SILICON

High Temperature Degradation Mechanisms Summary Table

Operation Condition	Typical failure mode	Behaviour	Alloy Characteristic	Common Mistakes	Typical Alloys
Creep (≥550°C)	Deformation, cracking, rupture	Creep rate, grain size	High melting point, solid solution or precipitation strengthening, large grains, high Ni	Ignoring creep below very high temps (<1000°C)	304H, 321H, 253MA, 310S, 800H/HT, HR-120
Oxidation	Metal loss, spalling	Oxide stability and adherence	High Cr, Si, Al, rare earths, high Ni	Using low Cr in cyclic oxidation	EN1.4828, 309S, 310S, 253MA, 314, 330, 800H, 601, 602CA
Sulphidation	Rapid loss, low-melting sulphides	Sulphide melting behaviour	High Cr, Co alloys, Si/Al, Mn sacrificial	Using high Ni in H2S/reducing env	253MA, HR-160, HR-120, 330,DS
Halogen corrosion	Volatilisation, penetration	Oxide stability, avoidance of volatile halides	High Ni	Using Mo,Ti,Nb alloys	600, 625, 601, 602CA, RA333
Dew point corrosion	Acid attack, SCC	Surface temp above dew point	Insulation, coatings	Allowing cold spots	304H, 321H, 309S, 310S
Coking	Carbon deposits	Catalytic behaviour	Low Mo/W/Nb	Assuming alloy is main cause	Process-related
Carburisation	Carbides, embrittlement	Affinity for Carbon	High Ni, Si, Cr/Al/Si oxides	Using low Ni Alloys	330, DS, 800H/HT, 600, 601, 602CA, RA333
Metal dusting	Surface disintegration	Protective oxide retention	High Ni, high Si/Al	Using 300 series	RA333, 602CA, 601, 800H/HT
Hydrogen attack	Decarb, cracking	Carbide stability	Cr, Al, Si; stable carbides	Assuming austenitics immune	800H/HT, 253MA, high Ni
Nitrogen pick-up	Nitrides, embrittlement	Solubility, alloy balance	High Ni, Cr/Si/Al oxides	Using high Si in nitridin	High Ni alloys
475C embrittlement	Ductility loss	Ferrite content	Fully austenitic	Using duplex/ferritic	All austenitic
Sensitisation	IGC	Carbon, carbide stabilisers	Low C; Ti/Nb stabilisers	Slow cooling	321H, 347, 316Ti, low-C300
Sigma formation	Embrittlement, corrosion loss	Cr, Si, Mo, ferrite	High Ni; lower Cr/Si	Using high Cr/Si in sigma range	330, DS, 800H/HT, 600, 601, 602CA, RA333