UTLENIANIE MATERIAŁÓW METALICZNYCH

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Własności wybranych tlenków metali

Oxide	*Structure*	*Melting point, °C*	*Boiling point, °C*	*Molar volume, cm^3*	*Volume ratio (oxide/metal)*
α-Al_2O_3	$D5_1$(corundum)	2015	2980	25.7	1.28
γ-Al_2O_3	(defect spinal)	$\gamma \rightarrow \alpha$	. . .	26.1	1.31
BaO	Bl (NaCl)	1923	~2000	26.8	0.69
BaO_2	Tetragonal (CaC_2)	450	d.800	34.1	0.87
BeO	Br (ZnS)	2530	~3900	8.3	1.70
CaO	Bl (NaCl)	2580	2850	16.6	0.64
CaO_2	Cll (CaC_2)	. . .	d.275	24.7	0.95
CdO	B1 (NaCl)	~1400	d.900	18.5	1.42
Ce_2O_3	$D5_2$ (La_2O_3)	1692	. . .	47.8	1.15
CeO_2	Cl (CaF_2)	~2600	. . .	24.1	1.17
CoO	Bl (NaCl)	1935	. . .	11.6	1.74
Co_2O_3	Hexagonal	. . .	d.895	32.0	2.40
Co_3O_4	Hl_1 (spinal)	$\rightarrow$ CoO	. . .	39.7	1.98
Cr_2O_3	$D5_1$ (αAl_2O_3)	2435	4000	29.2	2.02
Cs_2O	Hexagonal ($CdCl_2$)	. . .	d.400	66.3	0.47
Cs_2O_3	Cubic (Th_3P_4)	400	650	70.1	0.50
CuO	B26 monoclinic	1326	. . .	12.3	1.72
Cu_2O	C3 cubic	1235	d.1800	23.8	1.67
FeO	Bl (NaCl)	!420	. . .	12.6	1.78 on α-iron
α-Fe_2O_3	$D5_1$ (Haematite)	1565	. . .	30.5	2.15 on α-iron
γ-Fe_2O_3	$D5_7$ cubic	1457	. . .	31.5	2.22 on α-iron
Fe_3O_4	Hl_1 (spinel)	. . .	d. 1538	44.7	2.10 on α-iron
Ga_2O_3	Monoclinic	1900	. . .	31.9	1.35
HfO_2	Cubic	2812	~5400	21.7	1.62

Własności wybranych tlenków metali

Oxide	*Structure*	*Melting point, °C*	*Boiling point, °C*	*Molar volume, cm^3*	*Volume ratio (oxide/metal)*
In_2O_3	$D5_3(Sc_2O_3)$	. . .	d.850	38.7	1.23
IrO_2	C4 (TiO_2)	. . .	d.1100	19.1	2.23
La_2O_3	D53 (Sc_2O_3)	. . .	d.850	38.7	1.23
Li_2O	Cl (CaF_2)	~1700	1200	14.8	0.57
MgO	Bl (NaCl)	2800	3600	11.3	0.80
MnO	Bl (NaCl)	. . .	. . .	13.0	1.77
MnO_2	C4 (TiO_2)	. . .	d.535	17.3	2.37
Mn_2O_3	D53 (Sc_2O_3)	. . .	d.1080	35.1	2.40
Mn_3O_4	Hl_1 (spinel)	1705	. . .	47.1	2.14
MoO_3	Orthorhombic	795	. . .	30.7	3.27
Na_2O	Cl (CaF_2)	Subl. 1275	. . .	27.3	0.57
Nb_2O_5	Monoclinic	1460	. . .	59.5	2.74
Nd_2O_3	Hexagonal	~1900	. . .	46.5	1.13
NiO	Bl (NaCl)	1990	. . .	11.2	1.70
PbO	B10 tetragonal	888	. . .	23.4	1.28
Pb_3O_4	Tetragonal	. . .	d.500	75.3	1.37
PdO	B17 tetragonal	870	. . .	14.1	1.59
PtO	B17 (PdO)	. . .	d.550	14.2	1.56
Rb_2O_3	(Th_3P_4)	489	. . .	62.0	0.56
ReO_2	Monoclinic	. . .	d.1000	19.1	2.16
Rh_2O_3	D51 (α-Al_2O_3)	. . .	d.1100	31.0	1.87
SiO	Cubic	~1700	1880	20.7	1.72

Własności wybranych tlenków metali

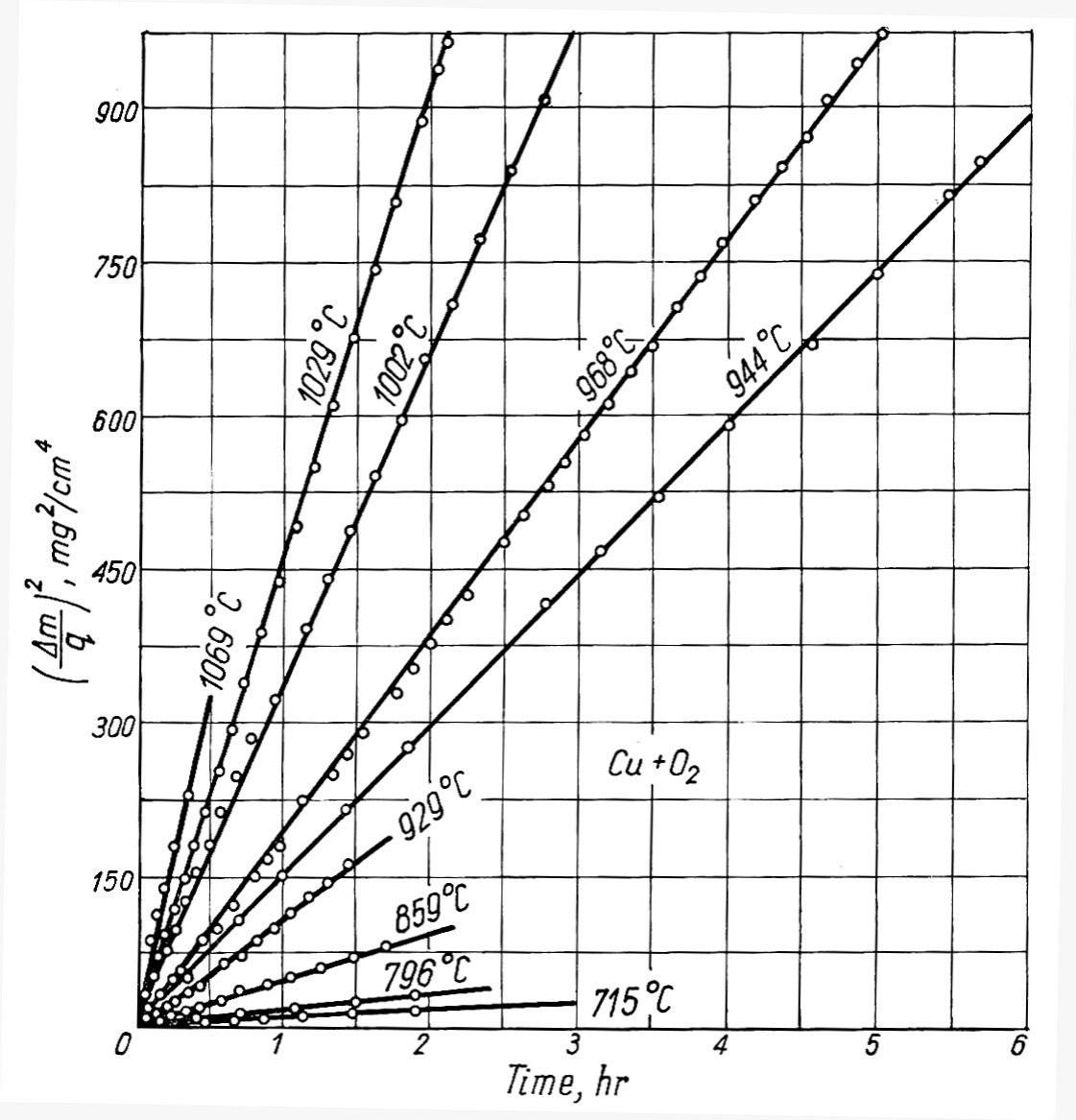
Oxide	*Structure*	*Melting point, °C*	*Boiling point, °C*	*Molar volume, cm^3*	*Volume ratio (oxide/metal)*
SiO_2	β cristobalite C9	1713	2230	25.9	2.15
SnO	B10 (PbO)	. . .	d.1080	20.9	1.26
SnO_2	C_4 (TiO_2)	1127	. . .	20.9	1.26
SrO	Bl (NaCl)	2430	~3000	22.0	0.65
Ta_2O_5	Triclinic	1800	. . .	53.9	2.47
TeO_2	C_4 (TiO_2)	733	1245	28.1	1.38
ThO_2	Cl (CaF_2)	3050	4400	26.8	1.35
TiO	Bl (NaCl)	1750	~3000	13.0	1.22
TiO_2	C4 (Rutile)	1830	~2700	18.8	1.76
Ti_2O_3	$D5_1$ (α-Al_2O_3)	. . .	d.2130	31.3	1.47
Tl_2O_3	$D5_3$ (Sc_2O_3)	717	d.875	44.8	1.30
UO_2	Cl (CaF_2)	2500	. . .	24.6	1.97
U_3O_8	Hexagonal	. . .	d.1300	101.5	2.71
VO_2	C4 (TiO_2)	1967	. . .	19.1	2.29
V_2O_3	$D5_1$ (α-Al_2O_3)	1970	. . .	30.8	1.85
V_2O_5	$D8_7$ Orthorhombic	690	d.1750	54.2	3.25
WO_2	C4 (TiO_2)	~1550	~1430	17.8	1.87
B-WO_3	Orthorhombic	1473	. . .	32.4	3.39
W_2O_5	Triclinic	Sub.~850	~1530	29.8	3.12
Y_2O_3	$D5_3$ (Sc_2O_3)	2410	. . .	45.1	1.13
ZnO	B3 (wurtzite)	1975	. . .	14.5	1.58
ZrO_2	$C4_3$ monoclinic	2715	. . .	22.0	1.57

Przebieg procesu utleniania wybranych metali

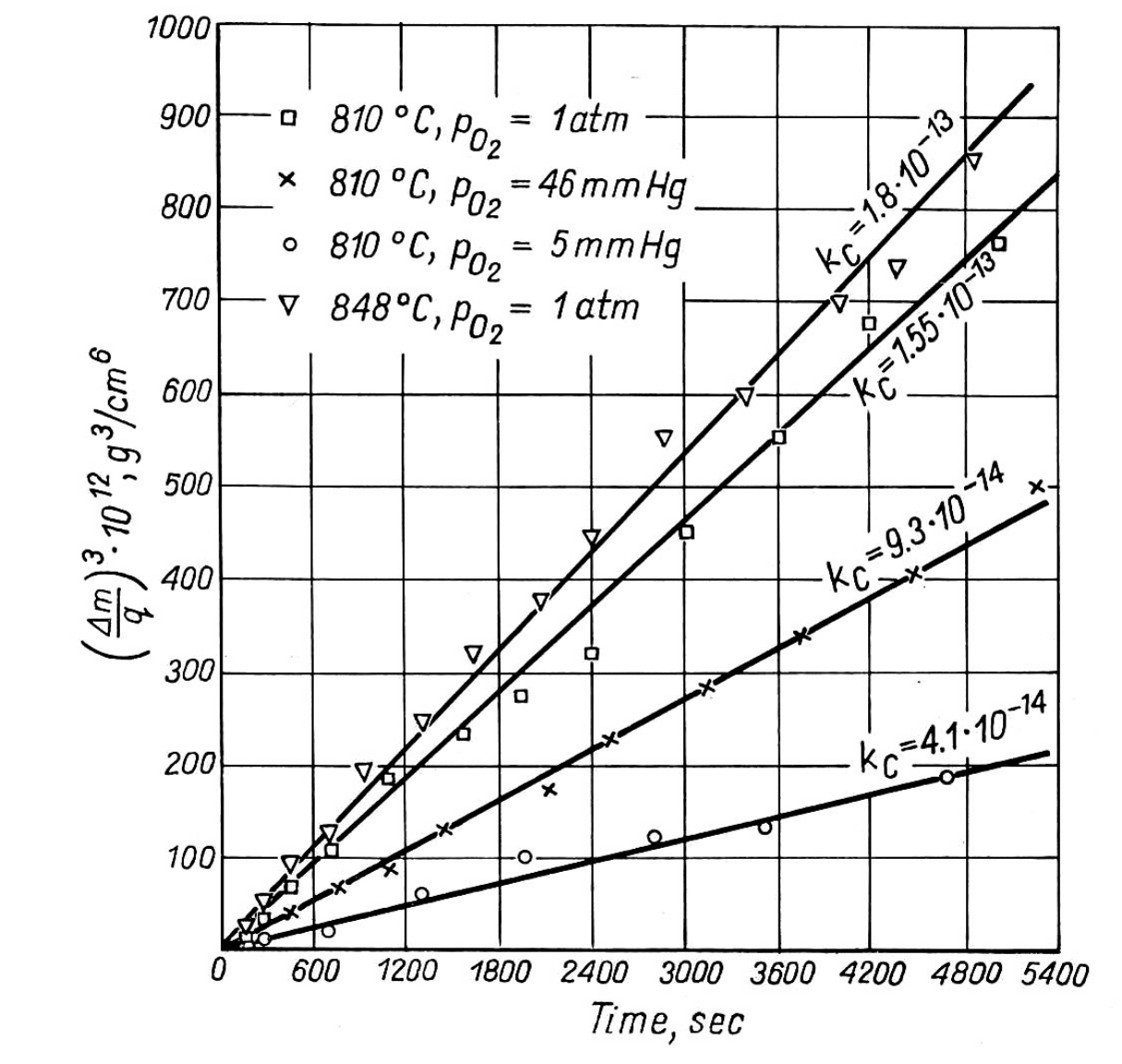
Metal	Temperature, °C										
	100	200	300	400	500	600	700	800	900	1000	1100
Mg	log.		par.	paralin.	lin.						
Ca	log.		par.	lin.	lin.						
Ce	log.	lin.	incr.								
Th			par.		lin.	lin.					
U	par.	paralin.	lin.	incr.							
Ti			log.	cu.		cu.	paralin.			paralin.	
Zn			log. cu			cu.			cu.	cu.	lin.
Nb			par.	par.	paralin.			lin.		lin.	incr.
Ta	log. inv.	log.		par.	paralin.			lin.		lin.	
Mo			par.	paralin.		paralin.		lin.		lin.	
W				par.		par.		paralin.		paralin.	
Fe	log.	log.	par.	par.	par.			par.		par.	par.
Ni		log.	log.	cu.	par.					par.	par.
Cu		log. cu.	cu.		par.		par.	par.			
Zn		log		log. par.							
Al	log. inv.	log.	log.	par.	lin.						
Ge				par.		paralin.					

Denotations: log. — logarithmic law; inv. log. — inversely logarithmic law; cu — cubic law; par. — parabolic law; paralin. — paralinear law; lin. — linear law; incr. — increased oxidation rate.

Kinetyka utleniania miedzi



Kinetyka utleniania CuO



Zależność szybkości utleniani kobaltu od ciśnienia

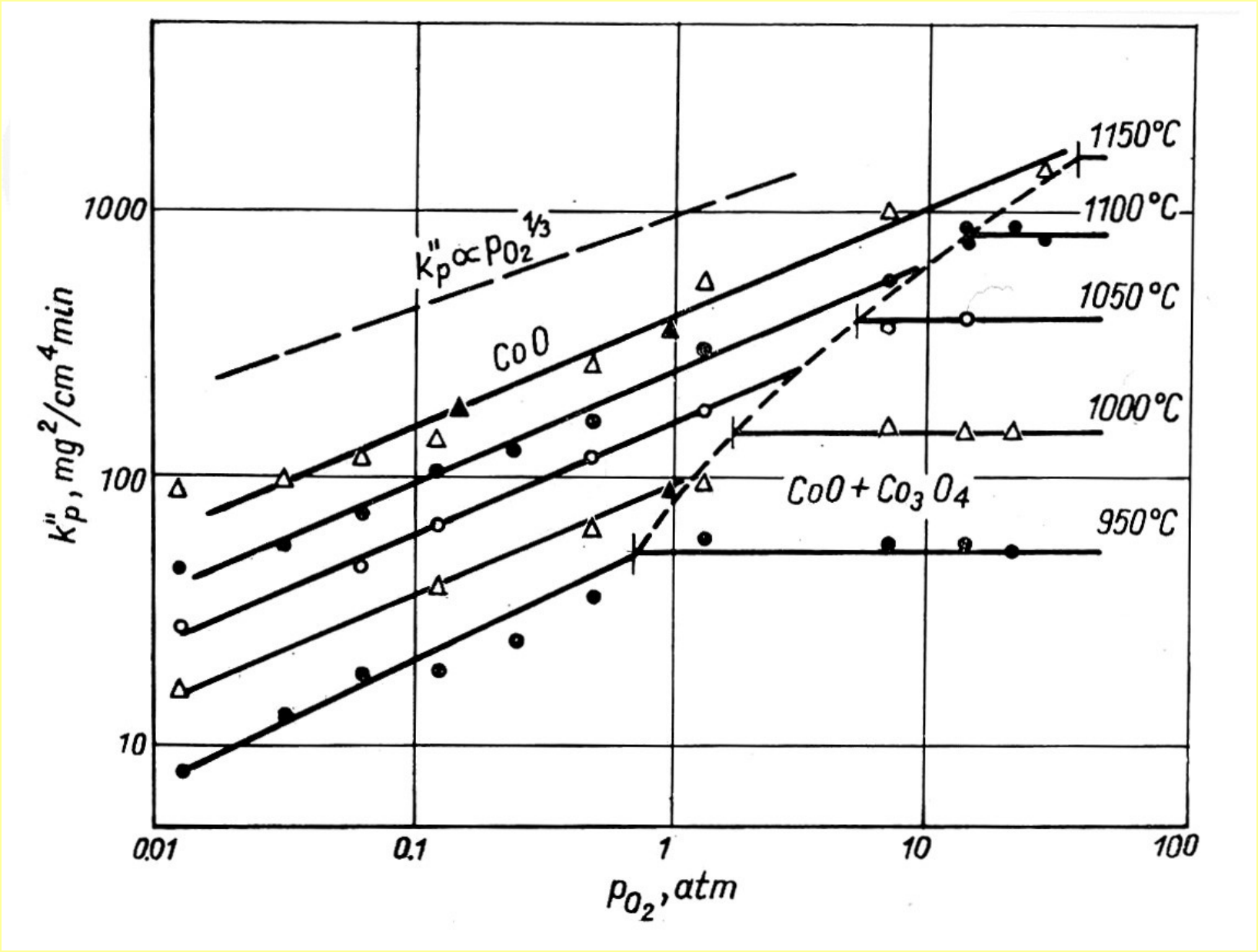
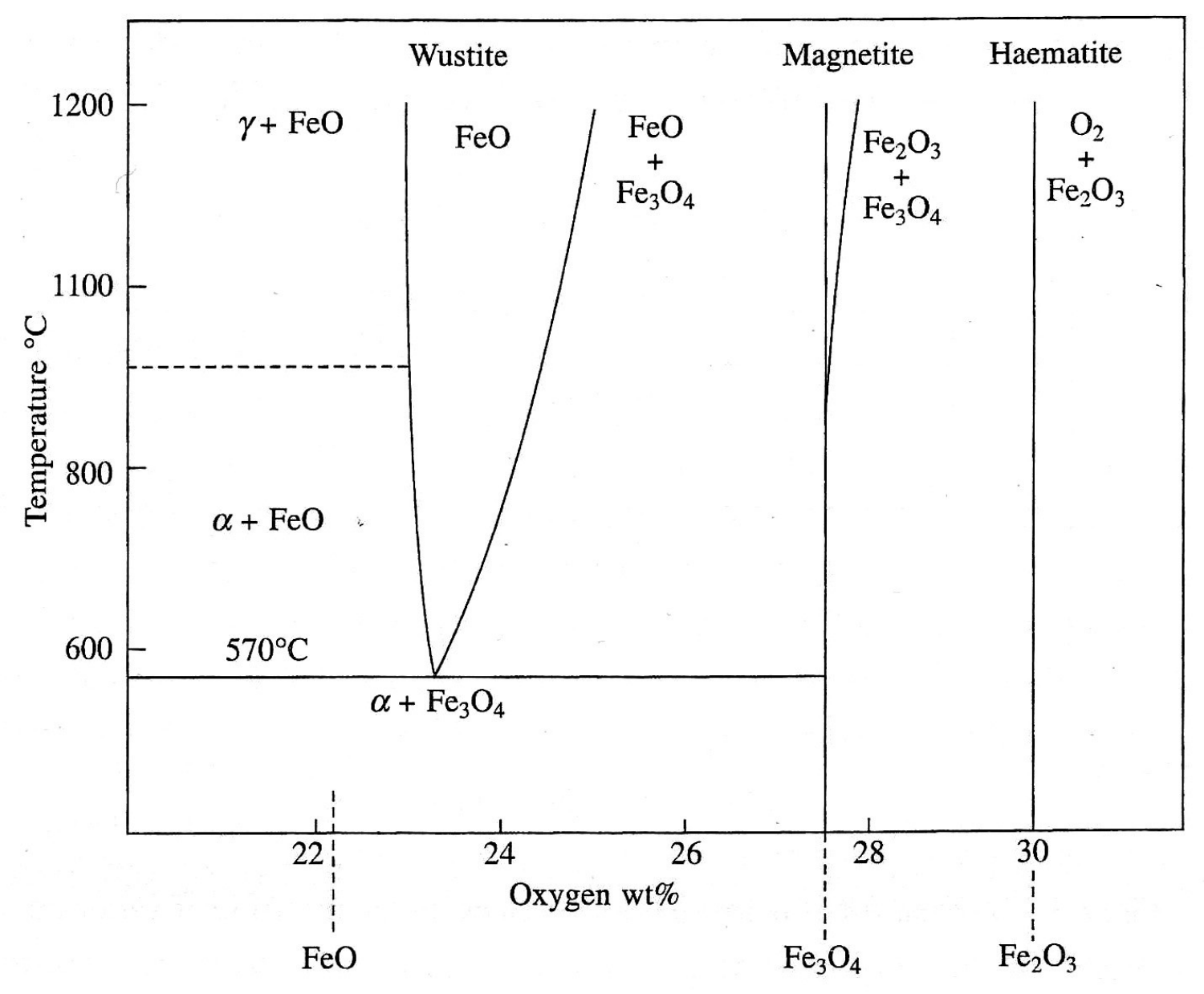
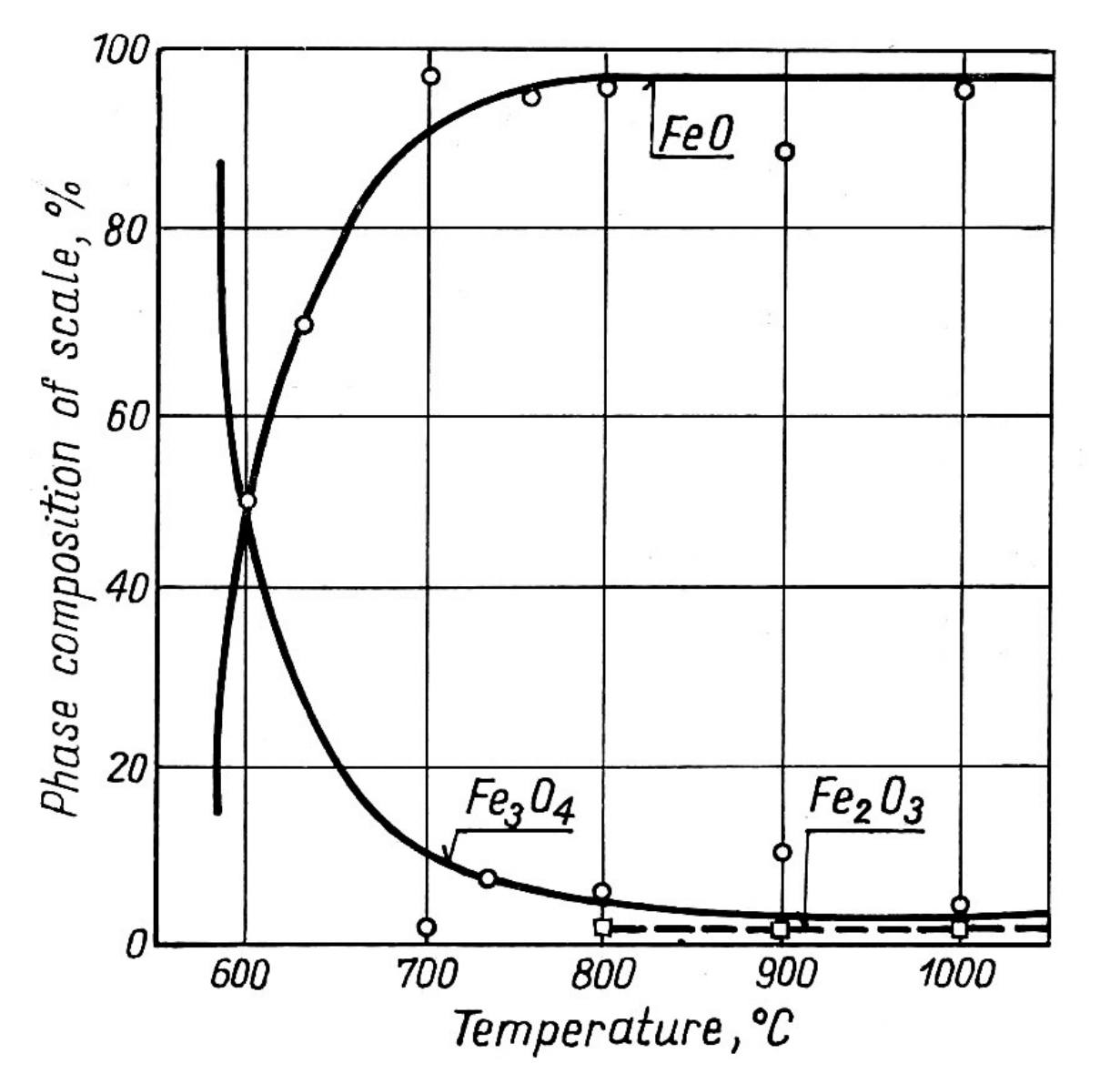


Diagram fazowy układu Fe-O_2



Wpływ temperatury na skład zgorzeliny tlenkowej narastającej na żelazie



Szybkości utleniania wybranych metali

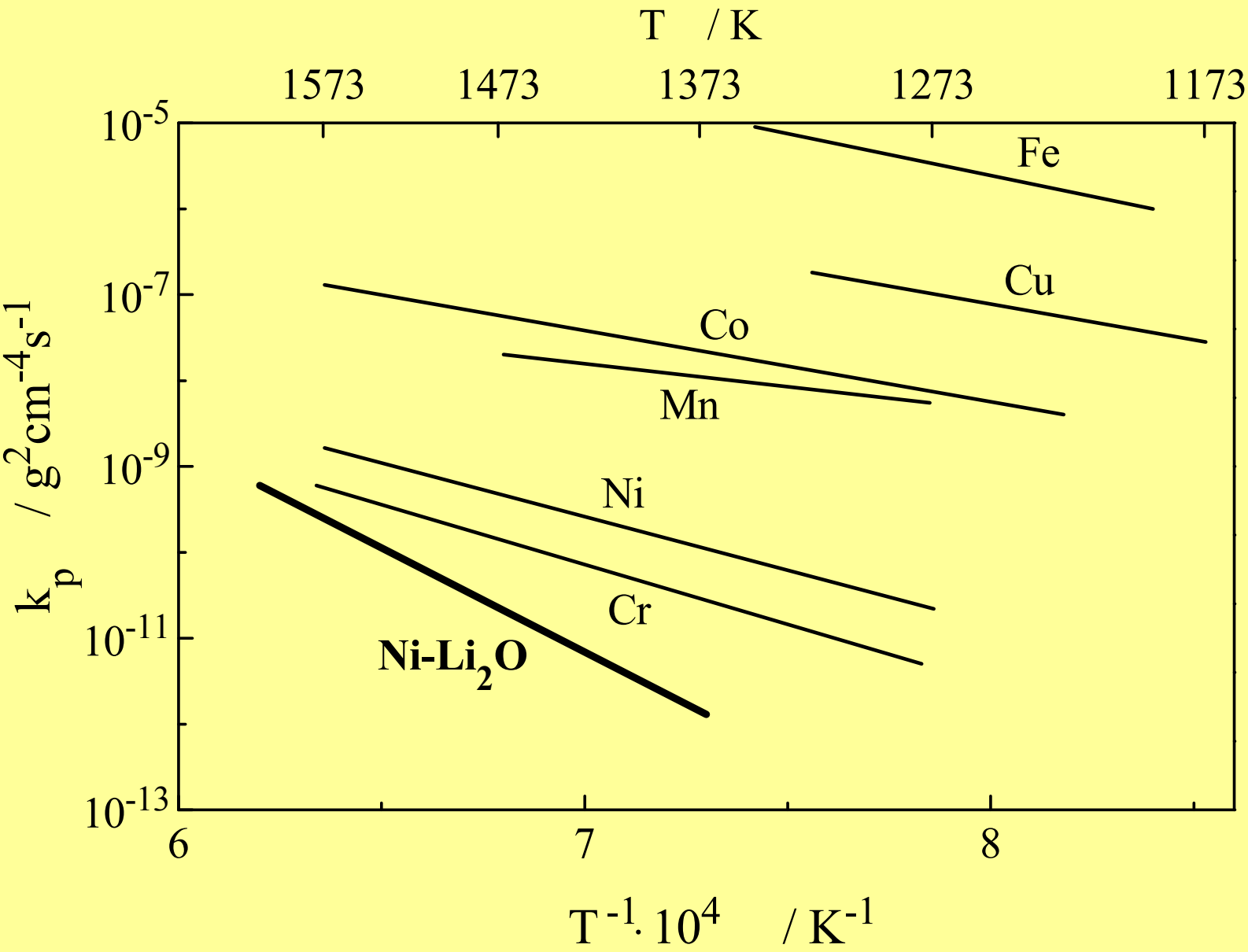
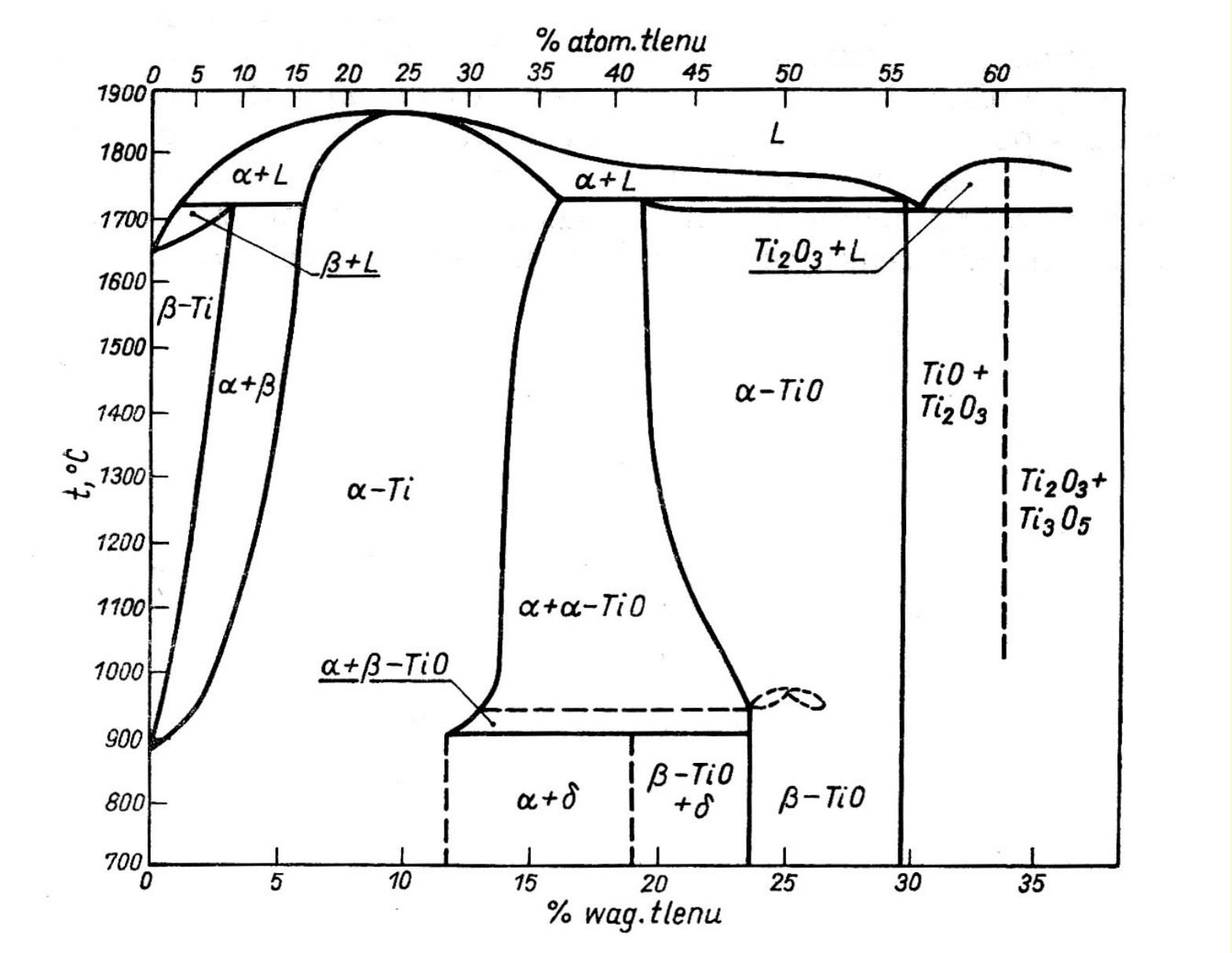
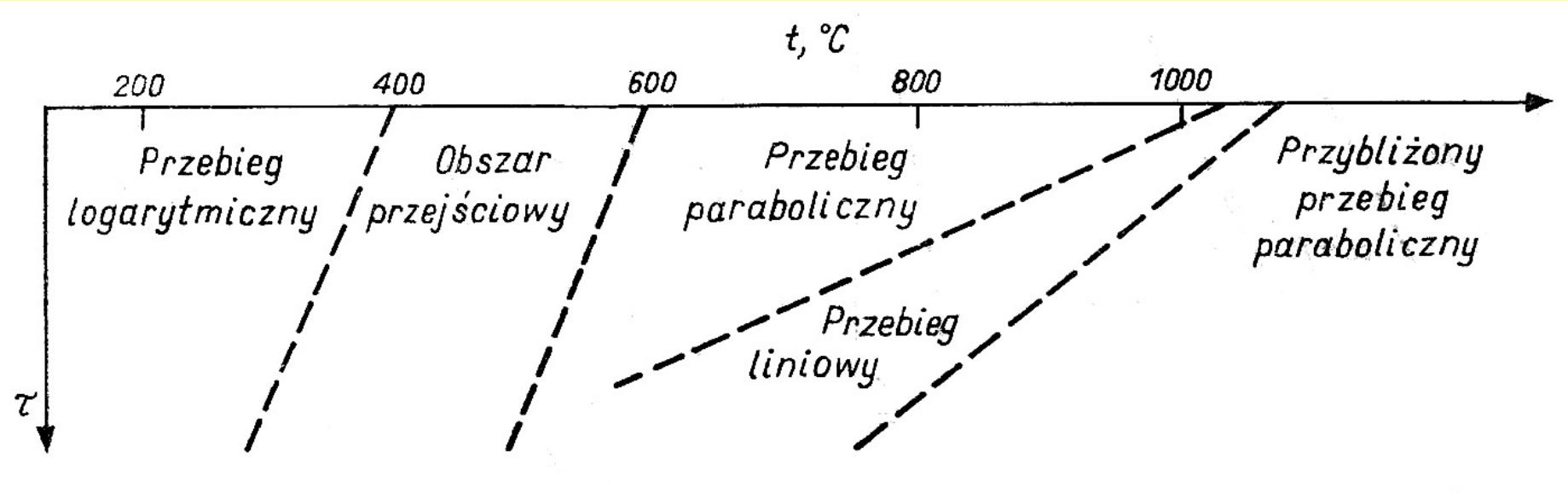


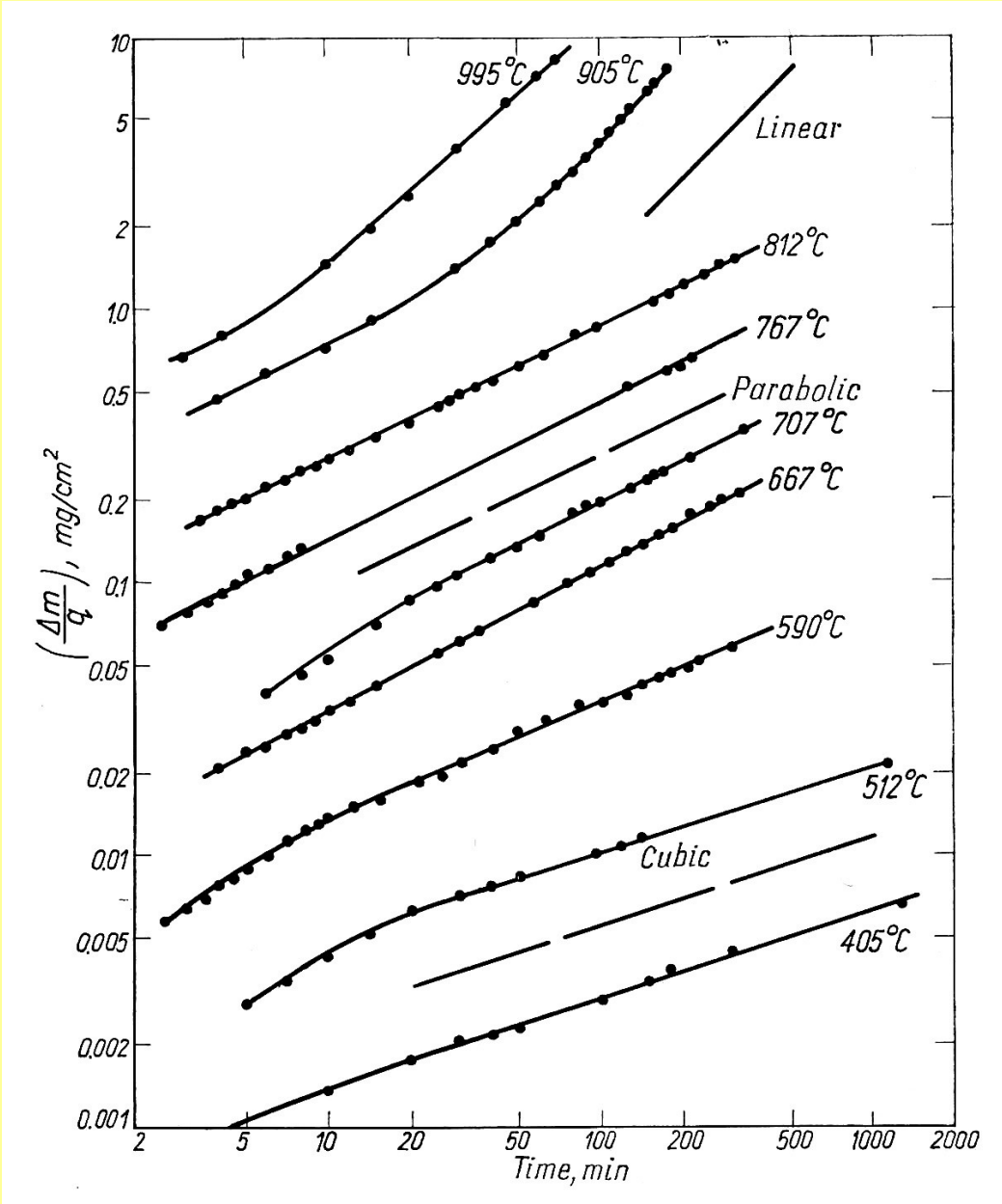
Diagram fazowy układu Ti-O_2



Schemat wpływu temperatury i czasu na kinetykę utleniania Ti



Wpływ temperatury na kinetykę utleniania Ti



Wpływ temperatury i ciśnienia tlenu na kinetykę utleniania Ti

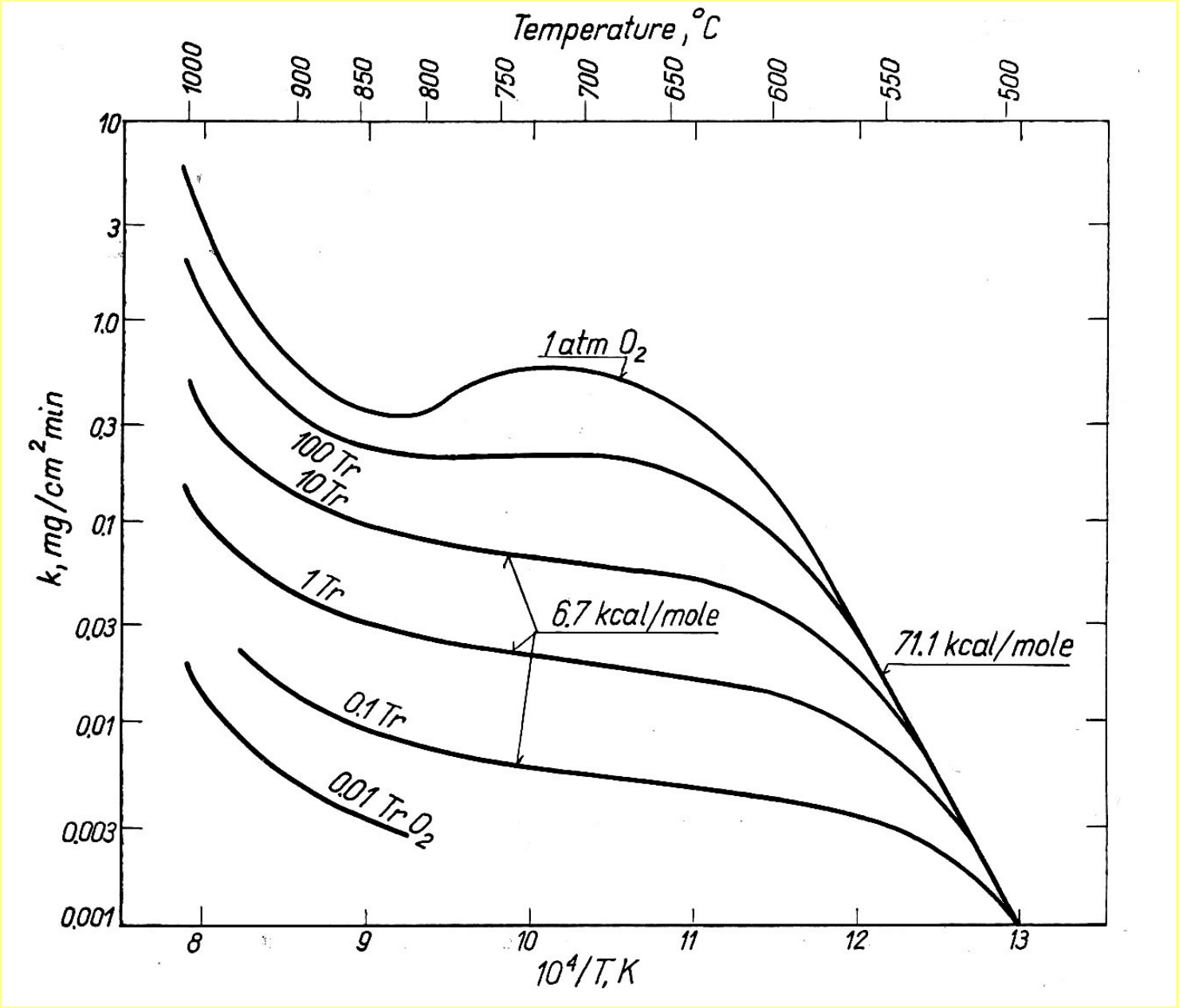


Diagram fazowy układu Hf-O_2

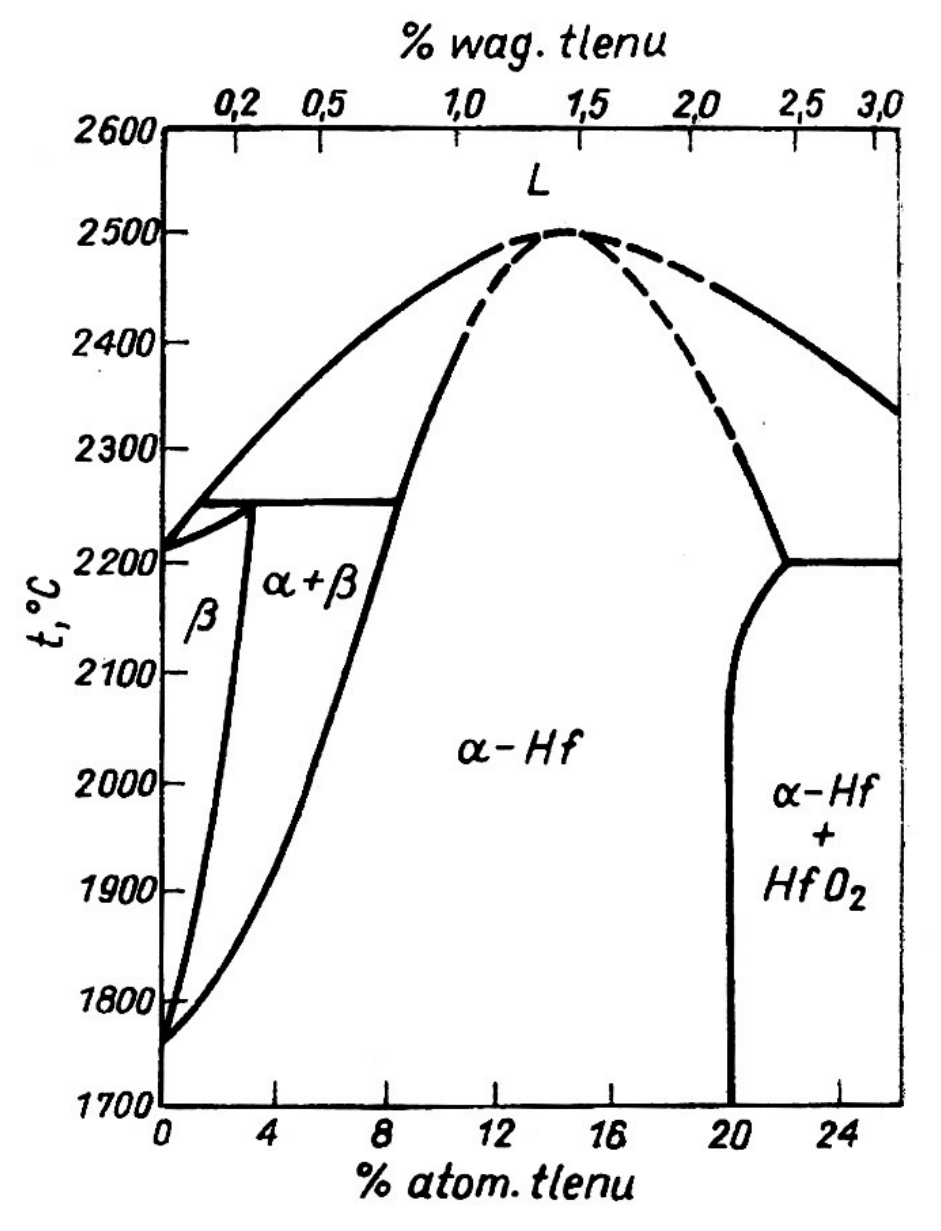
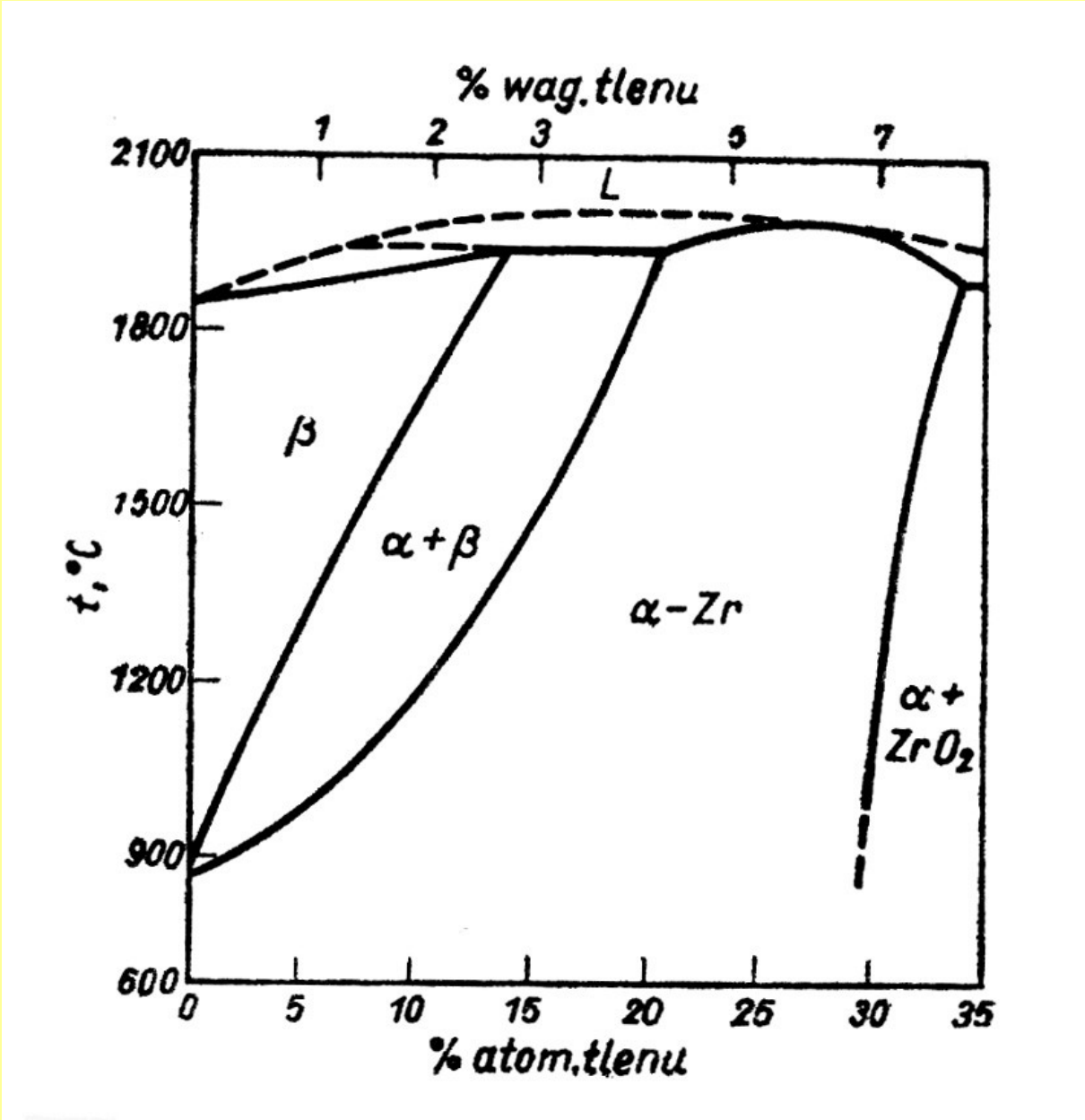
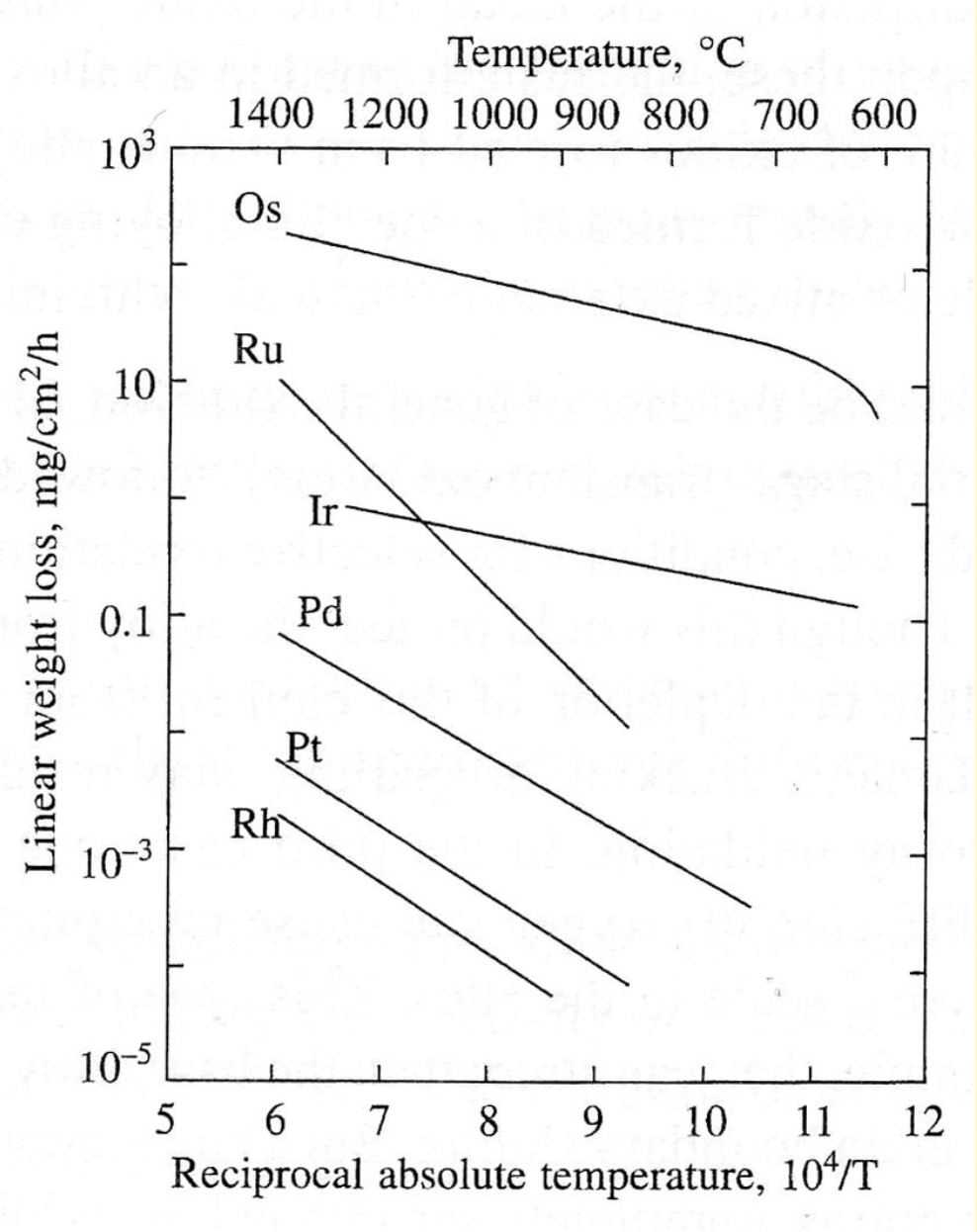


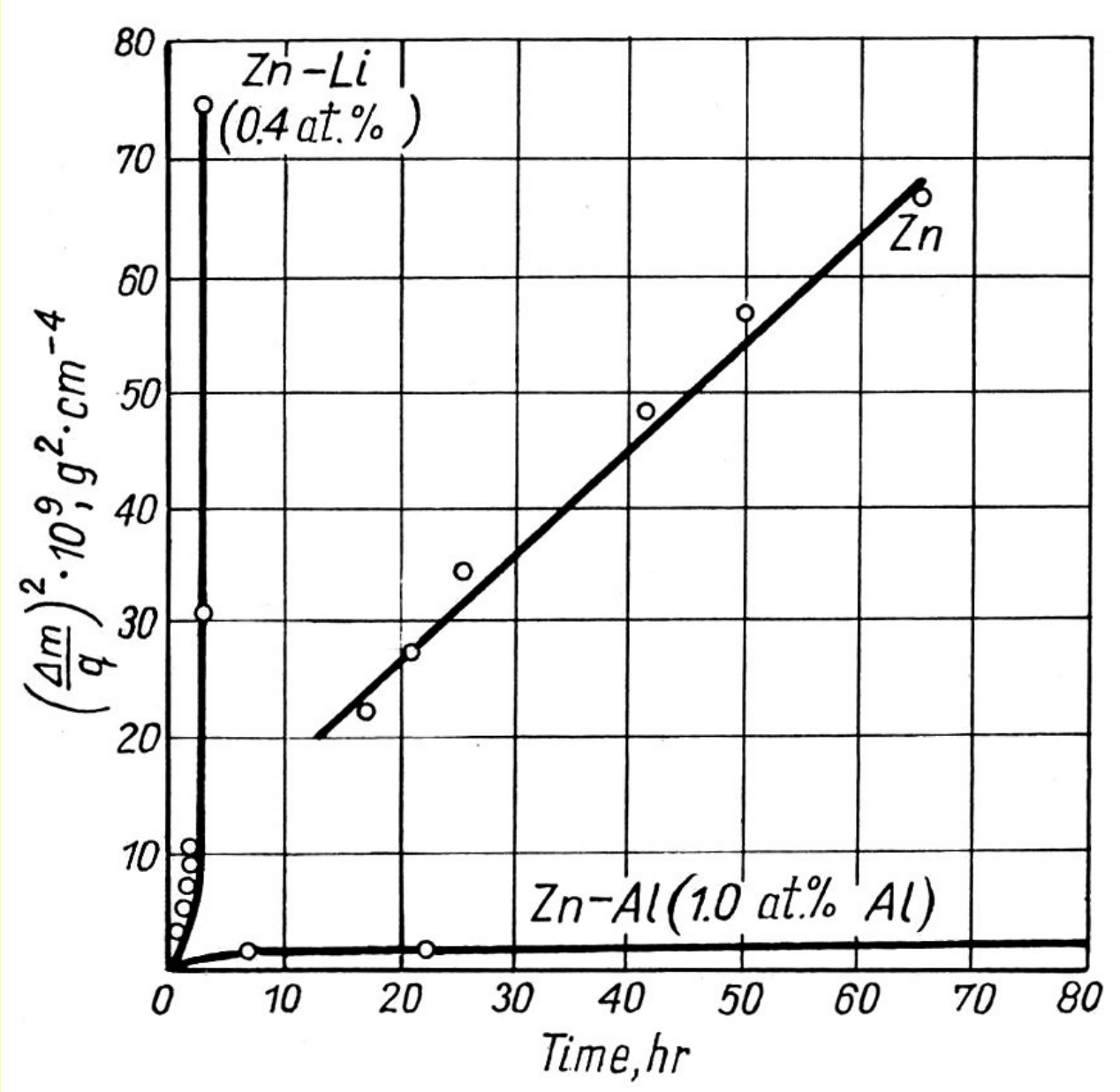
Diagram fazowy układu Zr-O_2



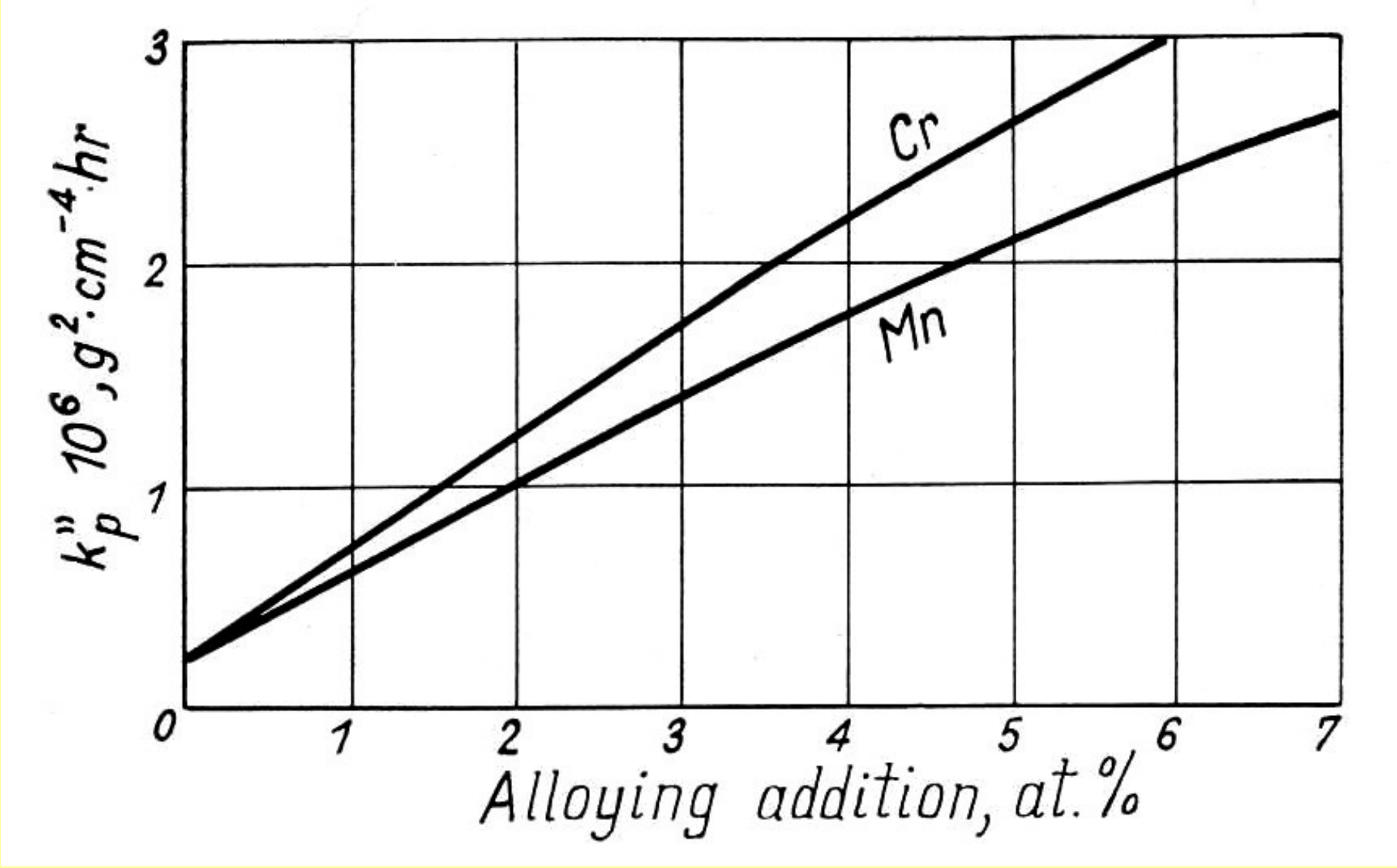
Wpływ temperatury na szybkość degradacji metali szlachetnych



Wpływ różnowartościowych domieszek na szybkość utleniania Zn



Wpływ różnowartościowych domieszek na szybkość utleniania Ni



Wpływ Si na szybkość utleniania stopów typu *kanthal* (Fe-Cr-Al)

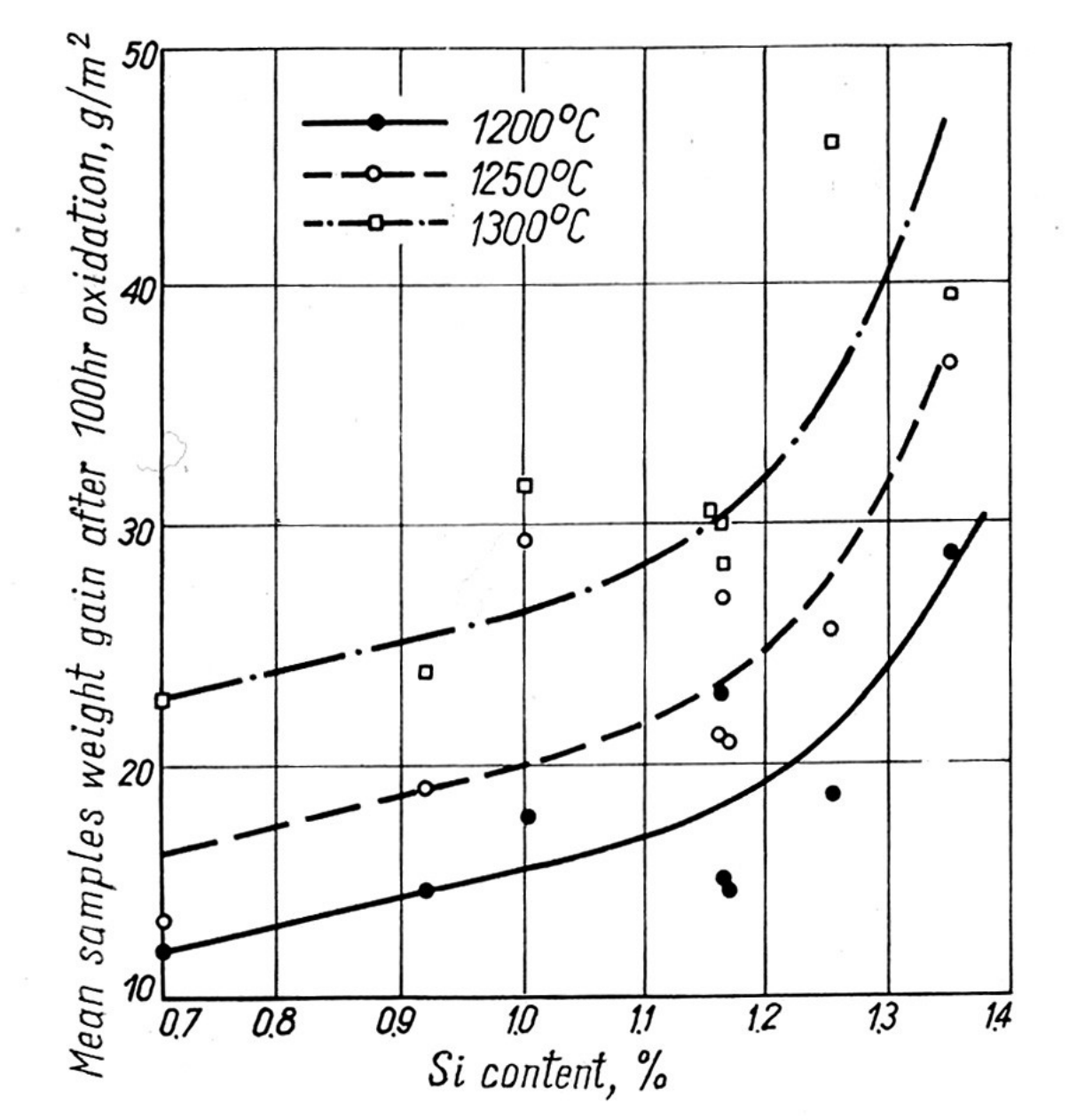
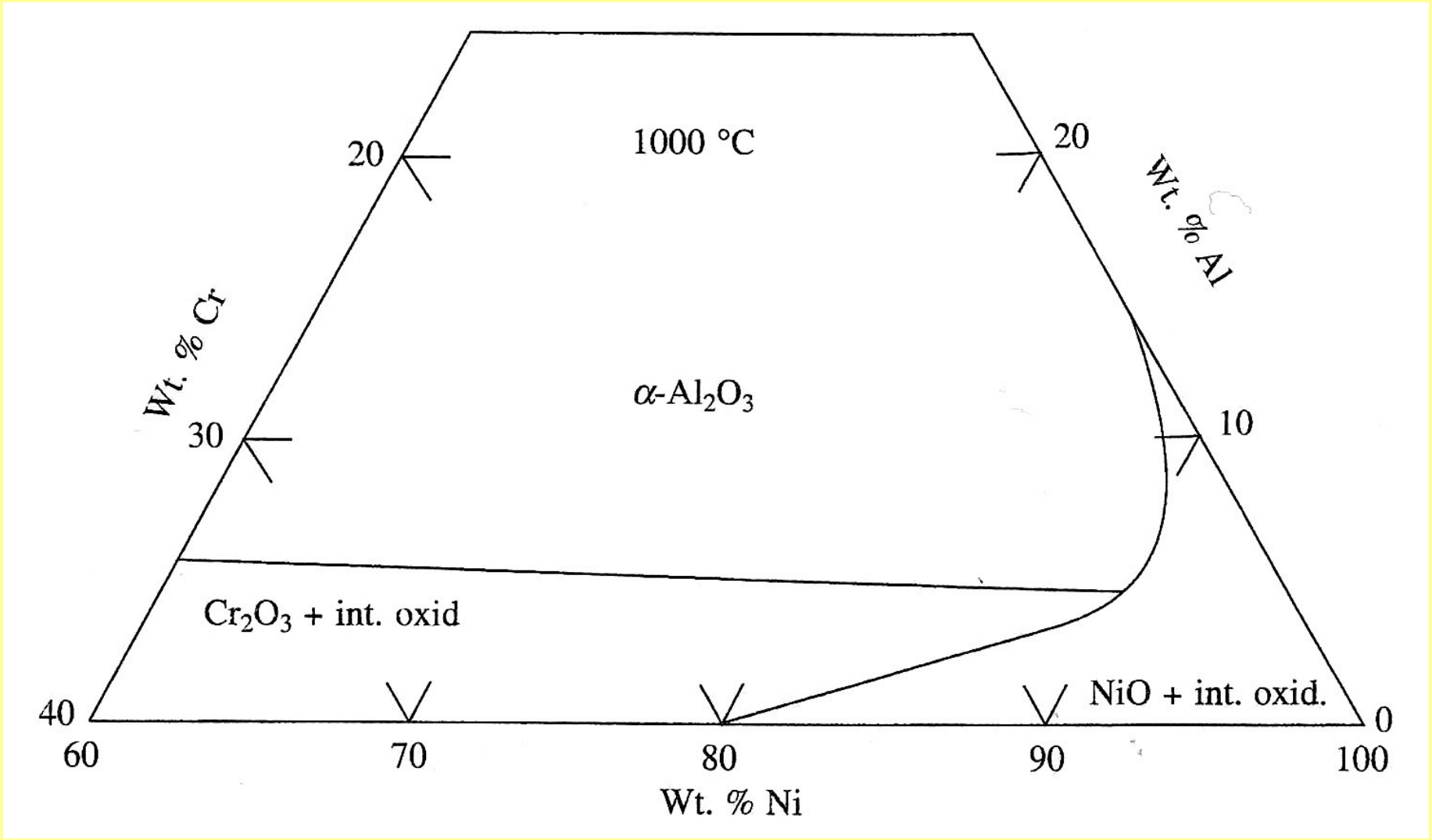
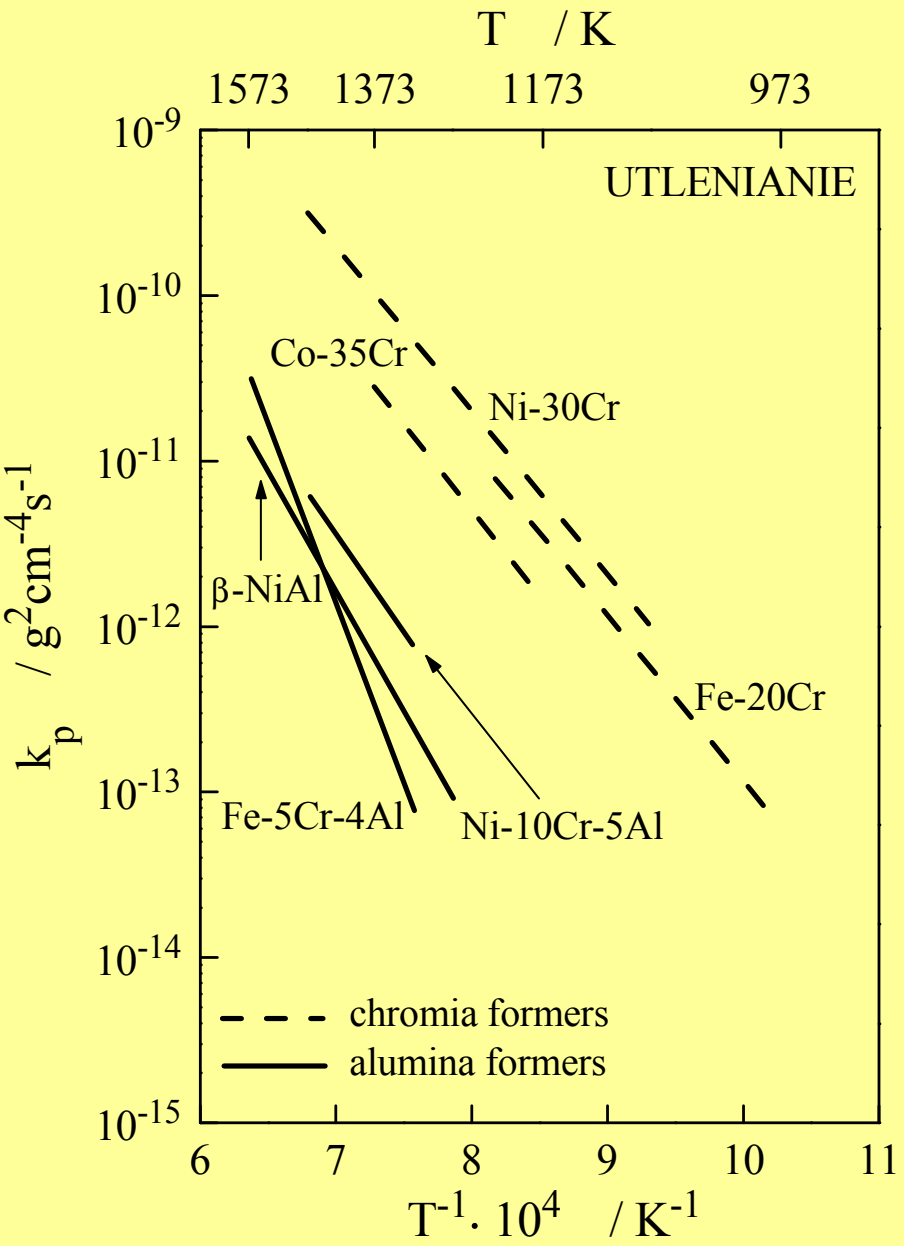


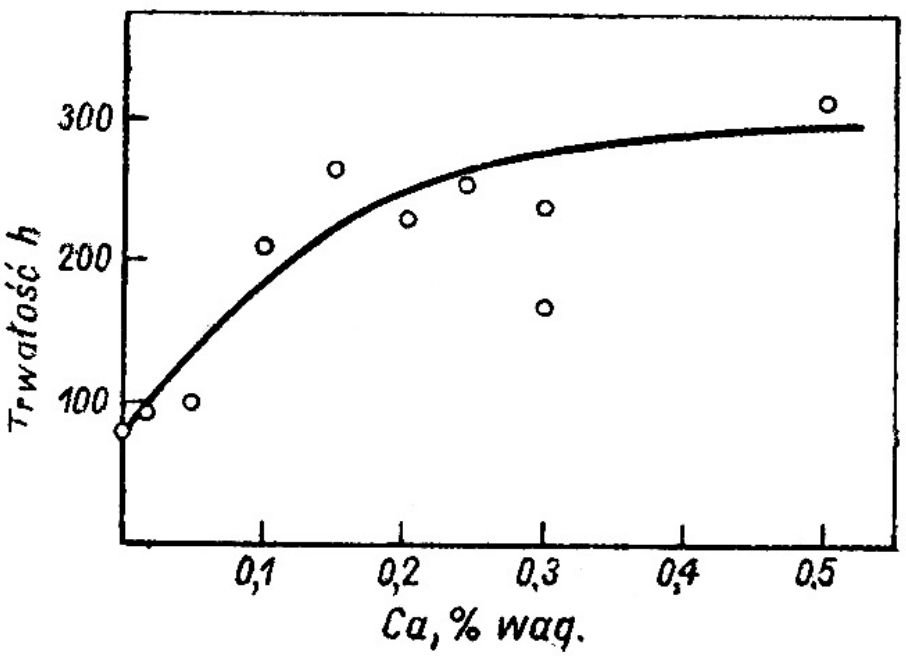
Diagram fazowy układu Al_2O_3-Cr_2O_3-NiO

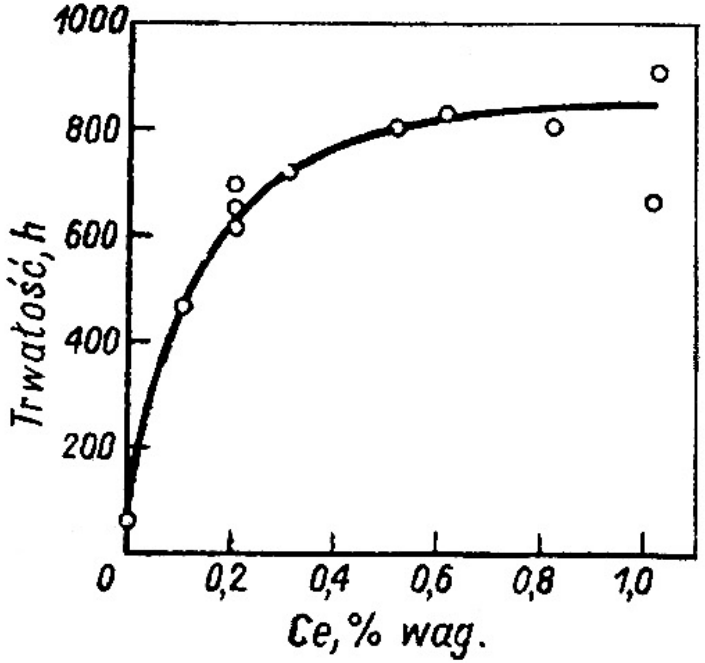


Szybkości utleniania wybranych stopów

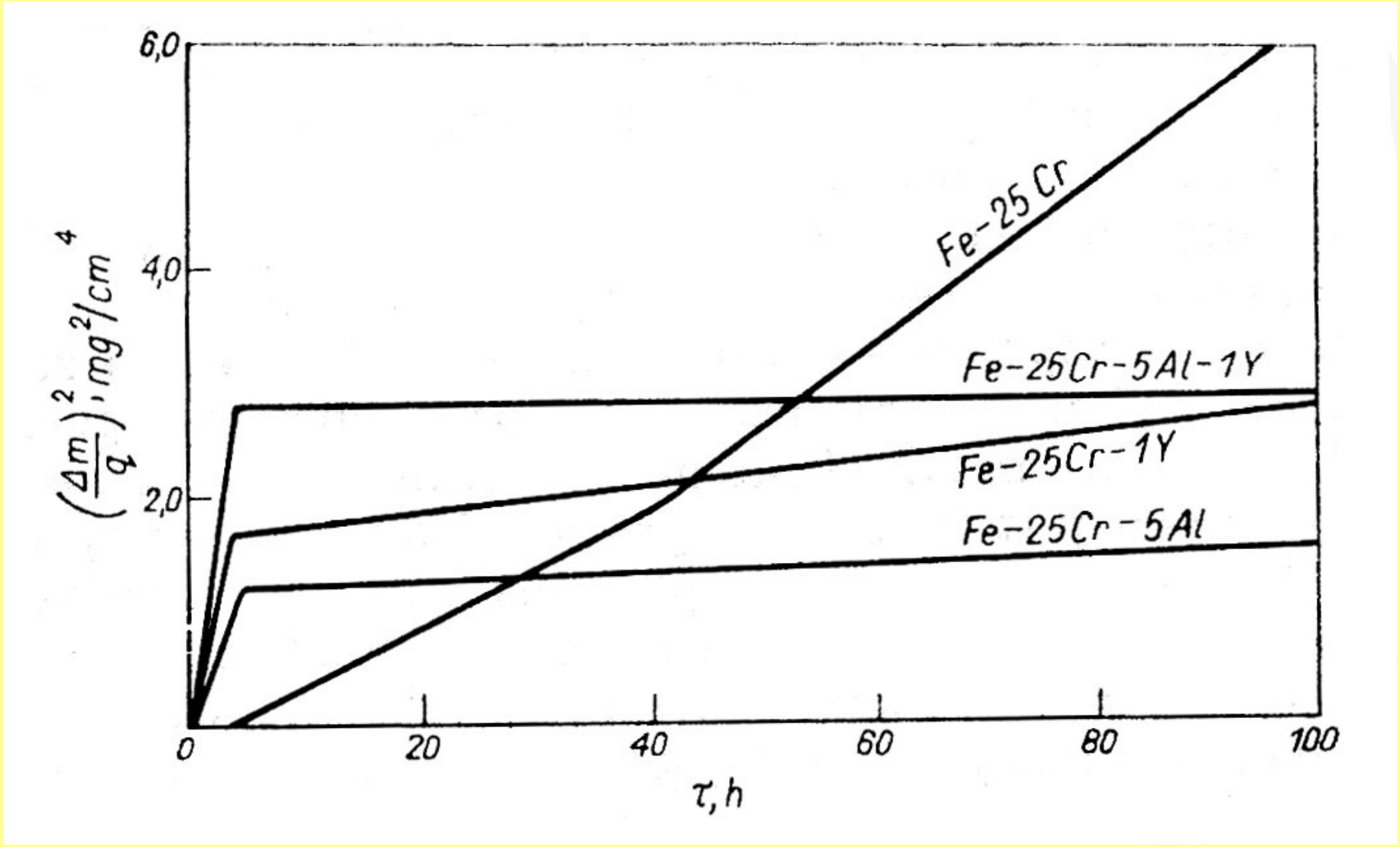


Wpływ Ca i Ce na trwałość stopu Ni-20Cr w temp. 1050 °C

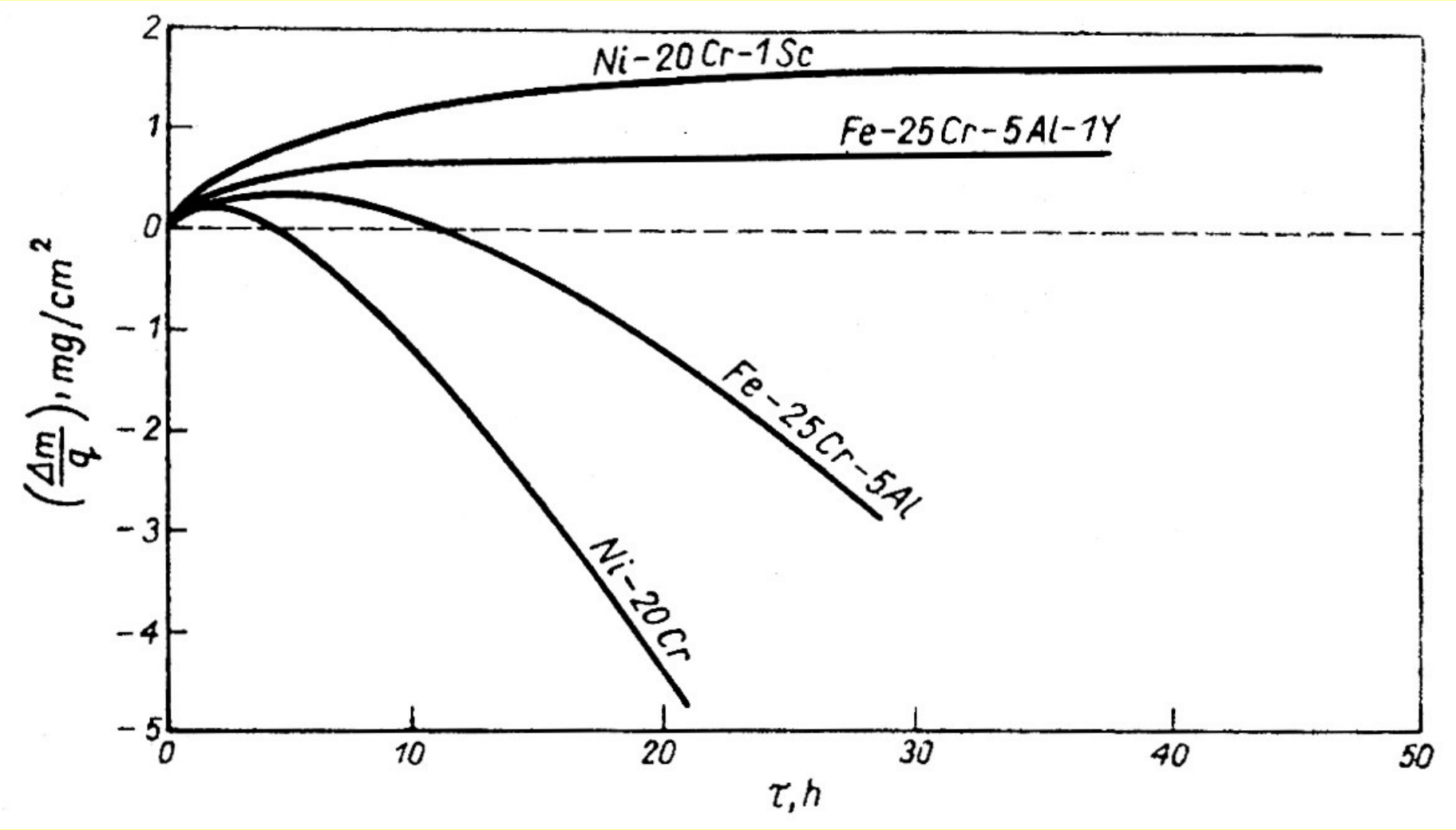




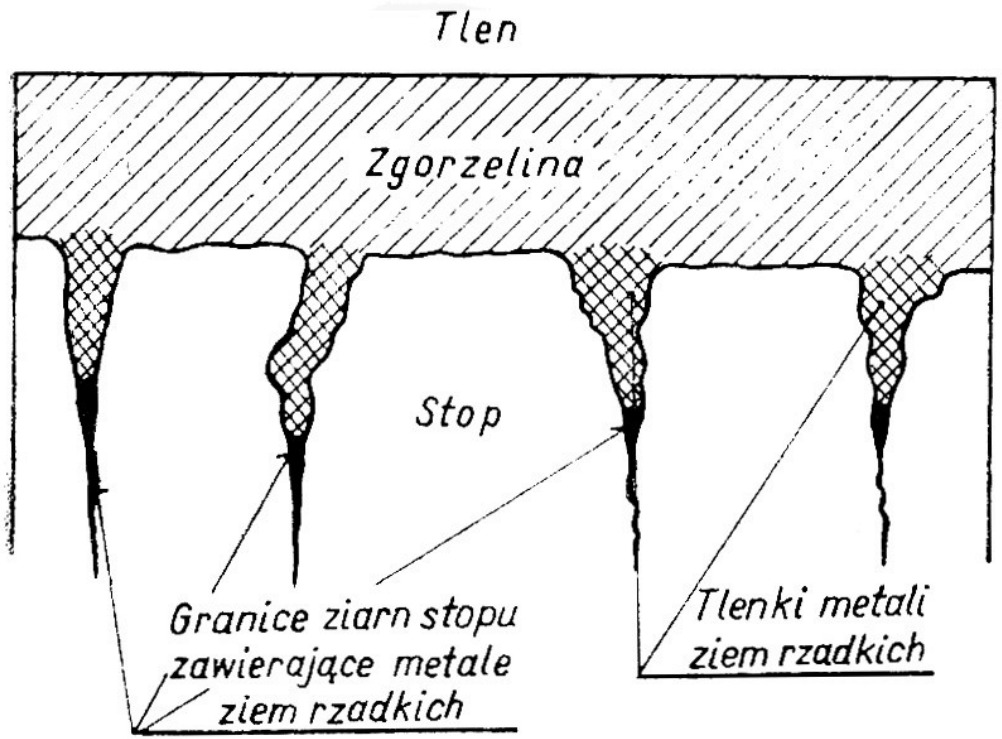
Wpływ Y na szybkość utleniania stopu Fe-25Cr-5Al

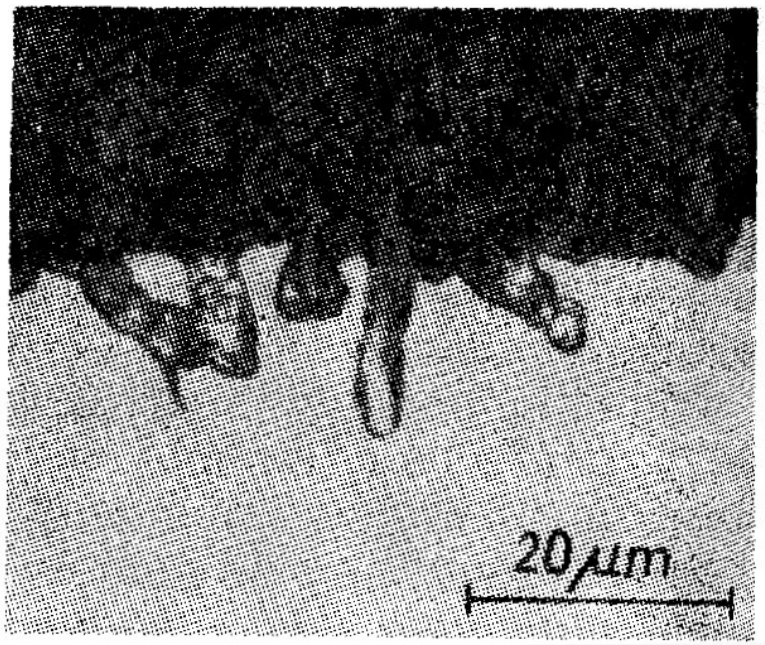


Wpływ Y i Sc na szybkość degradacji stopów Fe-25Cr-5Al oraz Ni-20Cr w warunkach cyklicznego utleniania

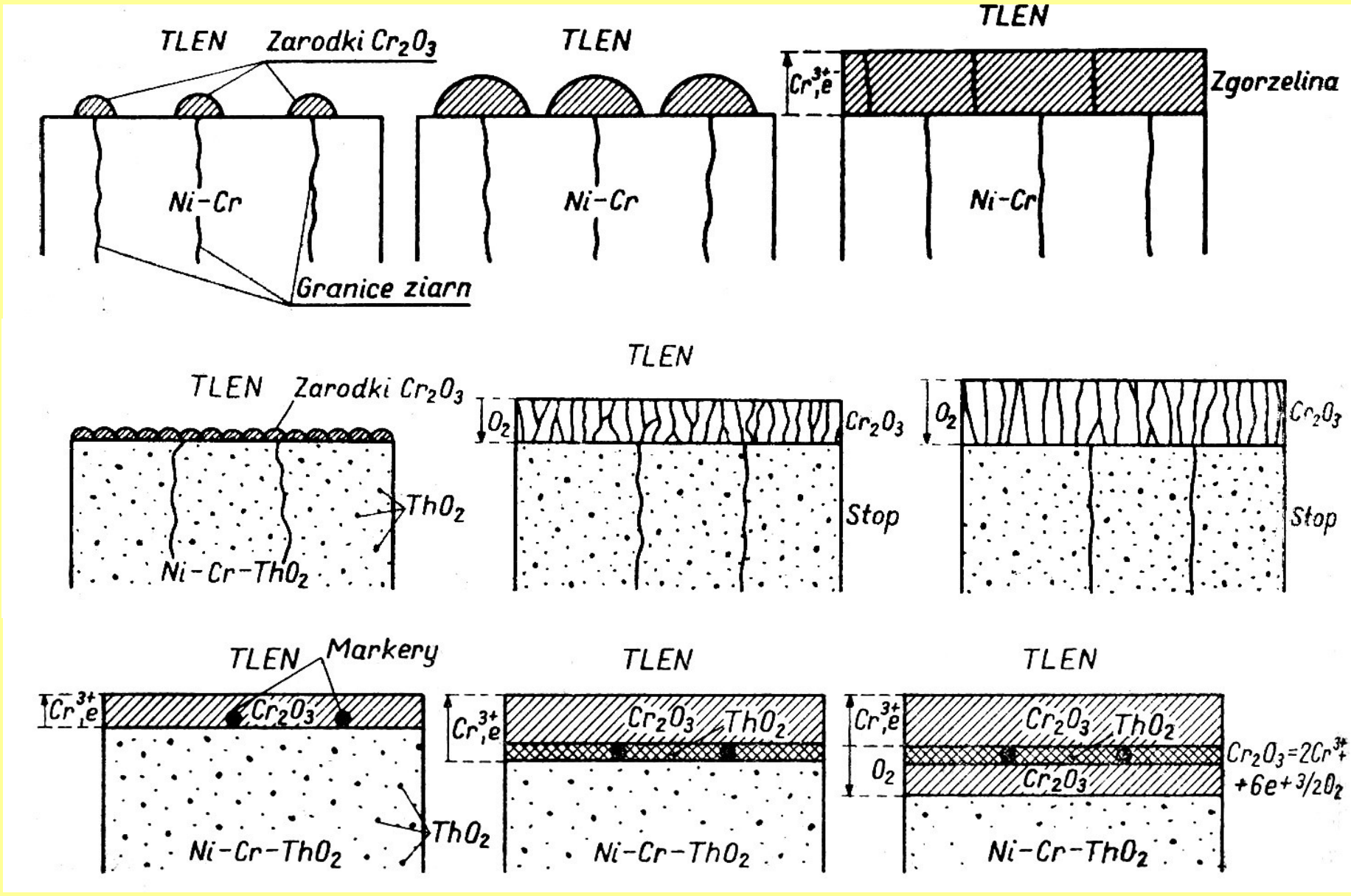


Schemat mechanicznego wiązania zgorzeliny z podłożem za pośrednictwem utlenionych wewnętrznie metali ziem rzadkich, zgromadzonych na granicach ziarn stopu





Schemat formowania się zgorzeliny Cr_2O_3 na wysokoprocentowych stopach Ni-Cr



KONIEC