0	0	
Co-Hf	-46214	78532	-168	0	0	0	
Co-In	14610	108277	-18	0	0	0	
Co-Ir	5363	-6318	-15	0	0	0	
Co-K	120810	170954	293	0	0	0	
Co-La	1855	145336	-93	0	0	0	
Co-Li	107997	52419	30	0	0	0	
Co-Mg	16641	79646	3	0	0	0	
Co-Mn	-20046	13781	-21	0	0	0	
Co-Mo	20358	-4296	-22	0	0	0	

Co-Na	98422	114475	180	0	0	0	
Co-Nb	-46908	11239	-111	0	0	0	
Co-Ni	-951	2237	-1	0	0	0	
Co-Os	18762	-16166	0	0	0	0	
Co-P	-190383	-1323	-213	0	0	0	
Co-Pb	77305	164046	32	0	0	0	
Co-Pd	11917	14296	-7	99	99	99	[26]
Co-Pt	-7017	8221	-33	0	0	0	
Co-Rb	99468	204073	323	0	0	0	
Co-Re	36548	-16047	9	0	0	0	
Co-Rh	5774	-3081	-9	0	0	0	
Co-Ru	9614	-9108	-3	0	0	0	
Co-Sb	31185	76157	-62	0	0	0	
Co-Sc	-66424	89592	-139	0	0	0	
Co-Si	14965	43724	138	0	0	0	
Co-Sn	57893	133594	-62	0	0	0	
Co-Sr	-22979	223622	53	0	0	0	
Co-Ta	-31549	11684	-109	0	0	0	
Co-Tc	19597	-11517	-1	0	0	0	
Co-Th	6481	158017	-166	0	0	0	
Co-Ti	-81386	17815	-126	0	0	0	
Co-Tl	59797	132085	40	0	0	0	
Co-V	-46872	-3455	-58	0	0	0	
Co-W	43800	-11619	-6	0	0	0	
Co-Y	-2025	128449	-112	0	0	0	
Co-Zn	-42355	27515	-49	0	0	0	
Co-Zr	-87071	53642	-197	-47428	37602	-131	[27]
Cr-Ag	127130	47370	120	0	0	0	
Cr-Al	-67078	20010	-87	0	0	0	
Cr-As	-105994	7770	-156	0	0	0	
Cr-Au	28398	40754	-1	0	0	0	
Cr-Ba	131195	256178	299	0	0	0	
Cr-Be	-3615	26982	-33	0	0	0	
Cr-Bi	116461	111060	61	0	0	0	
Cr-Ca	140522	178909	196	0	0	0	
Cr-Cd	71572	64156	46	0	0	0	
Cr-Co	-16469	-1485	-18	8045	99	-10.9162 + 0.0188 T	[25]
Cr-Cr	0	0	0	0	0	0	
Cr-Cs	254655	224003	628	0	0	0	
Cr-Cu	50195	16041	49	85330	20164	95.0886 - 0.0100 T	[1]
Cr-Fe	-5874	-1676	-6	10820	32	20.3649 - 0.0097 T	[1]

Cr-Ga	-12483	17370	-50	0	0	0	
Cr-Ge	-52729	16043	-77	0	0	0	
Cr-Hf	49497	85334	-44	0	0	0	
Cr-In	72255	104141	50	0	0	0	
Cr-Ir	-62828	-24252	-78	0	0	0	
Cr-K	267726	188120	516	0	0	0	
Cr-La	138801	155706	93	40000	85451	-76	[28]
Cr-Li	135747	57531	131	0	0	0	
Cr-Mg	102591	79113	98	0	0	0	
Cr-Mn	8525	15095	8	0	0	0	
Cr-Mo	27912	-13001	2	20928	-16300	-6.6997 - 0.0054 T	[1]
Cr-Na	97760	123003	329	0	0	0	
Cr-Nb	13612	8449	-32	30414	-11613	-31.8768 - 0.0057 T	
Cr-Ni	-24868	-233	-27	99	99	-18.9776 - 0.0002 T	[1]
Cr-Os	-34566	-31641	-46	0	0	0	
Cr-P	-248816	-11117	-274	0	0	0	
Cr-Pb	125873	160044	88	0	0	0	
Cr-Pd	-47157	-2586	-65	0	0	0	
Cr-Pt	-84231	-12458	-110	-105000	-19242	-123	[25]
Cr-Rb	254189	223441	571	0	0	0	
Cr-Re	-2796	-30424	-19	0	0	0	
Cr-Rh	-47689	-17651	-58	0	0	0	
Cr-Ru	-41470	-23550	-49	0	0	0	
Cr-Sb	53568	67631	-34	0	0	0	
Cr-Sc	54588	95020	3	38778	64650	-35.6913 + 0.0012 T	[24]
Cr-Si	-113321	2914	-134	-93843	8856	-76.1507 - 0.0020 T	
Cr-Sn	108192	132065	-10	26991	36290	-189.7966 + 0.0204 T	[29]
Cr-Sr	378859	237288	271	0	0	0	
Cr-Ta	26315	9606	-30	36943	-7597	-53.9542 + 0.0056 T	[30]
Cr-Tc	-25707	-25634	-39	0	0	0	
Cr-Th	136727	173727	12	0	0	0	
Cr-Ti	-3169	16737	-33	6894	6713	-35.9096 + 0.0091 T	[31]
Cr-Tl	119082	128278	110	0	0	0	
Cr-V	-3245	-6777	-8	-12937	-10218	-12.9202 - 0.0090 T	[31]
Cr-W	36290	-22583	4	31520	-24125	-1	[30]
Cr-Y	130699	137670	59	69000	104820	-2	[28]
Cr-Zn	-4557	24877	-9	0	0	0	
Cr-Zr	22694	59148	-58	0	0	0	
Cu-Ag	-	-	-	25745	15672	9.3077 - 0.0107 T	
Cu-Al	-	-	-	-51353	3437	-111.2690 - 0.0002 T	[8]
Cu-As	-	-	-	0	0	0	

Cu-Au	-	-	-	-18278	6894	-55.2644 + 0.0788 T - 0.0100 T Log[T]	[1]
Cu-Ba	-	-	-	-3828	94372	-10.7387 + 0.0034 T	
Cu-Be	-	-	-	0	0	0	
Cu-Bi	-	-	-	77869	54121	-26	
Cu-Ca	-	-	-	0	0	0	
Cu-Cd	-	-	-	0	0	0	
Cu-Co	27524	-8620	26	0	0	0	[1]
Cu-Cr	49996	-3525	51	0	0	0	[1]
Cu-Cs	-	-	-	0	0	0	
Cu-Cu	0	0	0	0	0	0	
Cu-Fe	51841	-6145	53	5561873	645791	-0.2917 + 5.5619 T	[1]
Cu-Ga	-	-	-	0	0	0	
Cu-Ge	-	-	-	99	99	-12.4755 + 0.0283 T	[32]
Cu-Hf	29082	31961	-81	-26000	39577	-125	[33]
Cu-In	-	-	-	0	0	0	
Cu-Ir	2182	-25730	1	0	0	0	
Cu-K	-	-	-	0	0	0	
Cu-La	16348	96148	-115	100000	85962	-7	[34]
Cu-Li	-	-	-	0	0	0	
Cu-Mg	-	-	-	-15227	36699	-58.3115 + 0.0083 T	[35]
Cu-Mn	15159	5577	15	9300	5763	19.7494 - 0.0035 T	[36]
Cu-Mo	90652	-16694	82	83144	-14012	69	[37]
Cu-Na	-	-	-	0	0	0	
Cu-Nb	47642	-8733	12	40472	-15258	-0.2035 - 0.0052 T	[37]
Cu-Ni	16829	-7689	14	11168	-7877	10.1863 + 0.0010 T	[38]
Cu-Os	42601	-31037	46	0	0	0	
Cu-P	-	-	-	0	0	0	
Cu-Pb	-	-	-	49394	27603	-46.1626 - 0.0247 T	[38]
Cu-Pd	-50600	-12850	-62	0	0	0	
Cu-Pt	-45274	-19285	-56	0	0	0	
Cu-Rb	-	-	-	0	0	0	
Cu-Re	77844	-30200	82	0	0	0	
Cu-Rh	-8785	-21679	-11	0	0	0	
Cu-Ru	28383	-23740	31	0	0	0	
Cu-Sb	-	-	-	-19910	36394	-101.5515 - 0.0064 T	[39]
Cu-Sc	-20609	47263	-115	-3890	51189	-84	[8]
Cu-Si	-	-	-	-28313	6920	-49.6755 + 0.0329 T	[1]
Cu-Sn	-	-	-	-12159	99	-159.7593 - 0.0101 T	[35]
Cu-Sr	-	-	-	0	0	0	
Cu-Ta	55045	-14344	9	104600	-2663	57	[40]
Cu-Tc	35626	-26689	37	0	0	0	

Cu-Th	-	-	-	1600	75685	-180	[41]
Cu-Ti	-5591	-1598	-40	-9882	-2667	-43	[42]
Cu-Tl	-	-	-	54500	21827	-28	
Cu-V	25023	-13336	21	55000	-10105	50	[43]
Cu-W	107666	-27533	101	0	0	0	
Cu-Y	31102	78285	-117	-67720	70358	-248.9774 + 0.0234 T	[21]
Cu-Zn	-	-	-	-32261	12662	-49.5023 + 0.0113 T	[44]
Cu-Zr	-5993	17819	-110	2233	15681	-96	[42]
Fe-Ag	127798	57682	123	0	0	0	
Fe-Al	-73627	28598	-91	-83930	22134	-121.2022 + 0.0351 T	[9]
Fe-As	-86318	17117	-131	0	0	0	
Fe-Au	59952	55775	37	22347	27848	4.6406 - 0.0124 T	[14]
Fe-Ba	71499	256451	213	0	0	0	
Fe-Be	5171	18529	-20	0	0	0	
Fe-Bi	115696	122789	71	0	0	0	
Fe-Ca	126868	181519	129	120233	103483	82	[9]
Fe-Cd	63068	73804	42	0	0	0	
Fe-Co	-1302	243	-2	0	0	0	
Fe-Cr	-5919	3737	-6	10820	5995	20.4249 - 0.0097 T	[45]
Fe-Cs	195774	219502	522	0	0	0	
Fe-Cu	51764	18932	50	35108	17047	38.9591 - 0.0041 T	[1]
Fe-Fe	0	0	0	0	0	0	
Fe-Ga	-22175	24654	-55	0	0	0	
Fe-Ge	-43740	24761	-64	0	0	0	
Fe-Hf	-3992	85679	-98	0	0	0	
Fe-In	60870	113811	43	41457	35934	-32.8661 + 0.0224 T	[46]
Fe-Ir	-23989	-10389	-38	0	0	0	
Fe-K	214003	186519	433	0	0	0	
Fe-La	81364	157672	25	54028	104530	-40.5965 + 0.0237 T	[47]
Fe-Li	127374	59451	94	0	0	0	
Fe-Mg	72131	85781	68	0	0	0	
Fe-Mn	1057	16605	1	-1522	16338	-2.8021 + 0.0012 T	[1]
Fe-Mo	19429	-4287	-9	27678	-1398	9.3429 - 0.0030 T	[1]
Fe-Na	170873	124969	277	0	0	0	
Fe-Nb	-23032	14408	-70	1933	-2724	-58.9598 + 0.0063 T	[48]
Fe-Ni	-4922	2124	-6	-2244	99	-3.8354 + 0.0006 T	[1]
Fe-Os	-5767	-19458	-17	0	0	0	
Fe-P	-208119	-2951	-229	0	0	0	
Fe-Pb	122094	170008	95	0	0	0	
Fe-Pd	-5043	11622	-19	0	0	0	
Fe-Pt	-37333	3611	-59	-175000	-23575	-311.3234 + 0.0710 T	[49]

Fe-Rb	196125	221137	477	0	0	0	
Fe-Re	16132	-18678	-1	0	0	0	
Fe-Rh	-13643	-5801	-23	0	0	0	
Fe-Ru	-12160	-12227	-20	0	0	0	
Fe-Sb	60533	80029	-16	31044	99	-36.2872 + 0.0263 T	[50]
Fe-Sc	-1792	98170	-53	-17527500	-1996183	-75.4391 - 17.5000 T	[51]
Fe-Si	-105822	11852	-122	-97767	22436	-49.5270 + 0.0465 T	[9]
Fe-Sn	92310	138873	-8	0	0	0	
Fe-Sr	64005	238271	191	93199	124316	181	[52]
Fe-Ta	-10123	15039	-67	12871	8790	-54.0047 + 0.0094 T	[53]
Fe-Tc	279	-14141	-13	0	0	0	
Fe-Th	73439	170073	-58	0	0	0	
Fe-Ti	-43355	22337	-74	-51247	12146	-72.9277 - 0.0006 T	[54]
Fe-Tl	109846	138216	106	0	0	0	
Fe-V	-23701	-1141	-29	0	0	0	
Fe-W	33806	-12559	0	41544	-5296	22	[1]
Fe-Y	70530	139447	-6	0	0	0	
Fe-Zn	-10582	30929	-14	7642	31981	-3	[55]
Fe-Zr	-35220	61444	-118	-19000	37318	-97	[56]
Ga-Ag	-	-	-	0	0	0	
Ga-Al	-	-	-	0	0	0	
Ga-As	-	-	-	0	0	0	
Ga-Au	-	-	-	-61363	-16773	-35.7811 - 0.0530 T	[15]
Ga-Ba	-	-	-	0	0	0	
Ga-Be	-	-	-	0	0	0	
Ga-Bi	-	-	-	0	0	0	
Ga-Ca	-	-	-	0	0	0	
Ga-Cd	-	-	-	0	0	0	
Ga-Co	-22518	-10811	-74	0	0	0	
Ga-Cr	3574	-12368	-38	0	0	0	
Ga-Cs	-	-	-	0	0	0	
Ga-Cu	-	-	-	0	0	0	
Ga-Fe	3353	-9833	-43	0	0	0	
Ga-Ga	0	0	-	0	0	0	
Ga-Ge	-	-	-	0	0	0	
Ga-Hf	-176223	-31055	-185	0	0	0	
Ga-In	-	-	-	20000	13382	8	[1]
Ga-Ir	-80307	-48938	-122	0	0	0	
Ga-K	-	-	-	0	0	0	
Ga-La	-151446	28934	-233	0	0	0	
Ga-Li	-	-	-	0	0	0	

Ga-Mg	-	-	-	0	0	0	
Ga-Mn	-56978	-3161	-80	0	0	0	
Ga-Mo	-2130	-42619	-18	0	0	0	
Ga-Na	-	-	-	0	0	0	
Ga-Nb	-78108	-46720	-77	0	0	0	
Ga-Ni	-35098	-10210	-88	0	0	0	
Ga-Os	-28790	-51546	-70	0	0	0	
Ga-P	-	-	-	0	0	0	
Ga-Pb	-	-	-	0	0	0	
Ga-Pd	-183143	-39750	-205	0	0	0	
Ga-Pt	-161100	-49501	-192	0	0	0	
Ga-Rb	-	-	-	0	0	0	
Ga-Re	2094	-54170	-31	0	0	0	
Ga-Rh	-99543	-41240	-135	0	0	0	
Ga-Ru	-42065	-42224	-84	0	0	0	
Ga-Sb	-	-	-	0	0	0	
Ga-Sc	-171494	-6460	-186	0	0	0	
Ga-Si	-	-	-	0	0	0	
Ga-Sn	-	-	-	6700	17523	-20	[1]
Ga-Sr	-	-	-	0	0	0	
Ga-Ta	-83432	-57177	-82	0	0	0	
Ga-Tc	-48236	-47489	-82	0	0	0	
Ga-Th	-	-	-	0	0	0	
Ga-Ti	-135848	-36905	-130	0	0	0	
Ga-Tl	-	-	-	0	0	0	
Ga-V	-53906	-31952	-67	0	0	0	
Ga-W	14701	-58048	-3	0	0	0	
Ga-Y	-151238	13081	-219	0	0	0	
Ga-Zn	-	-	-	0	0	0	
Ga-Zr	-199334	-37674	-212	0	0	0	
Ge-Ag	-	-	-	0	0	0	
Ge-Al	-	-	-	0	0	0	
Ge-As	-	-	-	0	0	0	
Ge-Au	-	-	-	0	0	0	
Ge-Ba	-	-	-	0	0	0	
Ge-Be	-	-	-	0	0	0	
Ge-Bi	-	-	-	0	0	0	
Ge-Ca	-	-	-	0	0	0	
Ge-Cd	-	-	-	0	0	0	
Ge-Co	-50282	-23264	-72	0	0	0	
Ge-Cr	-50838	-25657	-63	0	0	0	

Ge-Cs	-	-	-	0	0	0	
Ge-Cu	-	-	-	0	0	0	
Ge-Fe	-36104	-23054	-53	0	0	0	
Ge-Ga	-	-	-	0	0	0	
Ge-Ge	0	0	-	0	0	0	
Ge-Hf	-229598	-36997	-278	0	0	0	
Ge-In	-	-	-	0	0	0	
Ge-Ir	-79821	-53072	-93	0	0	0	
Ge-K	-	-	-	0	0	0	
Ge-La	-209091	22910	-343	0	0	0	
Ge-Li	-	-	-	0	0	0	
Ge-Mg	-	-	-	0	0	0	
Ge-Mn	-106400	-16306	-108	0	0	0	
Ge-Mo	-51691	-52531	-52	0	0	0	
Ge-Na	-	-	-	0	0	0	
Ge-Nb	-141907	-56818	-147	0	0	0	
Ge-Ni	-56656	-21912	-80	0	0	0	
Ge-Os	-42254	-57933	-55	0	0	0	
Ge-P	-	-	-	0	0	0	
Ge-Pb	-	-	-	0	0	0	
Ge-Pd	-165246	-42615	-171	0	0	0	
Ge-Pt	-141108	-50538	-151	0	0	0	
Ge-Rb	-	-	-	0	0	0	
Ge-Re	-22858	-61068	-30	0	0	0	
Ge-Rh	-101743	-47079	-112	0	0	0	
Ge-Ru	-54281	-48961	-68	0	0	0	
Ge-Sb	-	-	-	0	0	0	
Ge-Sc	-228637	-13069	-276	0	0	0	
Ge-Si	-	-	-	0	0	0	
Ge-Sn	-	-	-	25091	15737	-48.4776 + 0.0106 T	[16]
Ge-Sr	-	-	-	0	0	0	
Ge-Ta	-145227	-65930	-151	0	0	0	
Ge-Tc	-61386	-54133	-70	0	0	0	
Ge-Th	-	-	-	0	0	0	
Ge-Ti	-203199	-47973	-204	0	0	0	
Ge-Tl	-	-	-	0	0	0	
Ge-V	-117161	-44741	-113	0	0	0	
Ge-W	-29082	-66011	-30	0	0	0	
Ge-Y	-201180	7526	-322	0	0	0	
Ge-Zn	-	-	-	0	0	0	
Ge-Zr	-260495	-46533	-314	0	0	0	

Hf-Ag	-38726	51175	-48	0	0	0	
Hf-Al	-186957	36044	-189	0	0	0	
Hf-As	-359833	20391	-364	0	0	0	
Hf-Au	-235109	20127	-253	-85110	34073	-38.1400 - 0.0100 T	[17]
Hf-Ba	220110	153426	280	0	0	0	
Hf-Be	40647	168890	-129	0	0	0	
Hf-Bi	-80574	23524	-212	0	0	0	
Hf-Ca	160343	95922	179	0	0	0	
Hf-Cd	-111018	32801	-113	0	0	0	
Hf-Co	-16246	122669	-119	0	0	0	
Hf-Cr	70824	106075	-32	0	0	0	
Hf-Cs	349545	194921	625	0	0	0	
Hf-Cu	7960	111132	-58	4006	95567	-71.0668 - 0.0005 T	[33]
Hf-Fe	27423	117002	-71	0	0	0	
Hf-Ga	-179776	36774	-179	0	0	0	
Hf-Ge	-244471	50364	-244	0	0	0	
Hf-Hf	0	0	0	0	0	0	
Hf-In	-115752	27795	-128	0	0	0	
Hf-Ir	-173091	39128	-253	0	0	0	
Hf-K	363178	155341	482	0	0	0	
Hf-La	91954	54961	72	0	0	0	
Hf-Li	121358	62936	108	0	0	0	
Hf-Mg	29071	44846	29	0	0	0	
Hf-Mn	30156	91059	-41	0	0	0	
Hf-Mo	36059	44574	-15	0	0	0	
Hf-Na	243334	95957	273	0	0	0	
Hf-Nb	29675	16326	15	22445	9035	3.2977 + 0.0035 T	[57]
Hf-Ni	-42522	120892	-145	0	0	0	
Hf-Os	-92556	46160	-178	0	0	0	
Hf-P	-505860	8942	-488	0	0	0	
Hf-Pb	-133037	31285	-169	0	0	0	
Hf-Pd	-267221	37766	-301	0	0	0	
Hf-Pt	-292778	20080	-340	0	0	0	
Hf-Rb	324912	182652	551	0	0	0	
Hf-Re	-36318	35857	-111	0	0	0	
Hf-Rh	-161554	55732	-232	0	0	0	
Hf-Ru	-104082	56856	-188	0	0	0	
Hf-Sb	-251797	11449	-295	0	0	0	
Hf-Sc	22229	26417	21	0	0	0	
Hf-Si	-240237	122553	-262	0	0	0	
Hf-Sn	-185410	16083	-216	0	0	0	

Hf-Sr	204694	136694	249	0	0	0	
Hf-Ta	27645	-98	11	21867	-1710	6	[58]
Hf-Tc	-101324	47415	-172	0	0	0	
Hf-Th	54043	26678	25	0	0	0	
Hf-Ti	14472	27766	1	0	0	0	
Hf-Tl	-84745	35810	-103	0	0	0	
Hf-V	45280	65638	-8	0	0	0	
Hf-W	29900	19591	-24	0	0	0	
Hf-Y	70579	38856	51	0	0	0	
Hf-Zn	-104544	61684	-117	0	0	0	
Hf-Zr	-643	3048	-1	0	0	0	
In-Ag	-	-	-	0	0	0	
In-Al	-	-	-	0	0	0	
In-As	-	-	-	0	0	0	
In-Au	-	-	-	0	0	0	
In-Ba	-	-	-	0	0	0	
In-Be	-	-	-	0	0	0	
In-Bi	-	-	-	-21139	1479	-23	[59]
In-Ca	-	-	-	0	0	0	
In-Cd	-	-	-	0	0	0	
In-Co	52120	-11761	-11	0	0	0	
In-Cr	95821	-7680	32	0	0	0	
In-Cs	-	-	-	0	0	0	
In-Cu	-	-	-	0	0	0	
In-Fe	93993	-8322	28	0	0	0	
In-Ga	-	-	-	0	0	0	
In-Ge	-	-	-	0	0	0	
In-Hf	-117859	-55276	-112	0	0	0	
In-In	-	0	-	0	0	0	
In-Ir	14630	-40622	-41	0	0	0	
In-K	-	-	-	0	0	0	
In-La	-177335	-41188	-205	0	0	0	
In-Li	-	-	-	0	0	0	
In-Mg	-	-	-	0	0	0	
In-Mn	18552	261	-25	0	0	0	
In-Mo	117924	-33250	73	0	0	0	
In-Na	-	-	-	0	0	0	
In-Nb	27621	-42853	13	0	0	0	
In-Ni	35277	-11313	-27	0	0	0	
In-Os	76133	-42988	15	0	0	0	
In-P	-	-	-	0	0	0	

In-Pb	-	-	-	0	0	0	
In-Pd	-123435	-34545	-151	0	0	0	
In-Pt	-80598	-42259	-119	0	0	0	
In-Rb	-	-	-	0	0	0	
In-Re	118208	-44586	60	0	0	0	
In-Rh	-17442	-34790	-66	0	0	0	
In-Ru	55586	-34525	-4	0	0	0	
In-Sb	-	-	-	40000	9977	19.9173 + 0.0200 T	[2]
In-Sc	-154349	-35915	-145	0	0	0	
In-Si	-	-	-	0	0	0	
In-Sn	-	-	-	0	0	0	
In-Sr	-	-	-	0	0	0	
In-Ta	21825	-56079	6	0	0	0	
In-Tc	52187	-39345	-1	0	0	0	
In-Th	-	-	-	0	0	0	
In-Ti	-54571	-35081	-59	0	0	0	
In-Tl	-	-	-	0	0	0	
In-V	38633	-24752	4	0	0	0	
In-W	141603	-48750	93	0	0	0	
In-Y	-172075	-42102	-185	0	0	0	
In-Zn	-	-	-	99	99	99	[60]
In-Zr	-149624	-55647	-141	0	0	0	
Ir-Ag	61643	50076	61	0	0	0	
Ir-Al	-159649	24054	-156	0	0	0	
Ir-As	-123522	26563	-144	0	0	0	
Ir-Au	58011	52466	52	0	0	0	
Ir-Ba	-167788	217077	-70	0	0	0	
Ir-Be	90739	79058	-24	0	0	0	
Ir-Bi	26187	108808	-5	0	0	0	
Ir-Ca	-202089	149429	-97	0	0	0	
Ir-Cd	-27949	63326	-32	0	0	0	
Ir-Co	10462	37020	-13	0	0	0	
Ir-Cr	-54844	19279	-65	0	0	0	
Ir-Cs	25286	187499	214	0	0	0	
Ir-Cu	27747	39245	1	0	0	0	
Ir-Fe	-20050	29667	-32	0	0	0	
Ir-Ga	-122499	22979	-128	0	0	0	
Ir-Ge	-93902	30990	-95	0	0	0	
Ir-Hf	-240163	59687	-293	0	0	0	
Ir-In	-40282	96976	-52	0	0	0	
Ir-Ir	0	0	0	0	0	0	

Ir-K	48676	160443	179	0	0	0	
Ir-La	-158850	121223	-230	0	0	0	
Ir-Li	-184083	55010	-27	0	0	0	
Ir-Mg	-56745	68525	-58	0	0	0	
Ir-Mn	-60172	32431	-66	0	0	0	
Ir-Mo	-80809	-12632	-85	0	0	0	
Ir-Na	24815	108708	102	0	0	0	
Ir-Nb	-198283	-8433	-216	0	0	0	
Ir-Ni	20380	39988	-5	0	0	0	
Ir-Os	-1958	-9554	-2	0	0	0	
Ir-P	-177496	22783	-177	0	0	0	
Ir-Pb	33714	154780	16	0	0	0	
Ir-Pd	24594	22769	24	0	0	0	
Ir-Pt	3476	11391	2	0	0	0	
Ir-Rb	22652	190162	197	0	0	0	
Ir-Re	-11951	-16671	-13	0	0	0	
Ir-Rh	2945	8780	2	0	0	0	
Ir-Ru	-1119	1276	-2	0	0	0	
Ir-Sb	-16733	71538	-66	0	0	0	
Ir-Sc	-232941	68014	-255	0	0	0	
Ir-Si	-150823	27958	-149	0	0	0	
Ir-Sn	-28798	126860	-87	0	0	0	
Ir-Sr	-163619	201150	-73	0	0	0	
Ir-Ta	-190797	-8273	-211	0	0	0	
Ir-Tc	-5899	-4476	-6	0	0	0	
Ir-Th	-196526	139662	-316	0	0	0	
Ir-Ti	-224957	866	-228	0	0	0	
Ir-Tl	15970	121170	12	0	0	0	
Ir-V	-135934	-4676	-130	0	0	0	
Ir-W	-53998	-23018	-63	0	0	0	
Ir-Y	-177583	105410	-242	0	0	0	
Ir-Zn	-74960	34746	-75	0	0	0	
Ir-Zr	-280309	30157	-331	0	0	0	
La-Ag	-52417	65392	-100	0	0	0	
La-Al	-117967	59536	-155	0	0	0	
La-As	-312083	42259	-322	0	0	0	
La-Au	-79428	64456	-55	0	0	0	
La-Ba	67909	47819	69	0	0	0	
La-Be	43533	174961	-91	0	0	0	
La-Bi	-274461	-122	-277	0	0	0	
La-Ca	32070	25651	32	0	0	0	

La-Cd	-138897	35498	-155	0	0	0	
La-Co	74246	134654	-51	0	0	0	
La-Cr	193880	127656	52	99571	104205	-18	[61]
La-Cs	297222	102782	291	0	0	0	
La-Cu	30665	124662	-64	0	0	0	
La-Fe	150593	134968	14	54028	102636	-93.2013 + 0.0237 T	[47]
La-Ga	-150819	56398	-173	0	0	0	
La-Ge	-203399	73034	-231	0	0	0	
La-Hf	99006	8532	53	0	0	0	
La-In	-181042	12966	-178	0	0	0	
La-Ir	-53263	64457	-158	0	0	0	
La-K	177632	74611	207	0	0	0	
La-La	0	0	0	0	0	0	
La-Li	44982	45129	19	0	0	0	
La-Mg	-12637	36217	-31	0	0	0	
La-Mn	124626	117777	8	0	0	0	
La-Mo	225661	77073	103	0	0	0	
La-Na	95598	42834	92	0	0	0	
La-Nb	211759	49336	120	0	0	0	
La-Ni	39059	132923	-81	0	0	0	
La-Os	48121	70583	-70	0	0	0	
La-P	-394901	31863	-401	0	0	0	
La-Pb	-242063	-2548	-241	0	0	0	
La-Pd	-203935	60376	-270	0	0	0	
La-Pt	-186402	47171	-267	0	0	0	
La-Rb	199531	90361	247	0	0	0	
La-Re	132996	65167	9	0	0	0	
La-Rh	-65363	77357	-162	0	0	0	
La-Ru	24669	80439	-90	0	0	0	
La-Sb	-315952	8906	-319	0	0	0	
La-Sc	29484	18960	7	20485	99	-15.3948 + 0.0190 T	[24]
La-Si	-155032	123878	-207	0	0	0	
La-Sn	-237534	15696	-239	0	0	0	
La-Sr	57018	39721	58	0	0	0	
La-Ta	204357	31802	111	0	0	0	
La-Tc	35395	72830	-75	0	0	0	
La-Th	13197	-13909	10	0	0	0	
La-Ti	143488	54449	64	0	0	0	
La-Tl	-184753	9011	-182	0	0	0	
La-V	187603	93631	69	55758	61635	-40	[62]
La-W	228604	54158	104	0	0	0	

La-Y	3215	2175	1	0	0	0	
La-Zn	-73642	81592	-122	0	0	0	
La-Zr	81770	12785	45	0	0	0	
Li-Ag	-	-	-	0	0	0	
Li-Al	-	-	-	0	0	0	
Li-As	-	-	-	0	0	0	
Li-Au	-	-	-	0	0	0	
Li-Ba	-	-	-	0	0	0	
Li-Be	-	-	-	0	0	0	
Li-Bi	-	-	-	0	0	0	
Li-Ca	-	-	-	0	0	0	
Li-Cd	-	-	-	0	0	0	
Li-Co	63636	-20525	31	0	0	0	
Li-Cr	155697	-9323	127	0	0	0	
Li-Cs	-	-	-	0	0	0	
Li-Cu	-	-	-	0	0	0	
Li-Fe	125713	-13815	96	0	0	0	
Li-Ga	-	-	-	0	0	0	
Li-Ge	-	-	-	0	0	0	
Li-Hf	118607	-33802	127	0	0	0	
Li-In	-	-	-	0	0	0	
Li-Ir	2894	-51928	-36	0	0	0	
Li-K	-	-	-	0	0	0	
Li-La	36103	-15282	30	0	0	0	
Li-Li	-	0	-	0	0	0	
Li-Mg	-	-	-	-9449	-9173	-20.9311 + 0.0085 T	[4]
Li-Mn	95716	-1380	71	0	0	0	
Li-Mo	204271	-30140	195	0	0	0	
Li-Na	-	-	-	0	0	0	
Li-Nb	205440	-29802	206	0	0	0	
Li-Ni	37281	-21491	3	0	0	0	
Li-Os	73360	-51647	44	0	0	0	
Li-P	-	-	-	0	0	0	
Li-Pb	-	-	-	0	0	0	
Li-Pd	-118102	-47847	-165	0	0	0	
Li-Pt	-86506	-55837	-138	0	0	0	
Li-Rb	-	-	-	0	0	0	
Li-Re	137579	-49442	118	0	0	0	
Li-Rh	-17580	-45721	-55	0	0	0	
Li-Ru	52155	-43935	20	0	0	0	
Li-Sb	-	-	-	0	0	0	

Li-Sc	49488	-18595	54	47776	-16800	63	[24]
Li-Si	-	-	-	0	0	0	
Li-Sn	-	-	-	0	0	0	
Li-Sr	-	-	-	0	0	0	
Li-Ta	196188	-43010	196	0	0	0	
Li-Tc	62055	-47266	34	0	0	0	
Li-Th	-	-	-	0	0	0	
Li-Ti	139673	-21861	135	0	0	0	
Li-Tl	-	-	-	0	0	0	
Li-V	160120	-20348	141	0	0	0	
Li-W	211061	-46584	204	0	0	0	
Li-Y	38347	-19414	38	0	0	0	
Li-Zn	-	-	-	0	0	0	
Li-Zr	108611	-32330	117	0	0	0	
Mg-Ag	-	-	-	0	0	0	
Mg-Al	-	-	-	4450	2193	-12.0719 + 0.0001 T	[4]
Mg-As	-	-	-	0	0	0	
Mg-Au	-	-	-	0	0	0	
Mg-Ba	-	-	-	0	0	0	
Mg-Be	-	-	-	0	0	0	
Mg-Bi	-	-	-	-54819	-841	-44.0306 - 0.0210 T	[63]
Mg-Ca	-	-	-	0	0	0	
Mg-Cd	-	-	-	0	0	0	
Mg-Co	76871	20187	3	0	0	0	
Mg-Cr	145852	19487	75	0	0	0	
Mg-Cs	-	-	-	0	0	0	
Mg-Cu	-	-	-	10000	19521	-33	[35]
Mg-Fe	126691	22616	54	0	0	0	
Mg-Ga	-	-	-	0	0	0	
Mg-Ge	-	-	-	0	0	0	
Mg-Hf	29471	-37671	29	0	0	0	
Mg-In	-	-	-	0	0	0	
Mg-Ir	10072	-27394	-57	0	0	0	
Mg-K	-	-	-	0	0	0	
Mg-La	-9623	-6500	-41	0	0	0	
Mg-Li	-	-	-	-6285	6967	-11	[4]
Mg-Mg	-	0	-	0	0	0	
Mg-Mn	81564	25355	28	35338	34320	-3.0803 - 0.0018 T	[64]
Mg-Mo	168710	-15970	125	0	0	0	
Mg-Na	-	-	-	0	0	0	
Mg-Nb	129168	-27418	111	0	0	0	

Mg-Ni	54560	19658	-20	0	0	0	
Mg-Os	77759	-26758	11	0	0	0	
Mg-P	-	-	-	0	0	0	
Mg-Pb	-	-	-	0	0	0	
Mg-Pd	-113433	-23084	-161	0	0	0	
Mg-Pt	-85576	-34063	-144	0	0	0	
Mg-Rb	-	-	-	0	0	0	
Mg-Re	130901	-29267	72	0	0	0	
Mg-Rh	-10235	-18056	-71	0	0	0	
Mg-Ru	58974	-17326	-8	0	0	0	
Mg-Sb	-	-	-	0	0	0	
Mg-Sc	-19092	-19451	-20	0	0	0	
Mg-Si	-	-	-	-6255	17618	-41.1743 + 0.0009 T	[65]
Mg-Sn	-	-	-	-22000	108	-3	[35]
Mg-Sr	-	-	-	0	0	0	
Mg-Ta	122921	-41668	104	0	0	0	
Mg-Tc	61455	-22837	2	0	0	0	
Mg-Th	-	-	-	0	0	0	
Mg-Ti	65209	-18738	50	0	0	0	
Mg-Tl	-	-	-	0	0	0	
Mg-V	118583	-2945	74	0	0	0	
Mg-W	180858	-34455	136	0	0	0	
Mg-Y	-13560	-15943	-35	0	0	0	
Mg-Zn	-	-	-	2543	16504	-17.1382 + 0.0004 T	[66]
Mg-Zr	13000	-36817	13	40148	-33605	40	[67]
Mn-Ag	67790	29985	57	0	0	0	
Mn-Al	-103898	5279	-127	0	0	0	
Mn-As	-156741	-10231	-213	0	0	0	
Mn-Au	-25907	23465	-53	0	0	0	
Mn-Ba	112189	229772	176	0	0	0	
Mn-Be	-250231	-46557	-445	0	0	0	
Mn-Bi	34026	86022	-58	0	0	0	
Mn-Ca	79415	156575	102	0	0	0	
Mn-Cd	11576	45748	-25	0	0	0	
Mn-Co	-18827	-18154	-21	0	0	0	
Mn-Cr	8600	-11652	9	0	0	0	
Mn-Cs	183587	196187	480	0	0	0	
Mn-Cu	15159	-1901	15	99	99	12	[36]
Mn-Fe	1510	-16222	1	-1522	-16632	-3.3938 + 0.0012 T	[1]
Mn-Ga	-62955	291	-106	0	0	0	
Mn-Ge	-105410	-1304	-132	0	0	0	

Mn-Hf	29486	64558	-57	0	0	0	
Mn-In	5421	82134	-39	0	0	0	
Mn-Ir	-70847	-34508	-80	0	0	0	
Mn-K	194451	162624	387	0	0	0	
Mn-La	91022	133126	14	0	0	0	
Mn-Li	73974	39770	76	0	0	0	
Mn-Mg	54184	61819	37	85000	43186	57	[64]
Mn-Mn	0	0	0	0	0	0	
Mn-Mo	33978	-20564	22	0	0	0	
Mn-Na	185069	101601	235	0	0	0	
Mn-Nb	18629	-1297	-17	0	0	0	
Mn-Ni	-30160	-17223	-33	0	0	0	
Mn-Os	-33118	-40852	-38	0	0	0	
Mn-P	-277519	-28448	-305	0	0	0	
Mn-Pb	45049	131400	-26	41100	16836	-128	
Mn-Pd	-85201	-16851	-100	0	0	0	
Mn-Pt	-108482	-24522	-128	0	0	0	
Mn-Rb	184049	196971	432	0	0	0	
Mn-Re	3014	-38327	-2	0	0	0	
Mn-Rh	-63265	-29706	-70	0	0	0	
Mn-Ru	-42116	-33742	-46	0	0	0	
Mn-Sb	-22927	45919	-132	0	0	0	
Mn-Sc	23464	76249	-40	0	0	0	
Mn-Si	-149295	-11822	-167	0	0	0	
Mn-Sn	34287	102030	-99	0	0	0	
Mn-Sr	100052	211836	156	81258	91630	80	[52]
Mn-Ta	23817	-2204	-17	0	0	0	
Mn-Tc	-30090	-35685	-37	0	0	0	
Mn-Th	101396	144399	-42	0	0	0	
Mn-Ti	-9357	6056	-36	0	0	0	
Mn-Tl	43519	104053	6	0	0	0	
Mn-V	228	-16580	-3	0	0	0	
Mn-W	41047	-30126	28	0	0	0	
Mn-Y	88099	115266	-8	0	0	0	
Mn-Zn	-47725	8302	-55	0	0	0	
Mn-Zr	7502	42800	-74	0	0	0	
Mo-Ag	149078	59949	150	0	0	0	
Mo-Al	-64468	36181	-64	0	0	0	
Mo-As	-115254	31888	-133	0	0	0	
Mo-Au	16358	41697	14	0	0	0	
Mo-Ba	162937	256059	386	0	0	0	

Mo-Be	86660	87164	-30	0	0	0	
Mo-Bi	135324	112804	116	0	0	0	
Mo-Ca	219365	179624	263	0	0	0	
Mo-Cd	84920	72834	82	0	0	0	
Mo-Co	15269	45932	-18	0	0	0	
Mo-Cr	27912	36040	1	0	0	0	
Mo-Cs	356431	247293	730	0	0	0	
Mo-Cu	96512	56039	67	82313	51169	57	[48]
Mo-Fe	17621	42140	-7	0	0	0	
Mo-Ga	-13811	38657	-20	0	0	0	
Mo-Ge	-52173	40701	-53	0	0	0	
Mo-Hf	10681	62514	-17	0	0	0	
Mo-In	95839	102627	95	0	0	0	
Mo-Ir	-79729	-4146	-86	0	0	0	
Mo-K	361353	208907	601	0	0	0	
Mo-La	165253	148882	156	130000	109110	83	[68]
Mo-Li	211278	80507	169	0	0	0	
Mo-Mg	132707	86302	137	0	0	0	
Mo-Mn	36765	50226	18	0	0	0	
Mo-Mo	0	0	0	0	0	0	
Mo-Na	54812	141906	390	0	0	0	
Mo-Nb	-17589	6575	-23	0	0	0	
Mo-Ni	7900	46901	-27	0	0	0	
Mo-Os	-48478	-8748	-55	0	0	0	
Mo-P	-269274	17642	-270	0	0	0	
Mo-Pb	148511	147707	142	0	0	0	
Mo-Pd	-57599	17812	-59	0	0	0	
Mo-Pt	-110633	217	-114	0	0	0	
Mo-Rb	352245	242730	665	0	0	0	
Mo-Re	-24657	-13376	-27	0	0	0	
Mo-Rh	-53441	9057	-59	0	0	0	
Mo-Ru	-47522	2544	-56	0	0	0	
Mo-Sb	52787	75065	10	0	0	0	
Mo-Sc	55742	85851	45	0	0	0	
Mo-Si	-119754	40926	-120	0	0	0	
Mo-Sn	83995	110654	33	0	0	0	
Mo-Sr	-771653	236478	351	0	0	0	
Mo-Ta	-13328	940	-20	0	0	0	
Mo-Tc	-41452	-2261	-45	0	0	0	
Mo-Th	121628	146284	63	49000	96027	-26.1842 - 0.0062 T	[41]
Mo-Ti	-13211	22013	-15	0	0	0	

Mo-Tl	152312	125400	162	0	0	0	
Mo-V	5044	16331	0	19245	17499	13	[69]
Mo-W	-888	-16390	-1	2000	-15969	2	[1]
Mo-Y	138562	126945	114	100000	108824	55	[70]
Mo-Zn	18725	50220	16	0	0	0	
Mo-Zr	-2217	47254	-27	0	0	0	
Na-Ag	-	-	-	0	0	0	
Na-Al	-	-	-	0	0	0	
Na-As	-	-	-	0	0	0	
Na-Au	-	-	-	0	0	0	
Na-Ba	-	-	-	0	0	0	
Na-Be	-	-	-	0	0	0	
Na-Bi	-	-	-	0	0	0	
Na-Ca	-	-	-	0	0	0	
Na-Cd	-	-	-	0	0	0	
Na-Co	207554	18464	127	0	0	0	
Na-Cr	313898	26138	221	0	0	0	
Na-Cs	-	-	-	0	0	0	
Na-Cu	-	-	-	0	0	0	
Na-Fe	283156	24725	195	0	0	0	
Na-Ga	-	-	-	0	0	0	
Na-Ge	-	-	-	0	0	0	
Na-Hf	266311	-19774	221	0	0	0	
Na-In	-	-	-	0	0	0	
Na-Ir	166261	-15673	95	0	0	0	
Na-K	-	-	-	0	0	0	
Na-La	96687	-20274	98	0	0	0	
Na-Li	-	-	-	0	0	0	
Na-Mg	-	-	-	0	0	0	
Na-Mn	231843	32374	152	0	0	0	
Na-Mo	393061	2198	311	0	0	0	
Na-Na	-	0	-	0	0	0	
Na-Nb	388185	-4121	313	0	0	0	
Na-Ni	177588	17585	100	0	0	0	
Na-Os	247468	-14887	173	0	0	0	
Na-P	-	-	-	0	0	0	
Na-Pb	-	-	-	0	0	0	
Na-Pd	11619	-14560	-50	0	0	0	
Na-Pt	65005	-21240	-3	0	0	0	
Na-Rb	-	-	-	0	0	0	
Na-Re	322105	-14197	246	0	0	0	

Na-Rh	132226	-9684	64	0	0	0	
Na-Ru	219247	-7092	145	0	0	0	
Na-Sb	-	-	-	0	0	0	
Na-Sc	149535	-9454	125	0	0	0	
Na-Si	-	-	-	0	0	0	
Na-Sn	-	-	-	0	0	0	
Na-Sr	-	-	-	0	0	0	
Na-Ta	376003	-18697	302	0	0	0	
Na-Tc	230983	-11135	159	0	0	0	
Na-Th	-	-	-	0	0	0	
Na-Ti	292872	1462	225	0	0	0	
Na-Tl	-	-	-	0	0	0	
Na-V	317929	10544	231	0	0	0	
Na-W	406325	-14685	327	0	0	0	
Na-Y	113592	-18509	108	0	0	0	
Na-Zn	-	-	-	0	0	0	
Na-Zr	248359	-17461	208	0	0	0	
Nb-Ag	66116	47147	66	0	0	0	
Nb-Al	-117786	28632	-116	0	0	0	
Nb-As	-235326	19181	-252	0	0	0	
Nb-Au	-128848	16888	-134	0	0	0	
Nb-Ba	307404	210950	437	0	0	0	
Nb-Be	13697	79875	-90	0	0	0	
Nb-Bi	24824	68032	-17	0	0	0	
Nb-Ca	244893	142984	299	0	0	0	
Nb-Cd	14510	51666	10	0	0	0	
Nb-Co	-49420	42441	-88	30414	69083	-3.1545 - 0.0069 T	[71]
Nb-Cr	12455	39949	-26	0	0	0	
Nb-Cs	427970	241231	820	0	0	0	
Nb-Cu	37474	56267	9	49480	63256	27	[48]
Nb-Fe	-22191	42161	-57	1933	64340	-32.5147 + 0.0063 T	[48]
Nb-Ga	-77785	31717	-82	0	0	0	
Nb-Ge	-145045	33625	-144	0	0	0	
Nb-Hf	26154	20749	17	22714	26400	14	[58]
Nb-In	24993	64043	16	0	0	0	
Nb-Ir	-186361	-12134	-207	0	0	0	
Nb-K	410707	198723	657	0	0	0	
Nb-La	185141	101564	177	0	0	0	
Nb-Li	200623	77731	185	0	0	0	
Nb-Mg	118511	67194	121	0	0	0	
Nb-Mn	14111	53430	-13	0	0	0	

Nb-Mo	-15642	959	-22	0	0	0	
Nb-Na	350848	130180	408	0	0	0	
Nb-Nb	0	0	0	0	0	0	
Nb-Ni	-68842	42351	-107	0	0	0	
Nb-Os	-129788	-13336	-152	0	0	0	
Nb-P	-412762	5039	-407	0	0	0	
Nb-Pb	43106	83268	18	0	0	0	
Nb-Pd	-202318	5182	-208	0	0	0	
Nb-Pt	-256138	-14310	-267	0	0	0	
Nb-Rb	417800	230377	736	0	0	0	
Nb-Re	-84493	-16322	-100	0	0	0	
Nb-Rh	-158449	2194	-176	0	0	0	
Nb-Ru	-133647	-2226	-156	0	0	0	
Nb-Sb	-73118	42097	-125	0	0	0	
Nb-Sc	81327	53160	76	0	0	0	
Nb-Si	-196632	37973	-195	0	0	0	
Nb-Sn	-25527	52404	-68	0	0	0	
Nb-Sr	292385	192039	396	0	0	0	
Nb-Ta	0	-11491	0	0	0	0	
Nb-Tc	-123764	-6684	-139	0	0	0	
Nb-Th	134380	72895	95	0	0	0	
Nb-Ti	8165	17302	8	13045	17881	13	[72]
Nb-Tl	72457	79616	67	0	0	0	
Nb-V	8294	21405	-4	9080	23072	-2	[73]
Nb-W	-26650	-19161	-33	0	0	0	
Nb-Y	158775	80362	139	150000	86867	113	[74]
Nb-Zn	-32742	47406	-35	0	0	0	
Nb-Zr	26461	19478	17	1143	17603	-14.6427 + 0.0055 T	[75]
Ni-Ag	81153	50052	68	57720	34474	25.4002 + 0.0031 T	[5]
Ni-Al	-112848	21675	-139	0	0	0	
Ni-As	-100697	12510	-155	0	0	0	
Ni-Au	64670	54120	33	18378	24312	-14.1772 - 0.0171 T	[18]
Ni-Ba	-68074	230117	1	0	0	0	
Ni-Be	-5465	13179	-22	0	0	0	
Ni-Bi	55090	111466	-15	0	0	0	
Ni-Ca	-112270	160707	-37	0	0	0	
Ni-Cd	8804	64885	-24	0	0	0	
Ni-Co	-950	-2473	-1	0	0	0	
Ni-Cr	-24788	-728	-27	99	99	-27.6618 + 0.0035 T	[1]
Ni-Cs	57804	189848	284	0	0	0	
Ni-Cu	14038	12325	14	11168	12144	12.7562 + 0.0010 T	[38]

Ni-Fe	-4765	-3357	-6	0	0	0	
Ni-Ga	-68590	16218	-114	0	0	0	
Ni-Ge	-70201	19054	-99	0	0	0	
Ni-Hf	-73746	70712	-204	0	0	0	
Ni-In	-5296	102546	-42	0	0	0	
Ni-Ir	16098	-7923	-7	0	0	0	
Ni-K	81775	161638	235	0	0	0	
Ni-La	-36738	135983	-146	0	0	0	
Ni-Li	359317	46833	3	0	0	0	
Ni-Mg	-9284	73673	-25	0	0	0	
Ni-Mn	-31712	10005	-33	0	0	0	
Ni-Mo	14587	-8120	-32	0	0	0	
Ni-Na	66611	107292	140	0	0	0	
Ni-Nb	-65495	5372	-136	0	0	0	
Ni-Ni	0	0	0	0	0	0	
Ni-Os	27050	-17984	6	0	0	0	
Ni-P	-183571	-2851	-206	0	0	0	
Ni-Pb	58995	157948	8	30570	39574	-43.7160 - 0.0322 T	[76]
Ni-Pd	19417	12606	0	0	0	0	
Ni-Pt	5161	6879	-22	0	0	0	
Ni-Rb	58728	194012	259	0	0	0	
Ni-Re	40451	-18523	10	0	0	0	
Ni-Rh	12795	-4960	-4	0	0	0	
Ni-Ru	16762	-10997	2	0	0	0	
Ni-Sb	18319	71474	-79	0	0	0	
Ni-Sc	-100998	81615	-180	0	0	0	
Ni-Si	-118592	7754	-145	0	0	0	
Ni-Sn	40563	127412	-84	0	0	0	
Ni-Sr	-64137	213712	-6	0	0	0	
Ni-Ta	-49022	5753	-133	0	0	0	
Ni-Tc	25705	-13548	3	0	0	0	
Ni-Th	-30196	148016	-218	0	0	0	
Ni-Ti	-104978	11767	-154	0	0	0	
Ni-Tl	38845	126066	14	0	0	0	
Ni-V	-61654	-7949	-75	0	0	0	
Ni-W	41385	-15328	-14	0	0	0	
Ni-Y	-39936	119333	-162	0	0	0	
Ni-Zn	-56940	23446	-63	0	0	0	
Ni-Zr	-118196	45716	-237	0	0	0	
Pb-Ag	-	-	-	0	0	0	
Pb-Al	-	12468	-	0	0	0	

Pb-As	-	-	-	0	0	0	
Pb-Au	-	-	-	30000	16239	11	[19]
Pb-Ba	-	-	-	0	0	0	
Pb-Be	-	-	-	0	0	0	
Pb-Bi	-	-	-	0	0	0	
Pb-Ca	-	-	-	0	0	0	
Pb-Cd	-	-	-	0	0	0	
Pb-Co	118307	9975	18	0	0	0	
Pb-Cr	148622	9824	50	0	0	0	
Pb-Cs	-	-	-	0	0	0	
Pb-Cu	-	-	-	0	0	0	
Pb-Fe	157374	12302	54	0	0	0	
Pb-Ga	-	-	-	0	0	0	
Pb-Ge	-	-	-	0	0	0	
Pb-Hf	-140390	-55945	-132	0	0	0	
Pb-In	-	-	-	0	0	0	
Pb-Ir	101193	-21988	11	0	0	0	
Pb-K	-	-	-	0	0	0	
Pb-La	-239135	-48872	-250	0	0	0	
Pb-Li	-	-	-	0	0	0	
Pb-Mg	-	-	-	0	0	0	
Pb-Mn	56062	16416	-15	0	0	0	
Pb-Mo	171470	-19819	95	0	0	0	
Pb-Na	-	-	-	0	0	0	
Pb-Nb	41746	-35874	13	0	0	0	
Pb-Ni	103972	10746	5	30570	91086	4.9726 - 0.0204 T	[76]
Pb-Os	161343	-24347	62	0	0	0	
Pb-P	-	-	-	0	0	0	
Pb-Pb	-	0	-	0	0	0	
Pb-Pd	-58071	-17502	-105	0	0	0	
Pb-Pt	124	-24678	-62	0	0	0	
Pb-Rb	-	-	-	0	0	0	
Pb-Re	198290	-27764	101	0	0	0	
Pb-Rh	57982	-16160	-22	0	0	0	
Pb-Ru	137870	-15687	41	0	0	0	
Pb-Sb	-	-	-	0	0	0	
Pb-Sc	-193843	-38743	-176	0	0	0	
Pb-Si	-	-	-	0	0	0	
Pb-Sn	-	-	-	6696	4866	4.3696 + 0.0016 T	[1]
Pb-Sr	-	-	-	0	0	0	
Pb-Ta	36284	-49977	5	0	0	0	

Pb-Tc	130850	-21204	43	0	0	0	
Pb-Th	-	-	-	0	0	0	
Pb-Ti	-57301	-29647	-70	0	0	0	
Pb-Tl	-	-	-	0	0	0	
Pb-V	66522	-12140	9	0	0	0	
Pb-W	203781	-35526	121	0	0	0	
Pb-Y	-228216	-48338	-225	0	0	0	
Pb-Zn	-	19918	-	0	0	0	
Pb-Zr	-181838	-56517	-167	0	0	0	
Pd-Ag	-28331	15318	-28	0	0	0	
Pd-Al	-223222	-5339	-216	0	0	0	
Pd-As	-193221	-1930	-215	0	0	0	
Pd-Au	3266	15581	0	0	0	0	
Pd-Ba	-315043	139895	-298	0	0	0	
Pd-Be	39736	37794	-32	0	0	0	
Pd-Bi	-109781	49067	-178	0	0	0	
Pd-Ca	-352838	84342	-272	0	0	0	
Pd-Cd	-128127	22332	-136	0	0	0	
Pd-Co	11928	9006	-5	0	0	0	
Pd-Cr	-47222	-1415	-53	0	0	0	
Pd-Cs	-135024	131858	-40	0	0	0	
Pd-Cu	-38169	10747	-48	0	0	0	
Pd-Fe	-5894	5249	-16	0	0	0	
Pd-Ga	-205801	-7934	-213	0	0	0	
Pd-Ge	-170458	2263	-170	0	0	0	
Pd-Hf	-290164	-15040	-342	0	0	0	
Pd-In	-159074	39900	-186	0	0	0	
Pd-Ir	24783	-16830	24	0	0	0	
Pd-K	-109771	108907	-38	0	0	0	
Pd-La	-278945	48149	-388	0	0	0	
Pd-Li	- 1.3203197554 458831*^6	22405	-123	0	0	0	
Pd-Mg	-161381	25380	-162	0	0	0	
Pd-Mn	-80726	9716	-82	0	0	0	
Pd-Mo	-56191	-30677	-57	0	0	0	
Pd-Na	-117023	65416	-53	0	0	0	
Pd-Nb	-200992	-40737	-212	0	0	0	
Pd-Ni	19489	11869	0	0	0	0	
Pd-Os	32406	-25302	31	0	0	0	
Pd-P	-199416	770	-197	0	0	0	
Pd-Pb	-102453	74988	-152	0	0	0	

Pd-Pd	0	0	0	0	0	0	
Pd-Pt	8075	-9276	8	0	0	0	
Pd-Rb	-135594	134325	-39	0	0	0	
Pd-Re	26004	-32062	26	0	0	0	
Pd-Rh	8999	-10471	7	18507	-9017	17.9814 - 0.0033 T	[77]
Pd-Ru	26598	-15539	24	12541	-16506	-6.5768 + 0.0176 T	[77]
Pd-Sb	-132813	24182	-204	0	0	0	
Pd-Sc	-322485	5893	-352	0	0	0	
Pd-Si	-196668	-895	-190	0	0	0	
Pd-Sn	-150402	41312	-220	0	0	0	
Pd-Sr	-308330	126341	-285	0	0	0	
Pd-Ta	-196820	-48357	-210	0	0	0	
Pd-Tc	17211	-21391	17	0	0	0	
Pd-Th	-292401	34584	-440	0	0	0	
Pd-Ti	-255275	-30699	-256	0	0	0	
Pd-Tl	-116283	58023	-144	0	0	0	
Pd-V	-140106	-24597	-132	0	0	0	
Pd-W	-22908	-42876	-26	0	0	0	
Pd-Y	-286094	31259	-379	0	0	0	
Pd-Zn	-153507	6864	-143	0	0	0	
Pd-Zr	-337979	-28286	-391	-222417	17471	-55.7322 + 0.0697 T	[78]
Pt-Ag	-2569	27485	-3	0	0	0	
Pt-Al	-217364	5264	-207	0	0	0	
Pt-As	-176485	11318	-191	0	0	0	
Pt-Au	19288	26353	18	0	0	0	
Pt-Ba	-300141	156251	-233	0	0	0	
Pt-Be	67783	58232	-37	0	0	0	
Pt-Bi	-67356	65255	-110	0	0	0	
Pt-Ca	-331866	98107	-226	0	0	0	
Pt-Cd	-101451	34821	-102	0	0	0	
Pt-Co	-2646	23192	-26	-49573	23164	-71	[25]
Pt-Cr	-77114	8490	-87	-146232	4695	-164	[25]
Pt-Cs	-89156	150401	45	0	0	0	
Pt-Cu	-20068	25782	-42	0	0	0	
Pt-Fe	-34050	17388	-47	-169314	5171	-281.5713 + 0.0797 T	[49]
Pt-Ga	-191796	4544	-192	0	0	0	
Pt-Ge	-147460	16033	-145	0	0	0	
Pt-Hf	-338797	-10194	-374	0	0	0	
Pt-In	-126223	53372	-141	0	0	0	
Pt-Ir	3409	-8140	1	0	0	0	
Pt-K	-64483	126011	35	0	0	0	

Pt-La	-285256	59200	-368	0	0	0	
Pt-Li	-308919	35129	-96	0	0	0	
Pt-Mg	-138695	36507	-138	0	0	0	
Pt-Mn	-95390	20700	-101	0	0	0	
Pt-Mo	-110632	-26487	-108	0	0	0	
Pt-Na	-80768	79941	-3	0	0	0	
Pt-Nb	-261140	-38385	-264	0	0	0	
Pt-Ni	9006	26463	-17	0	0	0	
Pt-Os	339	-17296	-2	0	0	0	
Pt-P	-193212	13382	-188	0	0	0	
Pt-Pb	-59319	91419	-87	0	0	0	
Pt-Pd	8184	11863	8	0	0	0	
Pt-Pt	0	0	0	0	0	0	
Pt-Rb	-92445	151967	40	0	0	0	
Pt-Re	-17269	-26166	-17	0	0	0	
Pt-Rh	-3065	242	-6	0	0	0	
Pt-Ru	250	-6531	-4	0	0	0	
Pt-Sb	-100171	38742	-151	0	0	0	
Pt-Sc	-340010	13939	-354	0	0	0	
Pt-Si	-190196	14015	-184	0	0	0	
Pt-Sn	-128249	55173	-176	0	0	0	
Pt-Sr	-294690	142056	-225	0	0	0	
Pt-Ta	-256080	-46024	-260	0	0	0	
Pt-Tc	-11479	-13000	-12	0	0	0	
Pt-Th	-325740	44376	-445	0	0	0	
Pt-Ti	-297025	-26020	-290	0	0	0	
Pt-Tl	-73533	73103	-86	0	0	0	
Pt-V	-177648	-17485	-167	0	0	0	
Pt-W	-79191	-39579	-79	0	0	0	
Pt-Y	-301364	41393	-367	0	0	0	
Pt-Zn	-130409	19655	-126	0	0	0	
Pt-Zr	-384101	-23613	-421	0	0	0	
Rb-Ag	-	-	-	0	0	0	
Rb-Al	-	-	-	0	0	0	
Rb-As	-	-	-	0	0	0	
Rb-Au	-	-	-	0	0	0	
Rb-Ba	-	-	-	0	0	0	
Rb-Be	-	-	-	0	0	0	
Rb-Bi	-	-	-	0	0	0	
Rb-Ca	-	-	-	0	0	0	
Rb-Cd	-	-	-	0	0	0	

Rb-Co	271963	34239	151	0	0	0	
Rb-Cr	401792	43860	249	0	0	0	
Rb-Cs	-	-	-	0	0	0	
Rb-Cu	-	-	-	0	0	0	
Rb-Fe	361230	41137	221	0	0	0	
Rb-Ga	-	-	-	0	0	0	
Rb-Ge	-	-	-	0	0	0	
Rb-Hf	425466	4823	285	0	0	0	
Rb-In	-	-	-	0	0	0	
Rb-Ir	232749	3290	123	0	0	0	
Rb-K	-	-	-	0	0	0	
Rb-La	237721	-2047	170	0	0	0	
Rb-Li	-	-	-	0	0	0	
Rb-Mg	-	-	-	0	0	0	
Rb-Mn	314887	50599	182	0	0	0	
Rb-Mo	508259	22491	345	0	0	0	
Rb-Na	-	-	-	0	0	0	
Rb-Nb	536958	19221	364	0	0	0	
Rb-Ni	236564	33260	123	0	0	0	
Rb-Os	323383	3712	200	0	0	0	
Rb-P	-	-	-	0	0	0	
Rb-Pb	-	-	-	0	0	0	
Rb-Pd	60129	4527	-24	0	0	0	
Rb-Pt	122913	-1423	27	0	0	0	
Rb-Rb	-	0	-	0	0	0	
Rb-Re	411053	4845	273	0	0	0	
Rb-Rh	193882	8663	90	0	0	0	
Rb-Ru	290105	11212	171	0	0	0	
Rb-Sb	-	-	-	0	0	0	
Rb-Sc	295362	14960	192	0	0	0	
Rb-Si	-	-	-	0	0	0	
Rb-Sn	-	-	-	0	0	0	
Rb-Sr	-	-	-	0	0	0	
Rb-Ta	522026	4636	352	0	0	0	
Rb-Tc	307153	7531	186	0	0	0	
Rb-Th	-	-	-	0	0	0	
Rb-Ti	431085	24978	277	0	0	0	
Rb-Tl	-	-	-	0	0	0	
Rb-V	427989	30898	269	0	0	0	
Rb-W	519909	5668	359	0	0	0	
Rb-Y	258589	3285	179	0	0	0	

Rb-Zn	-	-	-	0	0	0	
Rb-Zr	413510	7877	277	0	0	0	
Re-Ag	151716	74179	152	0	0	0	
Re-Al	-78033	47461	-77	0	0	0	
Re-As	-74984	48056	-90	0	0	0	
Re-Au	85379	67364	83	0	0	0	
Re-Ba	46459	259743	210	0	0	0	
Re-Be	119915	99013	-7	0	0	0	
Re-Bi	137094	135424	130	0	0	0	
Re-Ca	-83716	185896	125	0	0	0	
Re-Cd	71272	87857	70	0	0	0	
Re-Co	38084	57263	8	0	0	0	
Re-Cr	4249	42154	-16	0	0	0	
Re-Cs	223176	236556	514	0	0	0	
Re-Cu	99202	63922	65	0	0	0	
Re-Fe	18699	50904	-1	0	0	0	
Re-Ga	-28864	48889	-33	0	0	0	
Re-Ge	-30356	53849	-31	0	0	0	
Re-Hf	-91744	83194	-129	0	0	0	
Re-In	74604	122261	76	0	0	0	
Re-Ir	-12144	14062	-13	0	0	0	
Re-K	240429	203749	431	0	0	0	
Re-La	40820	158588	14	0	0	0	
Re-Li	2.3174966197 41846*^6	83941	94	0	0	0	
Re-Mg	73309	96382	75	0	0	0	
Re-Mn	13101	56552	-2	0	0	0	
Re-Mo	-25443	8467	-27	0	0	0	
Re-Na	186724	143530	281	0	0	0	
Re-Nb	-93710	15416	-105	0	0	0	
Re-Ni	40451	59268	8	0	0	0	
Re-Os	-2592	6269	-4	0	0	0	
Re-P	-185988	37522	-186	0	0	0	
Re-Pb	146526	177880	151	0	0	0	
Re-Pd	26074	38215	26	0	0	0	
Re-Pt	-17027	23247	-18	0	0	0	
Re-Rb	219923	235792	472	0	0	0	
Re-Re	0	0	0	0	0	0	
Re-Rh	5988	25307	4	0	0	0	
Re-Ru	-749	17397	-4	0	0	0	
Re-Sb	71910	96012	39	0	0	0	
Re-Sc	-58943	97900	-72	0	0	0	

Re-Si	-100815	51355	-101	0	0	0	
Re-Sn	76413	144968	33	0	0	0	
Re-Sr	39500	241587	188	0	0	0	
Re-Ta	-87125	13628	-100	0	0	0	
Re-Tc	1303	12327	1	0	0	0	
Re-Th	-5082	169781	-81	0	0	0	
Re-Ti	-98868	28078	-101	0	0	0	
Re-Tl	134779	146924	148	0	0	0	
Re-V	-47409	20556	-48	0	0	0	
Re-W	-13030	-4628	-17	0	0	0	
Re-Y	14635	139283	-20	0	0	0	
Re-Zn	7422	59160	2	0	0	0	
Re-Zr	-118626	58866	-153	0	0	0	
Rh-Ag	39196	42634	38	0	0	0	
Rh-Al	-167387	17362	-167	0	0	0	
Rh-As	-141288	16701	-169	0	0	0	
Rh-Au	39319	45987	30	0	0	0	
Rh-Ba	-174240	208712	-108	0	0	0	
Rh-Be	57242	57646	-26	0	0	0	
Rh-Bi	-5273	98802	-57	0	0	0	
Rh-Ca	-212873	142396	-124	0	0	0	
Rh-Cd	-48278	55826	-59	0	0	0	
Rh-Co	7082	21252	-8	0	0	0	
Rh-Cr	-45312	9543	-50	0	0	0	
Rh-Cs	-878	176888	168	0	0	0	
Rh-Cu	5199	26090	-9	0	0	0	
Rh-Fe	-12912	16458	-20	0	0	0	
Rh-Ga	-134594	14450	-148	0	0	0	
Rh-Ge	-113572	21244	-118	0	0	0	
Rh-Hf	-208510	55347	-277	0	0	0	
Rh-In	-64129	89113	-86	0	0	0	
Rh-Ir	2814	-6573	3	0	0	0	
Rh-K	22466	150610	139	0	0	0	
Rh-La	-154988	115387	-245	0	0	0	
Rh-Li	-292272	46802	-43	0	0	0	
Rh-Mg	-72765	62219	-76	0	0	0	
Rh-Mn	-58209	22902	-60	0	0	0	
Rh-Mo	-51785	-15028	-61	0	0	0	
Rh-Na	2464	99938	72	0	0	0	
Rh-Nb	-162761	-8960	-188	0	0	0	
Rh-Ni	13773	24036	-3	0	0	0	

Rh-Os	8182	-16126	8	0	0	0	
Rh-P	-191391	12313	-194	0	0	0	
Rh-Pb	2352	144449	-33	0	0	0	
Rh-Pd	9066	14307	8	18507	14426	16.9964 - 0.0033 T	[77]
Rh-Pt	-3395	5107	-7	0	0	0	
Rh-Rb	-2456	180290	154	0	0	0	
Rh-Re	6568	-20836	4	0	0	0	
Rh-Rh	0	0	0	0	0	0	
Rh-Ru	5073	-6513	5	0	0	0	
Rh-Sb	-41869	62304	-109	0	0	0	
Rh-Sc	-221517	63617	-257	0	0	0	
Rh-Si	-162445	13257	-160	0	0	0	
Rh-Sn	-44357	116238	-123	0	0	0	
Rh-Sr	-170326	193141	-108	0	0	0	
Rh-Ta	-155244	-9282	-185	0	0	0	
Rh-Tc	1833	-11390	1	0	0	0	
Rh-Th	-174978	132095	-317	0	0	0	
Rh-Ti	-200716	-1247	-211	0	0	0	
Rh-Tl	-14234	112334	-30	0	0	0	
Rh-V	-117811	-9821	-113	0	0	0	
Rh-W	-24199	-24253	-37	0	0	0	
Rh-Y	-167855	99766	-253	0	0	0	
Rh-Zn	-94280	25831	-90	0	0	0	
Rh-Zr	-251230	27561	-316	0	0	0	
Ru-Ag	93995	56673	94	0	0	0	
Ru-Al	-125464	29476	-126	0	0	0	
Ru-As	-100425	29148	-124	0	0	0	
Ru-Au	71891	57968	64	0	0	0	
Ru-Ba	-82300	233565	32	0	0	0	
Ru-Be	71387	66869	-17	0	0	0	
Ru-Bi	70393	118630	43	0	0	0	
Ru-Ca	-131261	163273	-16	0	0	0	
Ru-Cd	10628	70831	4	0	0	0	
Ru-Co	11969	29401	-3	0	0	0	
Ru-Cr	-37230	17568	-43	0	0	0	
Ru-Cs	92185	202150	320	0	0	0	
Ru-Cu	43616	37351	25	0	0	0	
Ru-Fe	-10248	24231	-17	0	0	0	
Ru-Ga	-82364	28127	-93	0	0	0	
Ru-Ge	-68619	33810	-72	0	0	0	
Ru-Hf	-165399	71462	-227	0	0	0	

Ru-In	4696	106849	-5	0	0	0	
Ru-Ir	-1147	-18	-2	0	0	0	
Ru-K	113969	173164	268	0	0	0	
Ru-La	-74109	136803	-137	0	0	0	
Ru-Li	-194877	60931	16	0	0	0	
Ru-Mg	-8343	77763	-9	0	0	0	
Ru-Mn	-36019	32432	-40	0	0	0	
Ru-Mo	-48222	-7352	-58	0	0	0	
Ru-Na	85095	118330	166	0	0	0	
Ru-Nb	-144084	1384	-169	0	0	0	
Ru-Ni	18480	32172	2	0	0	0	
Ru-Os	547	-9957	0	0	0	0	
Ru-P	-177805	20962	-181	0	0	0	
Ru-Pb	77244	165038	64	0	0	0	
Ru-Pd	26747	23476	25	13408	21177	-4.4298 + 0.0149 T	[77]
Ru-Pt	396	12787	-4	0	0	0	
Ru-Rb	90279	204217	294	0	0	0	
Ru-Re	-478	-14580	-4	0	0	0	
Ru-Rh	5073	7696	5	-15995	5203	-26.5123 + 0.0104 T	[77]
Ru-Ru	0	0	0	0	0	0	
Ru-Sb	21786	79406	-29	0	0	0	
Ru-Sc	-157062	80895	-185	0	0	0	
Ru-Si	-131463	24014	-130	0	0	0	
Ru-Sn	19769	135854	-44	0	0	0	
Ru-Sr	-81422	216807	22	0	0	0	
Ru-Ta	-135214	1879	-164	0	0	0	
Ru-Tc	393	-4513	-1	0	0	0	
Ru-Th	-107368	153848	-225	0	0	0	
Ru-Ti	-166626	10565	-176	0	0	0	
Ru-Tl	59639	131269	60	0	0	0	
Ru-V	-98749	-566	-95	0	0	0	
Ru-W	-25415	-17012	-40	0	0	0	
Ru-Y	-93964	119951	-158	0	0	0	
Ru-Zn	-47306	38036	-47	0	0	0	
Ru-Zr	-202654	43156	-260	0	0	0	
Sb-Ag	-	-	-	0	0	0	
Sb-Al	-	-	-	0	0	0	
Sb-As	-	-	-	0	0	0	
Sb-Au	-	-	-	0	0	0	
Sb-Ba	-	-	-	0	0	0	
Sb-Be	-	-	-	0	0	0	

Sb-Bi	-	-	-	3850	2856	8.0579 - 0.0063 T	[23]
Sb-Ca	-	-	-	0	0	0	
Sb-Cd	-	-	-	0	0	0	
Sb-Co	53754	13668	-35	0	0	0	
Sb-Cr	61550	5314	-19	0	0	0	
Sb-Cs	-	-	-	0	0	0	
Sb-Cu	-	-	-	0	0	0	
Sb-Fe	78562	12776	-9	0	0	0	
Sb-Ga	-	-	-	0	0	0	
Sb-Ge	-	-	-	0	0	0	
Sb-Hf	-257965	-73647	-237	0	0	0	
Sb-In	-	-	-	0	0	0	
Sb-Ir	28288	-29876	-46	0	0	0	
Sb-K	-	-	-	0	0	0	
Sb-La	-317761	-43323	-336	0	0	0	
Sb-Li	-	-	-	0	0	0	
Sb-Mg	-	-	-	0	0	0	
Sb-Mn	-21925	9199	-76	0	0	0	
Sb-Mo	61263	-34210	7	0	0	0	
Sb-Na	-	-	-	0	0	0	
Sb-Nb	-80463	-56172	-90	0	0	0	
Sb-Ni	43995	14645	-45	0	0	0	
Sb-Os	79309	-31866	-2	0	0	0	
Sb-P	-	-	-	0	0	0	
Sb-Pb	-	-	-	0	0	0	
Sb-Pd	-105898	-25230	-144	0	0	0	
Sb-Pt	-59215	-34311	-110	0	0	0	
Sb-Rb	-	-	-	0	0	0	
Sb-Re	103756	-38519	27	0	0	0	
Sb-Rh	-7343	-21844	-73	0	0	0	
Sb-Ru	60936	-22109	-19	0	0	0	
Sb-Sb	-	0	-	0	0	0	
Sb-Sc	-282462	-51644	-256	0	0	0	
Sb-Si	-	-	-	0	0	0	
Sb-Sn	-	-	-	-1732	-4307	3.6820 - 0.0057 T	[23]
Sb-Sr	-	-	-	0	0	0	
Sb-Ta	-84929	-70354	-96	0	0	0	
Sb-Tc	49621	-29238	-21	0	0	0	
Sb-Th	-	-	-	0	0	0	
Sb-Ti	-166619	-48825	-162	0	0	0	
Sb-Tl	-	-	-	0	0	0	

Sb-V	-29753	-24064	-70	0	0	0	
Sb-W	92406	-51234	32	0	0	0	
Sb-Y	-311204	-51350	-310	0	0	0	
Sb-Zn	-	-	-	0	0	0	
Sb-Zr	-300736	-75570	-275	0	0	0	
Sc-Ag	-89187	20520	-108	0	0	0	
Sc-Al	-155278	15321	-170	-106397	15742	-133	[8]
Sc-As	-331113	520	-344	0	0	0	
Sc-Au	-251734	-8725	-293	0	0	0	
Sc-Ba	132561	99007	141	0	0	0	
Sc-Be	24519	121537	-122	0	0	0	
Sc-Bi	-215450	-7113	-258	0	0	0	
Sc-Ca	81434	51820	78	65910	40739	50	[24]
Sc-Cd	-144244	6763	-149	0	0	0	
Sc-Co	10866	78325	-100	0	0	0	
Sc-Cr	112565	70651	2	43195	70066	-54	[24]
Sc-Cs	234358	141365	416	0	0	0	
Sc-Cu	-13123	71374	-83	11500	63276	-64.9610 - 0.0030 T	[8]
Sc-Fe	71213	77789	-39	5700	70516	-99	[51]
Sc-Ga	-172245	14108	-178	0	0	0	
Sc-Ge	-227697	25315	-242	0	0	0	
Sc-Hf	24144	-20528	20	0	0	0	
Sc-In	-153827	-603	-164	0	0	0	
Sc-Ir	-125349	5346	-227	0	0	0	
Sc-K	225270	106063	305	0	0	0	
Sc-La	29394	15664	10	20485	99	-16.3184 + 0.0190 T	[24]
Sc-Li	-	-	45	58238	33308	55	[24]
Sc-Mg	-19535	16357	-20	0	0	0	
Sc-Mn	53812	64933	-28	0	0	0	
Sc-Mo	111280	19380	38	0	0	0	
Sc-Na	138508	55382	150	0	0	0	
Sc-Nb	98729	-1238	66	0	0	0	
Sc-Ni	-19775	76540	-130	0	0	0	
Sc-Os	-36468	11106	-141	0	0	0	
Sc-P	-434758	-7773	-445	0	0	0	
Sc-Pb	-190824	-2776	-220	0	0	0	
Sc-Pd	-257098	4648	-319	0	0	0	
Sc-Pt	-253553	-10671	-333	0	0	0	
Sc-Rb	245474	130016	359	0	0	0	
Sc-Re	32885	5825	-63	0	0	0	
Sc-Rh	-130186	19349	-221	0	0	0	

Sc-Ru	-54270	21436	-157	0	0	0	
Sc-Sb	-283018	-13523	-316	0	0	0	
Sc-Sc	0	0	0	0	0	0	
Sc-Si	-192537	70977	-232	0	0	0	
Sc-Sn	-215696	-8940	-234	0	0	0	
Sc-Sr	118888	84905	122	0	0	0	
Sc-Ta	94163	-17429	59	0	0	0	
Sc-Tc	-48850	14044	-141	0	0	0	
Sc-Th	14855	-8747	0	0	0	0	
Sc-Ti	55338	8283	28	0	0	0	
Sc-Tl	-141622	3553	-158	0	0	0	
Sc-V	95101	38429	25	0	0	0	
Sc-W	110918	-3624	34	0	0	0	
Sc-Y	17088	4251	4	11412	4196	-11.4565 + 0.0099 T	[79]
Sc-Zn	-105373	36398	-128	0	0	0	
Sc-Zr	17235	-17333	16	0	0	0	
Si-Ag	-	-	-	0	0	0	
Si-Al	-	-	-	65279	13099	108.7261 - 0.0461 T	[80]
Si-As	-	-	-	0	0	0	
Si-Au	-	-	-	40000	5328	35	[20]
Si-Ba	-	-	-	0	0	0	
Si-Be	-	-	-	0	0	0	
Si-Bi	-	-	-	0	0	0	
Si-Ca	-	-	-	0	0	0	
Si-Cd	-	-	-	0	0	0	
Si-Co	20838	-31510	-120	0	0	0	
Si-Cr	-114047	-31688	-119	0	0	0	
Si-Cs	-	-	-	0	0	0	
Si-Cu	-	-	-	0	0	0	
Si-Fe	-102624	-31568	-110	0	0	0	
Si-Ga	-	-	-	0	0	0	
Si-Ge	-	-	-	0	0	0	
Si-Hf	-231188	-23890	-323	0	0	0	
Si-In	-	-	-	0	0	0	
Si-Ir	-149686	-56287	-158	0	0	0	
Si-K	-	-	-	0	0	0	
Si-La	-182716	43747	-331	0	0	0	
Si-Li	-	-	-	0	0	0	
Si-Mg	-	-	-	0	0	0	
Si-Mn	-150191	-20631	-147	0	0	0	
Si-Mo	-119189	-54841	-126	0	0	0	

Si-Na	-	-	-	0	0	0	
Si-Nb	-189685	-53913	-216	0	0	0	
Si-Ni	-111095	-29883	-126	0	0	0	
Si-Os	-119258	-62550	-126	0	0	0	
Si-P	-	-	-	0	0	0	
Si-Pb	-	-	-	0	0	0	
Si-Pd	-197921	-41771	-206	0	0	0	
Si-Pt	-194791	-50589	-206	0	0	0	
Si-Rb	-	-	-	0	0	0	
Si-Re	-103872	-64997	-107	0	0	0	
Si-Rh	-159347	-50258	-165	0	0	0	
Si-Ru	-126064	-53568	-133	0	0	0	
Si-Sb	-	-	-	67796	39691	12	[20]
Si-Sc	-214523	2646	-286	0	0	0	
Si-Si	-	0	-	0	0	0	
Si-Sn	-	-	-	49105	33049	-65.4353 + 0.0238 T	[81]
Si-Sr	-	-	-	0	0	0	
Si-Ta	-184671	-61170	-217	0	0	0	
Si-Tc	-131693	-58172	-136	0	0	0	
Si-Th	-	-	-	0	0	0	
Si-Ti	-232966	-43478	-252	0	0	0	
Si-Tl	-	-	-	0	0	0	
Si-V	-170438	-46672	-166	0	0	0	
Si-W	-100807	-67591	-110	0	0	0	
Si-Y	-174765	27321	-318	0	0	0	
Si-Zn	-	-	-	0	0	0	
Si-Zr	-266042	-35122	-355	0	0	0	
Sn-Ag	-	-	-	18359	7310	-7	[6]
Sn-Al	-	-	-	0	0	0	
Sn-As	-	-	-	0	0	0	
Sn-Au	-	-	-	-18000	-7961	-52	[12]
Sn-Ba	-	-	-	0	0	0	
Sn-Be	-	-	-	0	0	0	
Sn-Bi	-	-	-	99	99	3.7814 - 0.0010 T	[23]
Sn-Ca	-	-	-	0	0	0	
Sn-Cd	-	-	-	0	0	0	
Sn-Co	115513	23518	-37	0	0	0	
Sn-Cr	139750	16467	-6	26991	78217	-68.2664 + 0.0204 T	[29]
Sn-Cs	-	-	-	0	0	0	
Sn-Cu	-	-	-	0	0	0	
Sn-Fe	142159	23189	-5	0	0	0	

Sn-Ga	-	-	-	0	0	0	
Sn-Ge	-	-	-	0	0	0	
Sn-Hf	-191748	-63061	-181	0	0	0	
Sn-In	-	-	-	0	0	0	
Sn-Ir	79237	-22762	-63	0	0	0	
Sn-K	-	-	-	0	0	0	
Sn-La	-237135	-35400	-266	0	0	0	
Sn-Li	-	-	-	0	0	0	
Sn-Mg	-	-	-	0	0	0	
Sn-Mn	46180	20091	-60	0	0	0	
Sn-Mo	115182	-23571	24	0	0	0	
Sn-Na	-	-	-	0	0	0	
Sn-Nb	-28578	-44402	-51	0	0	0	
Sn-Ni	103943	24129	-50	0	0	0	
Sn-Os	135431	-23871	-13	0	0	0	
Sn-P	-	-	-	0	0	0	
Sn-Pb	-	-	-	0	0	0	
Sn-Pd	-95325	-18725	-163	0	0	0	
Sn-Pt	-47710	-28517	-134	0	0	0	
Sn-Rb	-	-	-	0	0	0	
Sn-Re	157024	-29873	24	0	0	0	
Sn-Rh	39731	-14199	-87	0	0	0	
Sn-Ru	114919	-14055	-30	0	0	0	
Sn-Sb	-	-	-	-17728	99	25.5455 - 0.0666 T	[23]
Sn-Sc	-216065	-41740	-201	0	0	0	
Sn-Si	-	-	-	0	0	0	
Sn-Sn	-	0	-	0	0	0	
Sn-Sr	-	-	-	0	0	0	
Sn-Ta	-28592	-59024	-58	0	0	0	
Sn-Tc	97213	-20978	-29	0	0	0	
Sn-Th	-	-	-	0	0	0	
Sn-Ti	-107322	-36780	-119	0	0	0	
Sn-Tl	-	-	-	0	0	0	
Sn-V	25779	-12156	-44	0	0	0	
Sn-W	146006	-41325	45	0	0	0	
Sn-Y	-234171	-42694	-245	0	0	0	
Sn-Zn	-	-	-	0	0	0	
Sn-Zr	-228171	-63822	-213	0	0	0	
Sr-Ag	-	-	-	0	0	0	
Sn-Zn	-	-	-	26346	36421	-26.8830 + 0.0197 T	[60]
Sr-As	-	-	-	0	0	0	

Sr-Au	-	-	-	0	0	0	
Sr-Ba	-	-	-	0	0	0	
Sr-Be	-	-	-	0	0	0	
Sr-Bi	-	-	-	0	0	0	
Sr-Ca	-	-	-	0	0	0	
Sr-Cd	-	-	-	0	0	0	
Sr-Co	184296	107476	27	0	0	0	
Sr-Cr	315105	109055	136	0	0	0	
Sr-Cs	-	-	-	0	0	0	
Sr-Cu	-	-	-	0	0	0	
Sr-Fe	271798	111795	99	93941	95247	-24	[52]
Sr-Ga	-	-	-	0	0	0	
Sr-Ge	-	-	-	0	0	0	
Sr-Hf	273206	21103	160	0	0	0	
Sr-In	-	-	-	0	0	0	
Sr-Ir	103894	53641	-47	0	0	0	
Sr-K	-	-	-	0	0	0	
Sr-La	76658	-5218	50	0	0	0	
Sr-Li	-	-	-	0	0	0	
Sr-Mg	-	-	-	0	0	0	
Sr-Mn	230268	109637	76	60932	106989	-44	[52]
Sr-Mo	388158	70969	209	0	0	0	
Sr-Na	-	-	-	0	0	0	
Sr-Nb	397647	54770	236	0	0	0	
Sr-Ni	148197	106073	-3	0	0	0	
Sr-Os	202545	57325	39	0	0	0	
Sr-P	-	-	-	0	0	0	
Sr-Pb	-	-	-	0	0	0	
Sr-Pd	-71801	51338	-188	0	0	0	
Sr-Pt	-22523	41442	-157	0	0	0	
Sr-Rb	-	-	-	0	0	0	
Sr-Re	291495	55472	119	0	0	0	
Sr-Rh	73572	63184	-67	0	0	0	
Sr-Ru	172454	66336	14	0	0	0	
Sr-Sb	-	-	-	0	0	0	
Sr-Sc	156094	27994	82	0	0	0	
Sr-Si	-	-	-	0	0	0	
Sr-Sn	-	-	-	0	0	0	
Sr-Sr	-	0	-	0	0	0	
Sr-Ta	384851	37929	224	0	0	0	
Sr-Tc	186258	60627	29	0	0	0	

Sr-Th	-	-	-	0	0	0	
Sr-Ti	304001	59861	162	54816	43798	-26	[52]
Sr-Tl	-	-	-	0	0	0	
Sr-V	325449	84922	157	54048	61602	-46	[52]
Sr-W	396759	50534	216	0	0	0	
Sr-Y	102480	5041	61	0	0	0	
Sr-Zn	-	-	-	0	0	0	
Sr-Zr	257306	25497	154	0	0	0	
Ta-Ag	60655	59692	60	0	0	0	
Ta-Al	-70018	53381	-20	0	0	0	
Ta-As	-238166	32741	-255	0	0	0	
Ta-Au	-129717	29369	-135	0	0	0	
Ta-Ba	293597	227466	417	0	0	0	
Ta-Be	44223	125753	-89	0	0	0	
Ta-Bi	19202	79141	-28	0	0	0	
Ta-Ca	232761	156827	284	0	0	0	
Ta-Cd	8644	61912	3	0	0	0	
Ta-Co	-33584	80369	-86	0	0	0	
Ta-Cr	25498	69394	-24	36943	83938	-23.6430 + 0.0026 T	[30]
Ta-Cs	413515	249800	794	0	0	0	
Ta-Cu	42423	84511	7	104600	87538	70	[40]
Ta-Fe	-8162	76810	-54	12871	88830	-40.9515 + 0.0094 T	[53]
Ta-Ga	-83076	44868	-88	0	0	0	
Ta-Ge	-148923	49729	-148	0	0	0	
Ta-Hf	23727	33430	12	0	0	0	
Ta-In	18860	75163	7	0	0	0	
Ta-Ir	-174157	11744	-203	0	0	0	
Ta-K	396396	207733	635	0	0	0	
Ta-La	177125	117128	164	0	0	0	
Ta-Li	191368	88025	176	0	0	0	
Ta-Mg	111407	77370	113	0	0	0	
Ta-Mn	18747	74899	-14	0	0	0	
Ta-Mo	-10547	19988	-19	0	0	0	
Ta-Na	338270	139627	393	0	0	0	
Ta-Nb	0	12159	0	0	0	0	
Ta-Ni	-51995	79917	-105	0	0	0	
Ta-Os	-116470	12829	-147	0	0	0	
Ta-P	-410370	19910	-405	0	0	0	
Ta-Pb	37790	97861	7	0	0	0	
Ta-Pd	-197830	25126	-206	0	0	0	
Ta-Pt	-248769	4885	-263	0	0	0	

Ta-Rb	403314	239850	713	0	0	0	
Ta-Re	-74410	6210	-96	0	0	0	
Ta-Rh	-148532	27905	-173	0	0	0	
Ta-Ru	-120542	24419	-152	0	0	0	
Ta-Sb	-77157	52246	-133	0	0	0	
Ta-Sc	75065	64911	67	0	0	0	
Ta-Si	-194193	75447	-197	0	0	0	
Ta-Sn	-24908	64776	-76	0	0	0	
Ta-Sr	278260	208112	377	0	0	0	
Ta-Ta	0	0	0	0	0	0	
Ta-Tc	-113476	18047	-135	0	0	0	
Ta-Th	132718	93746	85	0	0	0	
Ta-Ti	5704	29034	5	0	0	0	
Ta-Tl	65765	91591	57	0	0	0	
Ta-V	12446	41758	-4	0	0	0	
Ta-W	-20489	-1887	-29	0	0	0	
Ta-Y	152119	95136	127	0	0	0	
Ta-Zn	-36971	62546	-40	0	0	0	
Ta-Zr	23469	30822	12	31965	29905	17.8190 - 0.0003 T	[82]
Tc-Ag	97015	59205	97	0	0	0	
Tc-Al	-122506	33013	-121	0	0	0	
Tc-As	-107706	32774	-128	0	0	0	
Tc-Au	62036	57389	58	0	0	0	
Tc-Ba	-61308	235351	57	0	0	0	
Tc-Be	86063	74035	-17	0	0	0	
Tc-Bi	68333	118337	42	0	0	0	
Tc-Ca	-139324	165205	5	0	0	0	
Tc-Cd	12627	72806	8	0	0	0	
Tc-Co	21498	36286	-1	0	0	0	
Tc-Cr	-20742	24497	-33	0	0	0	
Tc-Cs	114876	207984	346	0	0	0	
Tc-Cu	53769	43725	29	0	0	0	
Tc-Fe	2235	31346	-11	0	0	0	
Tc-Ga	-80903	32315	-88	0	0	0	
Tc-Ge	-70612	37945	-72	0	0	0	
Tc-Hf	-153184	68485	-201	0	0	0	
Tc-In	7207	106655	-1	0	0	0	
Tc-Ir	-5876	3467	-6	0	0	0	
Tc-K	135520	178448	290	0	0	0	
Tc-La	-56393	137703	-111	0	0	0	
Tc-Li	-524215	65979	27	0	0	0	

Tc-Mg	2033	80278	2	0	0	0	
Tc-Mn	-22104	39116	-30	0	0	0	
Tc-Mo	-41736	-3077	-45	0	0	0	
Tc-Na	97645	122797	180	0	0	0	
Tc-Nb	-131298	3665	-147	0	0	0	
Tc-Ni	26733	38801	2	0	0	0	
Tc-Os	1305	-5470	1	0	0	0	
Tc-P	-189500	24803	-190	0	0	0	
Tc-Pb	77055	161593	64	0	0	0	
Tc-Pd	17368	26329	17	0	0	0	
Tc-Pt	-11402	14441	-13	0	0	0	
Tc-Rb	112756	209347	318	0	0	0	
Tc-Re	1349	-10501	1	0	0	0	
Tc-Rh	1738	11977	1	0	0	0	
Tc-Ru	401	4648	-1	0	0	0	
Tc-Sb	16013	80307	-31	0	0	0	
Tc-Sc	-140272	81174	-162	0	0	0	
Tc-Si	-131122	30031	-129	0	0	0	
Tc-Sn	15412	129993	-41	0	0	0	
Tc-Sr	-63100	218490	46	0	0	0	
Tc-Ta	-124083	2449	-142	0	0	0	
Tc-Tc	0	0	0	0	0	0	
Tc-Th	-91996	149652	-195	0	0	0	
Tc-Ti	-151031	14145	-155	0	0	0	
Tc-Tl	62832	130522	63	0	0	0	
Tc-V	-82725	5363	-80	0	0	0	
Tc-W	-22185	-14077	-28	0	0	0	
Tc-Y	-76425	120020	-132	0	0	0	
Tc-Zn	-41820	42843	-42	0	0	0	
Tc-Zr	-186679	43493	-232	0	0	0	
Th-Ag	-	-	-	0	0	0	
Th-Al	-	-	-	99	99	-82.9590 - 0.0062 T	[11]
Th-As	-	-	-	0	0	0	
Th-Au	-	-	-	0	0	0	
Th-Ba	-	-	-	0	0	0	
Th-Be	-	-	-	0	0	0	
Th-Bi	-	-	-	0	0	0	
Th-Ca	-	-	-	0	0	0	
Th-Cd	-	-	-	0	0	0	
Th-Co	81258	180549	-93	0	0	0	
Th-Cr	193167	164767	7	0	0	0	

Th-Cs	-	-	-	0	0	0	
Th-Cu	-	-	-	0	0	0	
Th-Fe	146854	176072	-33	0	0	0	
Th-Ga	-	-	-	0	0	0	
Th-Ge	-	-	-	0	0	0	
Th-Hf	57047	15851	20	0	0	0	
Th-In	-	-	-	0	0	0	
Th-Ir	-69990	97235	-216	0	0	0	
Th-K	-	-	-	0	0	0	
Th-La	12865	20328	11	0	0	0	
Th-Li	-	-	-	0	0	0	
Th-Mg	-	-	-	0	0	0	
Th-Mn	125932	138586	-24	0	0	0	
Th-Mo	187078	102756	43	46286	94075	-71	[41]
Th-Na	-	-	-	0	0	0	
Th-Nb	156164	63298	67	0	0	0	
Th-Ni	47977	178407	-122	0	0	0	
Th-Os	29323	106055	-131	0	0	0	
Th-P	-	-	-	0	0	0	
Th-Pb	-	-	-	0	0	0	
Th-Pd	-220275	87799	-306	0	0	0	
Th-Pt	-216745	73848	-320	0	0	0	
Th-Rb	-	-	-	0	0	0	
Th-Re	104530	95891	-55	0	0	0	
Th-Rh	-74366	112172	-210	0	0	0	
Th-Ru	9336	115913	-147	0	0	0	
Th-Sb	-	-	-	0	0	0	
Th-Sc	15167	29103	0	0	0	0	
Th-Si	-	-	-	0	0	0	
Th-Sn	-	-	-	0	0	0	
Th-Sr	-	-	-	0	0	0	
Th-Ta	155963	45059	60	0	0	0	
Th-Tc	14395	105857	-132	0	0	0	
Th-Th	0	0	0	0	0	0	
Th-Ti	107396	67514	28	0	0	0	
Th-Tl	-	-	-	0	0	0	
Th-V	165653	120480	28	0	0	0	
Th-W	188156	77696	40	0	0	0	
Th-Y	5001	17157	5	0	0	0	
Th-Zn	-	-	-	20000	115556	-58	[11]
Th-Zr	41664	20534	15	20704	17433	-11.6578 + 0.0095 T	[83]

Ti-Ag	-6000	22288	-6	0	0	0	
Ti-Al	-162292	6737	-163	0	0	0	
Ti-As	-294495	-5174	-320	0	0	0	
Ti-Au	-191171	-7629	-203	0	0	0	
Ti-Ba	230690	182139	321	0	0	0	
Ti-Be	-35105	62863	-111	0	0	0	
Ti-Bi	-69961	37147	-143	0	0	0	
Ti-Ca	178417	116940	210	0	0	0	
Ti-Cd	-55821	26012	-69	0	0	0	
Ti-Co	-69372	25476	-103	0	0	0	
Ti-Cr	4432	24182	-27	23900	35856	-3	[31]
Ti-Cs	341647	208224	677	0	0	0	
Ti-Cu	-13912	35657	-33	16334	39275	-4	[42]
Ti-Fe	-31159	26213	-62	3061	38348	-49.7837 + 0.0231 T	[54]
Ti-Ga	-134371	7946	-145	0	0	0	
Ti-Ge	-205381	9957	-207	0	0	0	
Ti-Hf	14337	2960	1	0	0	0	
Ti-In	-53151	36904	-78	0	0	0	
Ti-Ir	-202908	-30479	-227	0	0	0	
Ti-K	311668	167602	530	0	0	0	
Ti-La	130197	76976	99	0	0	0	
Ti-Li	133340	54877	130	0	0	0	
Ti-Mg	59974	43514	58	0	0	0	
Ti-Mn	-9596	35482	-30	0	0	0	
Ti-Mo	-7990	-14264	-14	0	0	0	
Ti-Na	260047	102749	313	0	0	0	
Ti-Nb	8031	-15408	8	11742	-14970	12	[72]
Ti-Ni	-92257	24897	-126	0	0	0	
Ti-Os	-136972	-30290	-161	0	0	0	
Ti-P	-450595	-16550	-452	0	0	0	
Ti-Pb	-50874	53410	-103	0	0	0	
Ti-Pd	-249276	-17082	-260	0	0	0	
Ti-Pt	-285580	-34857	-304	0	0	0	
Ti-Rb	331100	198421	601	0	0	0	
Ti-Re	-82777	-32361	-100	0	0	0	
Ti-Rh	-184851	-16992	-204	0	0	0	
Ti-Ru	-145006	-19611	-169	0	0	0	
Ti-Sb	-158541	13082	-233	0	0	0	
Ti-Sc	47271	32138	33	0	0	0	
Ti-Si	-236245	17701	-236	0	0	0	
Ti-Sn	-99811	25272	-163	0	0	0	

Ti-Sr	218179	164099	288	86242	90596	69	[52]
Ti-Ta	5544	-27126	6	0	0	0	[40]
Ti-Tc	-134981	-24271	-153	0	0	0	
Ti-Th	99905	51596	41	0	0	0	
Ti-Ti	0	0	0	0	0	0	
Ti-Tl	-16541	50728	-43	0	0	0	
Ti-V	4193	5093	-6	23200	7132	13	[75]
Ti-W	-16121	-34222	-23	0	0	0	[84]
Ti-Y	112452	57058	73	0	0	0	
Ti-Zn	-88233	24893	-88	0	0	0	
Ti-Zr	13533	1280	-1	3460	-191	-12	[85]
Tl-Ag	-	-	-	0	0	0	
Tl-Al	-	-	-	0	0	0	
Tl-As	-	-	-	0	0	0	
Tl-Au	-	-	-	0	0	0	
Tl-Ba	-	-	-	0	0	0	
Tl-Be	-	-	-	0	0	0	
Tl-Bi	-	-	-	0	0	0	
Tl-Ca	-	-	-	0	0	0	
Tl-Cd	-	-	-	0	0	0	
Tl-Co	102210	-10220	25	0	0	0	
Tl-Cr	145770	-5788	67	0	0	0	
Tl-Cs	-	-	-	0	0	0	
Tl-Cu	-	-	-	0	0	0	
Tl-Fe	147234	-6425	66	0	0	0	
Tl-Ga	-	-	-	0	0	0	
Tl-Ge	-	-	-	0	0	0	
Tl-Hf	-88319	-53708	-84	0	0	0	
Tl-In	-	-	-	0	0	0	
Tl-Ir	77766	-36554	9	0	0	0	
Tl-K	-	-	-	0	0	0	
Tl-La	-180760	-44432	-197	0	0	0	
Tl-Li	-	-	-	0	0	0	
Tl-Mg	-	-	-	0	0	0	
Tl-Mn	59097	1282	3	0	0	0	
Tl-Mo	178066	-29723	117	0	0	0	
Tl-Na	-	-	-	0	0	0	
Tl-Nb	75852	-39912	50	0	0	0	
Tl-Ni	84702	-9768	9	0	0	0	
Tl-Os	140402	-38988	65	0	0	0	
Tl-P	-	-	-	0	0	0	

TI-Pb	-	-	-	0	0	0	
TI-Pd	-73636	-31459	-110	0	0	0	
TI-Pt	-20024	-38023	-69	0	0	0	
TI-Rb	-	-	-	0	0	0	
TI-Re	184191	-40461	110	0	0	0	
TI-Rh	38844	-31552	-22	0	0	0	
TI-Ru	116770	-30939	43	0	0	0	
TI-Sb	-	-	-	0	0	0	
TI-Sc	-143705	-36304	-132	0	0	0	
TI-Si	-	-	-	0	0	0	
TI-Sn	-	-	-	0	0	0	
TI-Sr	-	-	-	0	0	0	
TI-Ta	69524	-53242	42	0	0	0	
TI-Tc	113964	-35571	47	0	0	0	
TI-Th	-	-	-	0	0	0	
TI-Ti	-18426	-33201	-31	0	0	0	
TI-Tl	-	0	-	0	0	0	
TI-V	83835	-22781	36	0	0	0	
TI-W	205999	-44667	141	0	0	0	
TI-Y	-171239	-43957	-175	0	0	0	
TI-Zn	-	-	-	0	0	0	
TI-Zr	-124042	-54225	-115	0	0	0	
V-Ag	74784	37034	73	0	0	0	
V-Al	-102373	16480	-113	0	0	0	
V-As	-181439	6239	-224	0	0	0	
V-Au	-70246	15246	-87	0	0	0	
V-Ba	214371	224468	337	0	0	0	
V-Be	-22250	38140	-66	0	0	0	
V-Bi	50830	78078	-17	0	0	0	
V-Ca	172492	152769	224	0	0	0	
V-Cd	27672	49135	6	0	0	0	
V-Co	-45146	9845	-54	0	0	0	
V-Cr	-2583	11761	-8	-12937	12125	-11.2004 - 0.0085 T	[31]
V-Cs	307035	227634	685	0	0	0	
V-Cu	23628	26289	19	42475	28840	39	[43]
V-Fe	-21879	10825	-28	0	0	0	
V-Ga	-56560	16883	-83	0	0	0	
V-Ge	-114760	16219	-129	0	0	0	
V-Hf	39840	33763	-10	0	0	0	
V-In	30573	72567	6	0	0	0	
V-Ir	-137631	-27984	-146	0	0	0	

V-K	308404	188714	552	0	0	0	
V-La	155074	117459	118	98843	97619	75	[62]
V-Li	143500	63578	144	0	0	0	
V-Mg	97016	65589	93	0	0	0	
V-Mn	-102	27038	-3	0	0	0	
V-Mo	3061	-14516	0	19245	-12120	17	[69]
V-Na	271646	122223	343	0	0	0	
V-Nb	8989	-6247	-5	9080	-7829	-7	[73]
V-Ni	-59804	10365	-69	0	0	0	
V-Os	-92024	-31678	-97	0	0	0	
V-P	-335324	-9163	-354	0	0	0	
V-Pb	61790	104158	15	0	0	0	
V-Pd	-140829	-8746	-151	0	0	0	
V-Pt	-181806	-24236	-198	0	0	0	
V-Rb	304077	221984	617	0	0	0	
V-Re	-50890	-32395	-54	0	0	0	
V-Rh	-117640	-17251	-123	0	0	0	
V-Ru	-97898	-21979	-103	0	0	0	
V-Sb	-26267	44985	-113	0	0	0	
V-Sc	66736	61238	33	0	0	0	
V-Si	-170024	8814	-175	0	0	0	
V-Sn	21859	68799	-68	0	0	0	
V-Sr	204712	205512	304	87611	108437	85	[52]
V-Ta	13222	-13942	-4	6929	-11426	-9	[40]
V-Tc	-84448	-25147	-89	0	0	0	
V-Th	138679	100288	45	0	0	0	
V-Ti	2974	8704	-7	14000	9886	3	[73]
V-Tl	74167	91539	56	0	0	0	
V-V	0	0	0	0	0	0	
V-W	808	-30491	-3	0	0	0	
V-Y	142715	95588	85	113047	94588	18	[62]
V-Zn	-34110	28624	-36	0	0	0	
V-Zr	28536	25822	-17	0	0	0	
W-Ag	172050	78017	172	0	0	0	
W-Al	-52903	53610	-52	0	0	0	
W-As	-90688	52463	-104	0	0	0	
W-Au	48087	60017	48	0	0	0	
W-Ba	36690	268802	383	0	0	0	
W-Be	125760	121630	-18	0	0	0	
W-Bi	160880	130465	153	0	0	0	
W-Ca	259457	192523	261	0	0	0	

W-Cd	101524	89295	101	0	0	0	
W-Co	38410	77189	-5	0	0	0	
W-Cr	38679	61028	4	31520	62074	0	[30]
W-Cs	356782	260596	720	0	0	0	
W-Cu	120774	81901	80	0	0	0	
W-Fe	32314	70613	0	0	0	0	
W-Ga	-616	57220	-4	0	0	0	
W-Ge	-29999	61440	-30	0	0	0	
W-Hf	-3757	74863	-27	0	0	0	
W-In	113866	118569	118	0	0	0	
W-Ir	-54559	19225	-62	0	0	0	
W-K	364346	222879	597	0	0	0	
W-La	158208	161777	154	0	0	0	
W-Li	247384	96387	169	0	0	0	
W-Mg	140166	101022	144	0	0	0	
W-Mn	47548	71941	23	0	0	0	
W-Mo	-847	17558	-1	0	0	0	
W-Na	247099	156675	391	0	0	0	
W-Nb	-30034	19284	-34	0	0	0	
W-Ni	33748	78276	-11	0	0	0	
W-Os	-28856	15157	-38	0	0	0	
W-P	-241052	39558	-239	0	0	0	
W-Pb	172930	164970	176	0	0	0	
W-Pd	-25100	40546	-26	0	0	0	
W-Pt	-79777	21687	-82	0	0	0	
W-Rb	352612	256024	658	0	0	0	
W-Re	-12812	7512	-16	0	0	0	
W-Rh	-27398	33807	-36	0	0	0	
W-Ru	-26387	27130	-38	0	0	0	
W-Sb	77838	93205	46	0	0	0	
W-Sc	45752	98239	39	0	0	0	
W-Si	-98964	74457	-102	0	0	0	
W-Sn	101488	127538	61	0	0	0	
W-Sr	118448	249220	348	0	0	0	
W-Ta	-25181	13163	-30	0	0	0	
W-Tc	-22792	20990	-28	0	0	0	
W-Th	108427	160317	57	0	0	0	
W-Ti	-22633	35581	-23	18212	38345	14.7820 - 0.0018 T	[84]
W-Tl	173829	141730	189	0	0	0	
W-V	5069	35339	-3	0	0	0	
W-W	0	0	0	0	0	0	

W-Y	128989	139783	111	0	0	0	
W-Zn	34869	69463	28	0	0	0	
W-Zr	-18384	58933	-39	0	0	0	
Y-Ag	-51908	56870	-103	0	0	0	
Y-Al	-118624	49866	-161	0	0	0	
Y-As	-314852	31325	-330	0	0	0	
Y-Au	-200817	31991	-268	0	0	0	
Y-Ba	88002	68909	90	0	0	0	
Y-Be	78608	186522	-101	0	0	0	
Y-Bi	-260593	-4908	-272	0	0	0	
Y-Ca	45316	34541	45	0	0	0	
Y-Cd	-139717	25610	-154	0	0	0	
Y-Co	89742	143225	-67	0	0	0	
Y-Cr	200213	130666	35	63000	93676	-91	[86]
Y-Cs	29834	119150	329	0	0	0	
Y-Cu	44811	126983	-70	0	0	0	
Y-Fe	158166	140664	-4	0	0	0	
Y-Ga	-152094	46837	-175	0	0	0	
Y-Ge	-197765	65669	-235	0	0	0	
Y-Hf	77427	-2702	41	0	0	0	
Y-In	-175241	5972	-175	0	0	0	
Y-Ir	-42609	64828	-180	0	0	0	
Y-K	194025	87738	237	0	0	0	
Y-La	3209	3726	1	0	0	0	
Y-Li	46751	39944	26	0	0	0	
Y-Mg	-16328	27876	-29	0	0	0	
Y-Mn	127449	111150	-5	0	0	0	
Y-Mo	213658	73405	81	100000	44742	-19	[70]
Y-Na	108950	47307	110	0	0	0	
Y-Nb	189116	39465	102	150000	18947	73	[74]
Y-Ni	56196	141169	-97	0	0	0	
Y-Os	54400	72666	-93	0	0	0	
Y-P	-400170	19910	-416	0	0	0	
Y-Pb	-229778	-5643	-235	0	0	0	
Y-Pd	-194816	56927	-286	0	0	0	
Y-Pt	-179313	43593	-289	0	0	0	
Y-Rb	215871	107131	281	0	0	0	
Y-Re	131942	64582	-14	0	0	0	
Y-Rh	-54050	78719	-181	0	0	0	
Y-Ru	32541	82446	-112	0	0	0	
Y-Sb	-310281	-49	-319	0	0	0	

Y-Sc	17104	10155	3	11412	8726	-12.5041 + 0.0099 T	[79]
Y-Si	-142661	137448	-216	0	0	0	
Y-Sn	-234937	5869	-239	0	0	0	
Y-Sr	75493	57667	76	0	0	0	
Y-Ta	183768	21469	93	0	0	0	
Y-Tc	40009	73467	-96	0	0	0	
Y-Th	5013	-15653	5	0	0	0	
Y-Ti	126875	43967	51	0	0	0	
Y-Tl	-173944	4563	-175	0	0	0	
Y-V	181649	90361	54	70170	50907	-49	[62]
Y-W	217059	49347	81	0	0	0	
Y-Y	0	0	0	0	0	0	
Y-Zn	-69742	72970	-125	0	0	0	
Y-Zr	60818	1580	34	40000	-3551	15	[87]
Zn-Ag	-	-	-	-18700	-8926	-20	[7]
Zn-Al	-	-	-	9868	-3257	17.8464 - 0.0090 T	[1]
Zn-As	-	-	-	0	0	0	
Zn-Au	-	-	-	0	0	0	
Zn-Ba	-	-	-	0	0	0	
Zn-Be	-	-	-	0	0	0	
Zn-Bi	-	-	-	0	0	0	
Zn-Ca	-	-	-	0	0	0	
Zn-Cd	-	-	-	0	0	0	
Zn-Co	-23476	-21843	-45	0	0	0	
Zn-Cr	4469	-20800	-9	0	0	0	
Zn-Cs	-	-	-	0	0	0	
Zn-Cu	-	-	-	-25214	-13340	-24.0248 - 0.0108 T	[44]
Zn-Fe	3754	-20019	-13	23602	-17870	7	[55]
Zn-Ga	-	-	-	11756	-6279	3	[88]
Zn-Ge	-	-	-	0	0	0	
Zn-Hf	-91353	-23561	-141	0	0	0	
Zn-In	-	-	-	23114	4645	-16	[60]
Zn-Ir	-68962	-53890	-88	0	0	0	
Zn-K	-	-	-	0	0	0	
Zn-La	-69538	37752	-191	0	0	0	
Zn-Li	-	-	-	0	0	0	
Zn-Mg	-	-	-	2543	11723	-17.5956 - 0.0007 T	[66]
Zn-Mn	-44350	-10965	-50	0	0	0	
Zn-Mo	16968	-45784	17	0	0	0	
Zn-Na	-	-	-	0	0	0	
Zn-Nb	-32075	-45705	-39	0	0	0	

Zn-Ni	-35782	-21315	-60	0	0	0	
Zn-Os	-22911	-57223	-37	0	0	0	
Zn-P	-	-	-	0	0	0	
Zn-Pb	-	61304	-	0	0	0	
Zn-Pd	-152729	-44020	-171	0	0	0	
Zn-Pt	-134813	-52666	-157	0	0	0	
Zn-Rb	-	-	-	0	0	0	
Zn-Re	9291	-58569	3	0	0	0	
Zn-Rh	-85148	-47329	-102	0	0	0	
Zn-Ru	-35996	-48502	-52	0	0	0	
Zn-Sb	-	-	-	0	0	0	
Zn-Sc	-98626	-1157	-154	0	0	0	
Zn-Si	-	-	-	0	0	0	
Zn-Sn	-	-	-	30453	11900	-49	[60]
Zn-Sr	-	-	-	0	0	0	
Zn-Ta	-36197	-55078	-44	0	0	0	
Zn-Tc	-37210	-53066	-49	0	0	0	
Zn-Th	-	-	-	0	0	0	[11]
Zn-Ti	-85886	-36447	-93	0	0	0	
Zn-Tl	-	-	-	0	0	0	
Zn-V	-33280	-36801	-34	0	0	0	
Zn-W	30683	-60131	32	0	0	0	
Zn-Y	-61778	21249	-180	0	0	0	
Zn-Zn	-	0	-	0	0	0	
Zn-Zr	-111664	-31399	-166	0	0	0	
Zr-Ag	-68797	35309	-78	0	0	0	
Zr-Al	-206788	22633	-208	0	0	0	
Zr-As	-394173	7007	-397	0	0	0	
Zr-Au	-275895	2083	-294	0	0	0	
Zr-Ba	217299	147295	269	0	0	0	
Zr-Be	-11005	118556	-147	0	0	0	
Zr-Bi	-205206	16284	-256	0	0	0	
Zr-Ca	154585	91824	169	0	0	0	
Zr-Cd	-139883	24753	-142	0	0	0	
Zr-Co	-51191	75016	-137	-47428	86132	-134	[27]
Zr-Cr	48989	68682	-41	0	0	0	
Zr-Cs	347333	191412	613	0	0	0	
Zr-Cu	-21772	75668	-78	11337	78639	-51	[42]
Zr-Fe	1112	74279	-85	0	0	0	
Zr-Ga	-203765	23086	-203	0	0	0	
Zr-Ge	-273738	31071	-272	0	0	0	

Zr-Hf	-585	-2771	-1	0	0	0	
Zr-In	-147730	21785	-160	0	0	0	
Zr-Ir	-212231	3338	-281	0	0	0	
Zr-K	334899	151404	466	0	0	0	
Zr-La	78304	50587	60	0	0	0	
Zr-Li	111528	58649	100	0	0	0	
Zr-Mg	13000	39894	13	40148	43106	40	[67]
Zr-Mn	13198	69396	-52	0	0	0	
Zr-Mo	26869	18560	-23	0	0	0	
Zr-Na	230121	92057	257	0	0	0	
Zr-Nb	32136	4210	15	5133	-445	-11	[75]
Zr-Ni	-80685	73566	-165	0	0	0	
Zr-Os	-127269	7492	-202	0	0	0	
Zr-P	-541914	-3032	-521	0	0	0	
Zr-Pb	-175061	24291	-210	0	0	0	
Zr-Pd	-309480	8657	-339	-106109	30245	-154	[78]
Zr-Pt	-334680	-9520	-377	0	0	0	
Zr-Rb	-15045	178736	537	0	0	0	
Zr-Re	-61530	2829	-129	0	0	0	
Zr-Rh	-200496	18563	-261	0	0	0	
Zr-Ru	-139629	18510	-212	0	0	0	
Zr-Sb	-296217	3225	-337	0	0	0	
Zr-Sc	16719	23580	16	0	0	0	
Zr-Si	-269761	65075	-284	0	0	0	
Zr-Sn	-223668	9408	-250	0	0	0	
Zr-Sr	200707	130998	238	0	0	0	
Zr-Ta	29800	-10923	10	30052	-9341	13	[82]
Zr-Tc	-132239	11879	-195	0	0	0	
Zr-Th	40864	22645	19	0	0	0	[83]
Zr-Ti	14527	17348	-1	3460	16180	-11	[85]
Zr-Tl	-120285	29565	-139	0	0	0	
Zr-V	37371	40170	-13	0	0	0	
Zr-W	18559	-4522	-34	0	0	0	
Zr-Y	57806	35488	42	40000	35145	21	[87]
Zr-Zn	-125703	45709	-137	0	0	0	
Zr-Zr	0	0	0	0	0	0	

References

- [1] CALPHAD. Thermocalc.
- [2] Liu XJ, Yamaki T, Ohnuma I, Kainuma R, Ishida K. Thermodynamic calculations of phase equilibria, surface tension and viscosity in the In-Ag-X (X=Bi, Sb) system. *Materials Transactions* 2004;45:637.
- [3] Zhu W, Liu H, Wang J, Dong H, Jin Z. Thermodynamic assessment of the Sn–Ag–Co system and solidification simulation of the ternary alloy. *Journal of Alloys and Compounds* 2009;481:503.
- [4] Saunders N. A review and thermodynamic assessment of the Al-Mg and Mg-Li systems. *Calphad* 1990;14:61.
- [5] Liu XJ, Gao F, Wang CP, Ishida K. Thermodynamic assessments of the Ag-Ni binary and Ag-Cu-Ni ternary systems. *Journal of Electronic Materials* 2008;37:210.
- [6] Oh C-S, Shim J-H, Lee B-J, Dong Nyung L. A thermodynamic study on the Ag · Sb · Sn system. *Journal of Alloys and Compounds* 1996;238:155.
- [7] Gomez-Acebo T. Thermodynamic assessment of the Ag-Zn system. *Calphad-Computer Coupling of Phase Diagrams and Thermochemistry* 1998;22.
- [8] Bo H, Liu LB, Jin ZP. Thermodynamic analysis of Al–Sc, Cu–Sc and Al–Cu–Sc system. *Journal of Alloys and Compounds* 2010;490:318.
- [9] Anglezio JC, Servant C, Ansara I. Contribution to the experimental and thermodynamic assessment of the Al · Ca · Fe · Si system—I. Al · Ca · Fe, Al · Ca · Si, Al · Fe · Si and Ca · Fe · Si systems. *Calphad* 1994;18:273.
- [10] Watson A. Re-assessment of phase diagram and thermodynamic properties of the Al-Ga system. *Calphad* 1992;16:207.
- [11] Li ZS, Liu XJ, Wen MZ, Wang CP, Tang AT, Pan FS. Thermodynamic assessments of the Al–Th and Th–Zn systems. *Journal of Nuclear Materials* 2010;396:170.
- [12] Gao F, Wang C, Liu X, Takaku Y, Ohnuma I, Ishida K. Thermodynamic assessment of phase equilibria in the Sn-Au-Bi system with key experimental verification. *Journal of Materials Research* 2010;25.
- [13] Dong H, Jin S, Zhang L, Wang J, Tao X, Liu H, Jin Z. Thermodynamic Assessment of the Au-Co-Sn Ternary System. *Journal of Electronic Materials* 2009;38:2158.
- [14] Liu Y, Ge Y, Yu D. Thermodynamic descriptions for Au–Fe and Na–Zn binary systems. *Journal of Alloys and Compounds* 2009;476:79.
- [15] Liu J, Guo C, Li C, Du Z. Thermodynamic assessment of the Au-Ga system. *Journal of Alloys and Compounds* 2010;508.
- [16] Wang J, Leinenbach C, Roth M. Thermodynamic modeling of the Au-Ge-Sn ternary system. *Journal of Alloys and Compounds* 2009;481.
- [17] Du ZM, Yang LS. Thermodynamic assessment of the Au-Hf system. *Journal of Alloys and Compounds* 2003;353:213.
- [18] Liu X, Kinaka M, Takaku Y, Ohnuma I, Kainuma R, Ishida K. Experimental investigation and thermodynamic calculation of phase equilibria in the Sn-Au-Ni system. *Journal of Electronic Materials* 2005;34:670.
- [19] Wang J, Liu HS, Jin Z. Thermodynamic assessment of the Au-Pb system. *Calphad-Computer Coupling of Phase Diagrams and Thermochemistry* 2004;28.
- [20] Wang J, Liu YJ, Liu LB, Zhou HY, Jin ZP. Thermodynamic modeling of the Au-Sb-Si ternary system. *Journal of Alloys and Compounds* 2011;509.
- [21] Rudnyi EB, Voronin GF. Thermodynamic assessment of the Ba · Cu · Y ternary system. Direct optimization of the miscibility gap. *Calphad* 1996;20:297.
- [22] Shang S, Liu Z-J, Liu Z-K. Thermodynamic modeling of the Ba–Ni–Ti system. *Journal of Alloys and Compounds* 2007;430:188.
- [23] Manasijevic D, Vrest'al J, Minic D, Kroupa A, Zivkovic D, Zivkovic I. Phase equilibria and thermodynamics of the Bi-Sb-Sn ternary system. *Journal of Alloys and Compounds* 2007;438.
- [24] Bu M, Peng Y, Wang M, Du Y, Xu H, Zhao D, Sha C. Thermodynamic Optimization of the Sc-X (X = La, Li, Ca, Cr) Systems. *Journal of Phase Equilibria and Diffusion* 2012;33:40.
- [25] Oikawa K, Qin GW, Ikeshoji T, Kitakami O, Shimada Y, Ishida K, Fukamichi K. Thermodynamic calculations of phase equilibria of Co-Cr-Pt ternary system and magnetically induced phase separation in the FCC and HCP phases. *Journal of Magnetism and Magnetic Materials* 2001;236:220.
- [26] Wang H, Belegatis MS, Theiner J, Tomiska J. Computer-aided thermodynamic study of solid Co · Pd alloys by Knudsen cell mass spectrometry, and calculation of the phase diagram. *Journal of Alloys and Compounds* 1995;220:32.
- [27] Liu XJ, Zhang HH, Wang CP, Ishida K. Experimental determination and thermodynamic assessment of the phase diagram in the Co–Zr system. *Journal of Alloys and Compounds* 2009;482:99.
- [28] Chan W, Gao MC, Dogan ON, King P, Rollett AD. Thermodynamic Assessment of Cr-Rare Earth Systems. *Journal of Phase Equilibria and Diffusion* 2009;30:578.
- [29] Pérez RJ, Sundman B. Thermodynamic assessment of the CR-SN binary system. *Calphad* 2001;25:59.
- [30] Kaufman L, Turchi PEA, Huang W, Liu Z-K. Thermodynamics of the Cr-Ta-W system by combining the Ab Initio and CALPHAD methods. *Calphad* 2001;25:419.
- [31] Ghosh G. Thermodynamic and kinetic modeling of the Cr-Ti-V system. *Journal of Phase Equilibria* 2002;23:310.

- [32] Wang J, Jin S, Leinenbach C, Jacot A. Thermodynamic assessment of the Cu–Ge binary system. *Journal of Alloys and Compounds* 2010;504:159.
- [33] Liang D, Liu Y. Reevaluation of the Cu–Hf binary system. *Journal of Alloys and Compounds* 2006;426:101.
- [34] Du Z, Xu Y, Zhang W. Thermodynamic assessment of the Cu–La system. *Journal of Alloys and Compounds* 1999;289:88.
- [35] Miettinen J, Vassilev G. THERMODYNAMIC RE-OPTIMIZATION OF THE Cu-Mg-Sn SYSTEM AT THE Cu-Mg SIDE. *Journal of Mining and Metallurgy Section B-Metallurgy* 2012;48.
- [36] Miettinen J. Thermodynamic solution phase data for binary Mn-based systems. *Calphad* 2001;25:43.
- [37] Wang C, Liu X, Ohnuma I, Kainuma R, Ishida K, Hao S. Phase equilibria in the Cu-Fe-Mo and Cu-Fe-Nb systems. *Journal of Phase Equilibria* 2000;21:54.
- [38] Miettinen J, Gandova V, Georgiev S, Vassilev G. Thermodynamic description of the Cu-Ni-Pb system. *Central European Journal of Chemistry* 2011;9:743.
- [39] Gierlotka W, Jendrzeczyk-Handzlik D. Thermodynamic description of the Cu–Sb binary system. *Journal of Alloys and Compounds* 2009;484:172.
- [40] Lany K. Coupled thermochemical and phase diagram data for tantalum based binary alloys. *Calphad* 1991;15:243.
- [41] Wang CP, Li YF, Liu XJ, Ishida K. Thermodynamic assessments of the Cu-Th and Mo-Th systems. *Journal of Alloys and Compounds* 2008;458:208.
- [42] Arroyave R, Eagar TW, Kaufman L. Thermodynamic assessment of the Cu–Ti–Zr system. *Journal of Alloys and Compounds* 2003;351:158.
- [43] Turchanin MA. Phase equilibria and thermodynamics of binary copper systems with 3d-metals. II. The copper-vanadium system. *Powder Metallurgy and Metal Ceramics* 2006;45:272.
- [44] Jantzen T, Spencer PJ. Thermodynamic assessments of the Cu-Pb-Zn and Cu-Sn-Zn systems. *Calphad* 1998;22:417.
- [45] Miettinen J. Thermodynamic reassessment of Fe-Cr-Ni system with emphasis on the iron-rich corner. *Calphad-Computer Coupling of Phase Diagrams and Thermochemistry* 1999;23.
- [46] Ohno M, Yoh K. Thermodynamic Calculation of Phase Equilibria in As-Fe-In Ternary System Based on CALPHAD Approach. *Materials Transactions* 2009;50:1202.
- [47] Povoden-Karadeniz E, Grundy AN, Chen M, Ivas T, Gauckler LJ. Thermodynamic Assessment of the La-Fe-O System. *Journal of Phase Equilibria and Diffusion* 2009;30:351.
- [48] Wang CP, Liu XJ, Ohnuma I, Kainuma R, Hao SM, Ishida K. Phase equilibria in the Cu-Fe-Mo and Cu-Fe-Nb systems. *Journal of Phase Equilibria* 2000;21:54.
- [49] Fredriksson P, Sundman B. A thermodynamic assessment of the Fe-Pt system. *Calphad-Computer Coupling of Phase Diagrams and Thermochemistry* 2001;25:535.
- [50] Pei BY, Bjorkman B, Sundman B, Jansson B. A THERMODYNAMIC ASSESSMENT OF THE IRON - ANTIMONY SYSTEM. *Calphad-Computer Coupling of Phase Diagrams and Thermochemistry* 1995;19:1.
- [51] Liu XJ, Yu P, Wang CP, Ishida K. Thermodynamic evaluation of the Co-Sc and Fe-Sc systems. *Journal of Alloys and Compounds* 2008;466:169.
- [52] Peng Y, Zhao D, Hu B, Zhou L, Du Y, Gang T, Liu S, Chang K. Thermodynamic Modeling of the Sr-M (M = Fe, Mn, Ni, Ti, V) Systems. *Journal of Phase Equilibria and Diffusion* 2011;32:42.
- [53] Witusiewicz VT, Bondar AA, Hecht U, Voblikov VM, Fomichov OS, Petyukh VM, Rex S. Experimental study and thermodynamic re-assessment of the binary Fe-Ta system. *Intermetallics* 2011;19:1059.
- [54] Jonsson S. Assessment of the Fe-Ti system. *Metallurgical and Materials Transactions B-Process Metallurgy and Materials Processing Science* 1998;29.
- [55] Tang Y, Yuan X, Du Y, Xiong W. THERMODYNAMIC MODELING OF THE Fe-Zn SYSTEM USING EXPONENTIAL TEMPERATURE DEPENDENCE FOR THE EXCESS GIBBS ENERGY. *Journal of Mining and Metallurgy Section B-Metallurgy* 2011;47:1.
- [56] Servant C, Gueneau C, Ansara I. EXPERIMENTAL AND THERMODYNAMIC ASSESSMENT OF THE FE-ZR SYSTEM. *Journal of Alloys and Compounds* 1995;220:19.
- [57] Ghosh G, van de Walle A, Asta M, Olson GB. Phase stability of the Hf-Nb system: From first-principles to CALPHAD. *Calphad* 2002;26:491.
- [58] Guillermet AF. Gibbs energy coupling of phase stability and thermochemistry in the Hf-Nb system. *Journal of Alloys and Compounds* 1996;234:111.
- [59] Witusiewicz VT, Hecht U, Boettger B, Rex S. Thermodynamic re-optimisation of the Bi-In-Sn system based on new experimental data. *Journal of Alloys and Compounds* 2007;428.
- [60] Lee BJ. Thermodynamic assessments of the Sn-Zn and In-Zn binary systems. *Calphad-Computer Coupling of Phase Diagrams and Thermochemistry* 1996;20.
- [61] Povoden E, Chen M, Grundy AN, Ivas T, Gauckler LJ. Thermodynamic Assessment of the La-Cr-O System. *Journal of Phase Equilibria and Diffusion* 2009;30:12.
- [62] Chan W, Gao MC, Dogan ON, King P. Thermodynamic Assessment of V-Rare Earth Systems. *Journal of Phase Equilibria and Diffusion* 2010;31:425.

- [63] Oh CS, Kang SY, Lee DN. ASSESSMENT OF THE MG-BI SYSTEM. *Calphad-Computer Coupling of Phase Diagrams and Thermochemistry* 1992;16.
- [64] Grobner J, Mirkovic D, Ohno M, Schmid-Fetzer R. Experimental investigation and thermodynamic calculation of binary Mg-Mn phase equilibria. *Journal of Phase Equilibria and Diffusion* 2005;26:234.
- [65] Miettinen J, Vassilev G. Thermodynamic assessment of the Cu-Mg-Si system in its copper-rich region. *Crystal Research and Technology* 2011;46:1122.
- [66] Qi HY, Huang GX, Bo H, Xu GL, Liu LB, Jin ZP. Experimental investigation and thermodynamic assessment of the Mg-Zn-Gd system focused on Mg-rich corner. *Journal of Materials Science* 2012;47.
- [67] Hamalainen M, Bochvar N, Rokhlin LL, Zeng K. Thermodynamic evaluation of the Cu-Mg-Zr system. *Journal of Alloys and Compounds* 1999;285:162.
- [68] Wang CP, Wang J, Liu XJ, Ohnuma I, Kainuma R, Ishida K. Thermodynamic assessment of the Co-La and Mo-La systems. *Journal of Alloys and Compounds* 2008;453:174.
- [69] Bratberg J, Frisk K. A thermodynamic analysis of the Mo-V and Mo-V-C systems. *Calphad-Computer Coupling of Phase Diagrams and Thermochemistry* 2002;26:459.
- [70] Chan W, Gao MC, Dogan ON, King P. Thermodynamic Assessment of Mo-Ce and Mo-Y Systems. *Journal of Phase Equilibria and Diffusion* 2010;31:414.
- [71] Liu XJ, Jiang ZP, Wang CP, Ishida K. Experimental determination and thermodynamic calculation of the phase equilibria in the Cu-Cr-Nb and Cu-Cr-Co systems. *Journal of Alloys and Compounds* 2009;478:287.
- [72] Zhang YL, Liu HS, Jin ZP. Thermodynamic assessment of the Nb-Ti system. *Calphad-Computer Coupling of Phase Diagrams and Thermochemistry* 2001;25:305.
- [73] Kumar KCH, Wollants P, Delaey L. THERMODYNAMIC CALCULATION OF NB-TI-V PHASE-DIAGRAM. *Calphad-Computer Coupling of Phase Diagrams and Thermochemistry* 1994;18:71.
- [74] Mattern N, Zinkevich M, Loeser W, Behr G, Acker J. Experimental and thermodynamic assessment of the Nb-Ni-Y system. *Journal of Phase Equilibria and Diffusion* 2008;29:141.
- [75] Kumar KCH, Wollants P, Delaey L. THERMODYNAMIC ASSESSMENT OF THE TI-ZR SYSTEM AND CALCULATION OF THE NB-TI-ZR PHASE-DIAGRAM. *Journal of Alloys and Compounds* 1994;206:121.
- [76] Wang CP, Liu XJ, Ohnuma I, Kainuma R, Ishida K. Thermodynamic assessment of the Cu-Ni-Pb system. *Calphad-Computer Coupling of Phase Diagrams and Thermochemistry* 2000;24:149.
- [77] Gürler R. A computer assessment of the ternary Ru-Rh-Pd system. *Journal of Nuclear Materials* 1992;199:22.
- [78] Du ZM. Thermodynamic assessment of the Pd-Zr system. *Zeitschrift Fur Metallkunde* 2003;94:864.
- [79] Wang SL, Wang CP, Liu XJ, Ishida K. Thermodynamic assessments of the Ag-Y and Sc-Y systems. *Journal of Alloys and Compounds* 2009;476:187.
- [80] Liu ZK, Chang YA. Thermodynamic assessment of the Al-Fe-Si system. *Metallurgical and Materials Transactions a-Physical Metallurgy and Materials Science* 1999;30.
- [81] Meng FG, Liu HS, Liu LB, Jin ZP. Thermodynamic description of the Au-Si-Sn system. *Journal of Alloys and Compounds* 2007;431:292.
- [82] Guillermet AF. PHASE-DIAGRAM AND THERMOCHEMICAL PROPERTIES OF THE ZR-TA SYSTEM - AN ASSESSMENT BASED ON GIBBS ENERGY MODELING. *Journal of Alloys and Compounds* 1995;226:174.
- [83] Li ZS, Liu XJ, Wang CP. Thermodynamic modeling of the Th-U, Th-Zr and Th-U-Zr systems. *Journal of Alloys and Compounds* 2009;476:193.
- [84] Kwang Lee S, Nyung Lee D. Calculation of phase diagrams using partial phase diagram data. *Calphad*;10:61.
- [85] Turchanin MA, Agraval PG, Abdulov AR. Thermodynamic assessment of the Cu-Ti-Zr system. II. Cu-Zr and Ti-Zr systems. *Powder Metallurgy and Metal Ceramics* 2008;47:428.
- [86] Chan W, Gao M, Doğan Ö, King P, Rollett A. Thermodynamic Assessment of Cr-Rare Earth Systems. *Journal of Phase Equilibria and Diffusion* 2009;30:578.
- [87] Bu MJ, Wang PS, Xu HH, Liu SH, Sha CS, Du Y, Pan FS, Tang AT. EXPERIMENTAL INVESTIGATION AND THERMODYNAMIC MODELING OF THE Zr-Y SYSTEM. *Journal of Mining and Metallurgy Section B-Metallurgy* 2010;46:181.
- [88] Mathon M, Jardet K, Aragon E, Satre P, Sebaoun A. Al-Ga-Zn System: Reassessments of the Three Binary Systems and Discussion on Possible Estimations and on Optimisation of the Ternary System. *Calphad* 2000;24:253.