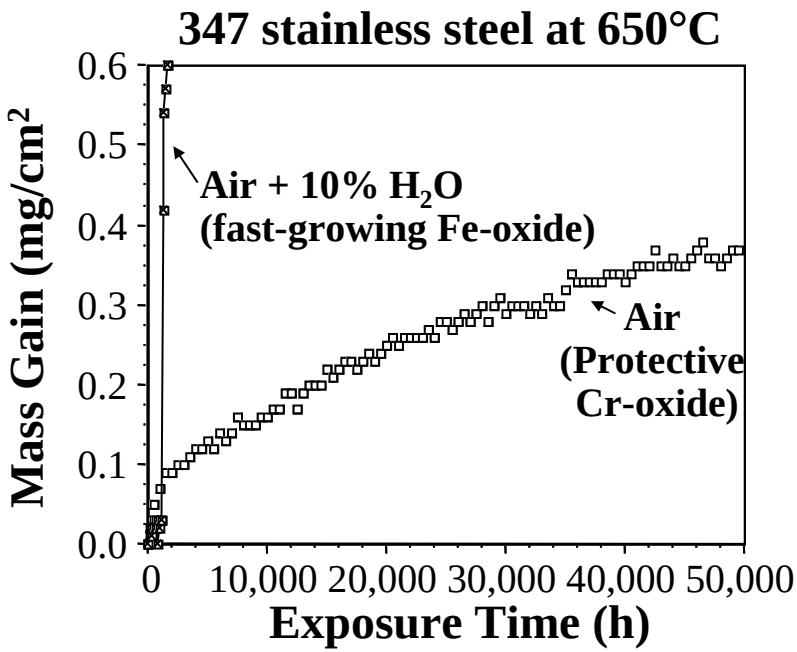
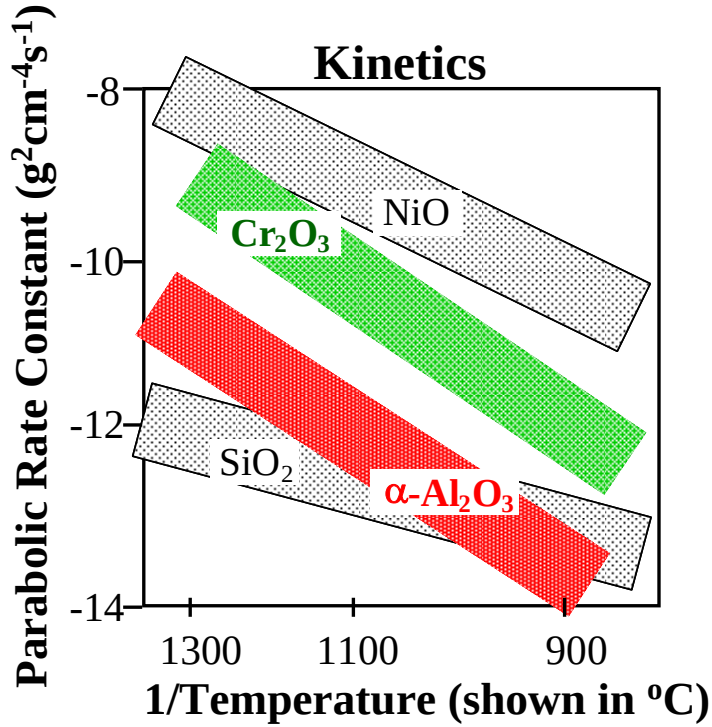
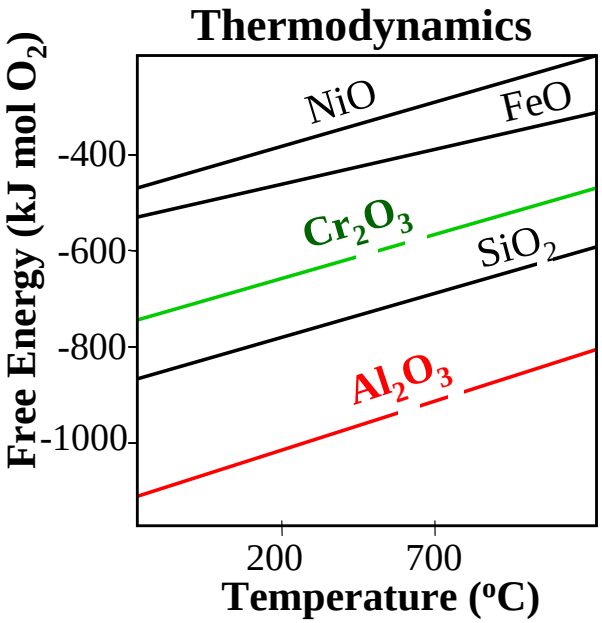
Better High-Temperature Stainless Steels Needed



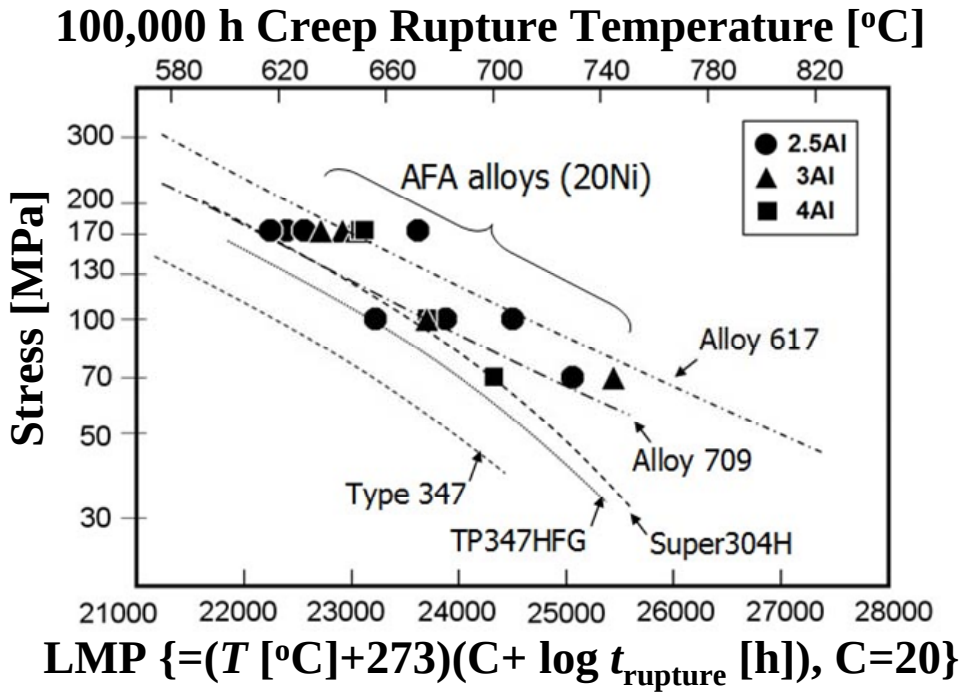


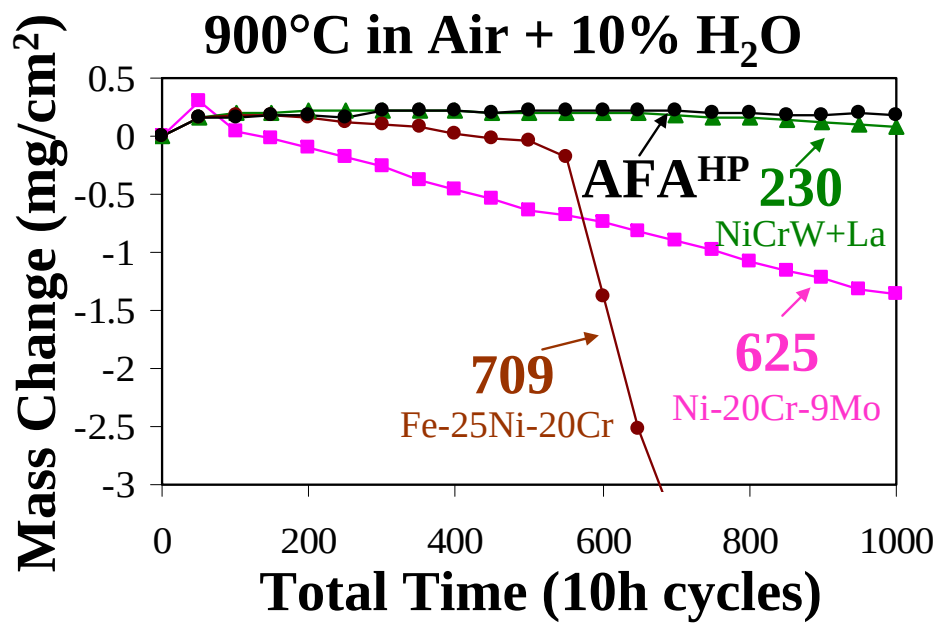


Key issues are Creep and Corrosion

- Significant gains in recent years for improved creep resistance via nano carbide/nitride
- Cr-oxide used for corrosion resistance can be compromised by H_2O, C, or S species
- Al-oxide offers better corrosion resistance but additions of Al degrade creep resistance

Alumina-Forming Austenitic (AFA) Alloy Family





AFA Alloy Grades

AFA^{HP}: Fe-(25-30)Ni-(14-15)Cr-(3.5-4.5)Al-(1-3)Nb + Hf/Y ~850-900°C Al_2O_3 limit

AFA: Fe-(20-25)Ni-(14-15)Cr-(2.5-3.5)Al-(1-3)Nb base ~750-800°C Al_2O_3 limit

AFA^{LN}: Fe-12Ni-14Cr-2.5Al-0.6Nb ~650°C Al_2O_3 limit

- **Superior corrosion resistance without loss of creep resistance**
- **Properties approaching Ni-base alloys at stainless steel cost**
- **Key is Nb: promotes Al_2O_3 and strengthens via nano NbC**

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