Appendix A

High Temperature Alloys

Tables A1–A4

TABLE A1 Precipitation Strengthened Nickel-Based Superalloy Compositions[a] (wt%)

Alloy	Cr	Co	Al	Mo	W	Ti	Nb	Re	Ta	Hf	Other
Waspaloy	19.5	13.5	3	4.3		1.4					0.1Zr, <2Fe
IN738	16	8.5	3.4	1.7	2.6	3.4	0.9		1.7		0.1Zr
René 80	14	9.5	3	4		5					0.03Zr
PWA 1480	10	5	5		4	1.5			12		
SRR 99	9.6	5	12	0.3	3	2.7			0.9		
René N4	9.8	7.5	4.2	6	6	3.5	0.5		4.8	0.15	
René N5	7.5	7.7	6.2	1.4	6.4			2.8	7.1	0.15	
MC 2	7.8	5.2	5.0	2.1	8.0				5.8		
CMSX-4	6.5	9	5.6	0.6	6	1.0		3	6.5	0.1	
PWA 1484	5	10	5.6	2	6			3	8.7	0.1	
TMS-82+	4.9	7.8	5.3	1.9	8.7	0.5		2.4	6	0.1	
René N6	4.2	12.5	5.8	1.4	6			5.4	7.2	0.15	
TMS-75	3	12	6	2	6			5	6	0.1	
CMSX-10	2	3	5.7	0.4	8	0.2	0.1	5.4	7.2	0.15	
TMS-138	3.2	5.8	5.9	2.8	5.9			5.0	5.6	0.1	2.0Ru

[a]*Balance Ni*

TABLE A2 Wrought Austenitic High-Temperature Alloy Compositions[a] (wt%)

Alloy	Ni	Cr	Al	Ti	C[b]	Si[b]	Mn[b]	Other
304 Stainless	8–10.5	18–20			0.08	1	2	
310 Stainless	19–22	24–26			0.04	1.5	2	
253 MA	11	21			0.09	1.7	0.6	0.16N, 0.04Ce, 0.24Mo
353 MA	35	26			0.05	1.5	1.7	0.13N, 0.05Ce
330 Stainless	34–37	17–20			0.08	0.75–1.5	2	
DS	34–37	15–18	0.15	0.15	0.15	1.5–2.5		
AC66	32	27	1.5			0.2	0.5	0.07Ce, 0.8Nb
800	30–35	19–23	0.15–0.6	0.15–0.6	0.1	1	1.5	0.8Cu
801	30–34	19–22		0.75–1.5	0.1	1	1.5	
HR120	37	25	0.1		0.05	0.6	0.7	≤3Co, 2.5Mo, 2.5W, 0.7Nb, 0.2N
45TM	47	27			0.08	2.7		
HR160	37	28		0.5	0.05	2.75	0.05	1Mo, 1W, 1Nb
HR235	57	31	0.3	0.3		0.4	0.5	3.8Cu, 5.6Mo, 1.1Co
601	58–63	21–25	1–1.7		0.1	0.5	1	
602CA	60–66	24–26	1.8–2.4	0.1–0.2	0.25			0.05–0.12Y, 0.01–0.1Zr
617	52	22	1.2	0.3	0.07	0.5	0.5	12.5Co, 9Mo
625	61	21	0.4	0.17	0.02	0.1	0.1	9Mo, 3.4(Nb + Ta), 0.3Co
690	61	27	0.2	0.24	0.02	0.1	0.2	
693	61	29	3.2	0.38	0.01	0.1	0.1	0.45Nb
709	25	20				0.5	1	1.5Mo, 0.2Nb, 0.16N
214	75	16	4.5		0.05	0.2	0.5	0.1Zr, 0.01Y
Nichrome	80	20						

[a] *Balance Fe*
[b] *Maximum*

TABLE A3 Ferritic Alumina-Forming Alloy Compositions[a] (wt%)

Alloy	Cr	Si	Mn	Al	C	Other
Kanthal A	20.5–23.5	0.7	0.5	5.3	0.08	
Kanthal AF	21			5.1		0.08Ti, 0.06Zr
Kawasaki R20	20	0.2		5.5	0.01	0.06La
MA 956[b]	20			4.5	0.01	0.5Ti, 0.5Y_2O_3
PM2000[b]	19			5.8	0.01	0.5Ti, 0.5 Y_2O_3
JA13	16	0.3	0.1	5.0	0.03	0.3Y

[a]*Balance Fe*
[b]*Mechanically alloyed*

TABLE A4 Oxide Dispersion-Strengthened Inconel Compositions[a] (wt%)

Alloy	Cr	Al	Ti	C	Y_2O_3	Mo	W	Other
MA 754	20	0.3	0.5	0.05	0.6			1Fe
MA 758	30	0.3	0.5	0.05	0.6			1Fe
MA 6000	15	4.5	2.5	0.05	1.1	2	4	2Ta
MA 760	20	6.0		0.05	0.95	2	3.5	

[a]*Balance Ni*