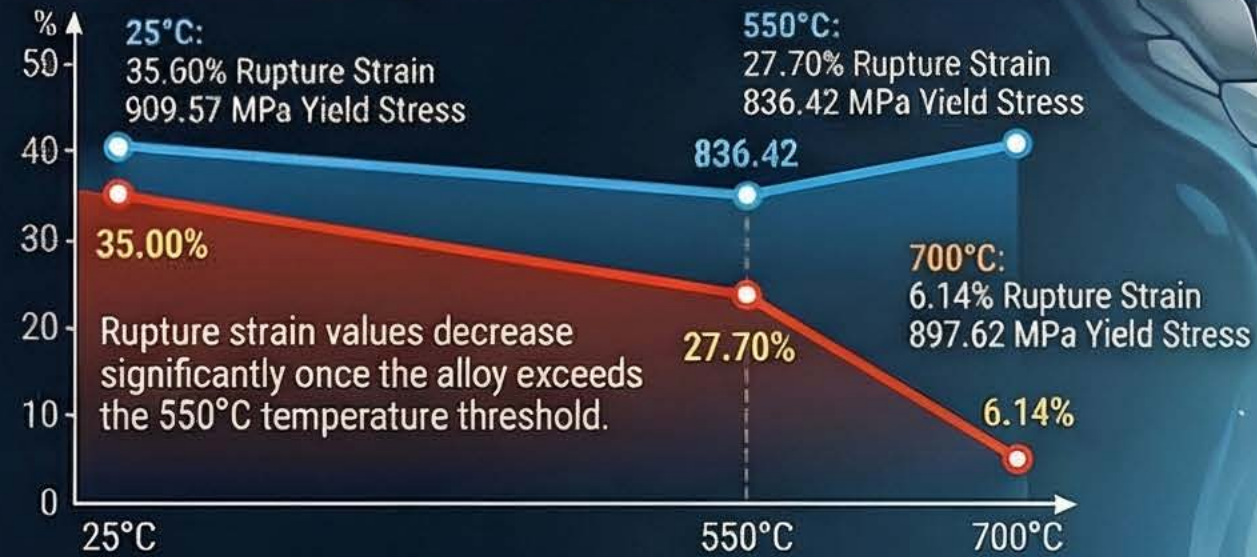


Thermal Degradation and Fracture in E1698-VD Nickel Alloy

Impact of elevated temperatures on the strength, plasticity, and fracture mechanisms of a heat-resistant nickel-based alloy used in gas turbine engines.

Thermal Properties & Deformation

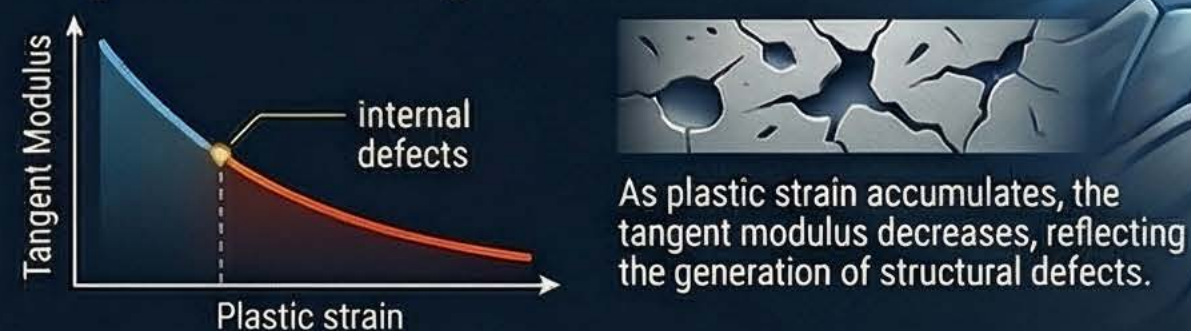
Sharp Plasticity Loss Above 550°C



The Serrated Flow (PLC) Effect



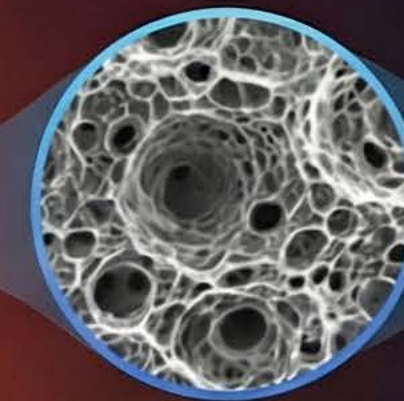
Logarithmic Tangent Modulus Decline



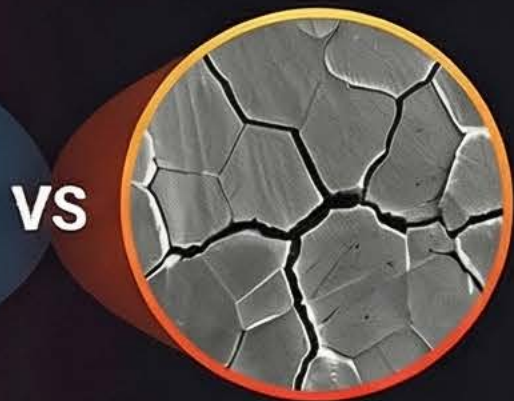
Fracture Mechanisms & Root Causes

Shift from Ductile to Brittle Fracture

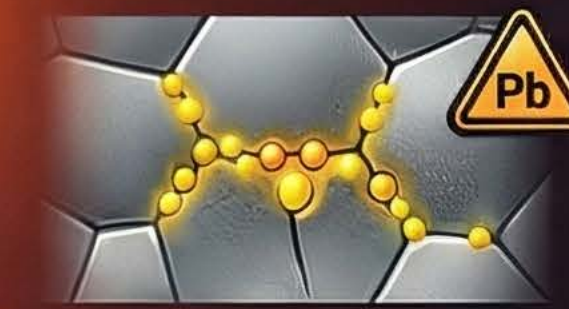
Failure transitions from ductile pore coalescence to brittle intergranular cracking at higher temperatures.



Lower Temps (<550°C)
Ductile Pore Coalescence



Higher Temps (>550°C)
Brittle Intergranular Cracking



Critical Lead (Pb) Contamination

Lead levels 90 times the acceptable limit promote premature cracking and reduce strength.



Surface-Initiated Crack Growth

At 650°C-700°C, fracture initiates from surface defects rather than internal voids.