WOODWORTH HEAT TREATING

Nanowear™

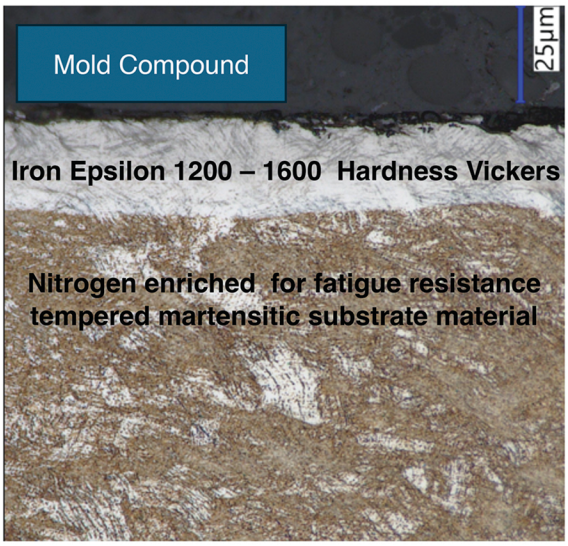
Introduction:

A great deal of time and dollars have been spent to mitigate fatigue cracking on hydrofracturing operations. Historically, specialty alloys have been utilized but the latest industry trends are utilizing precipitation hardening 'stainless' steel. This article covers 15-5 stainless steel which is categorized as a martensitic stainless steel. Oftentimes the material is age hardened from 482° to 621° C to achieve desired mechanical properties; Age hardening results in the following mechanical properties. Please see chart below

Nanowear™ is Woodworth's proprietary thermal-chemical diffusion process for stainless steels. The process is base material dependent and low temperature and alters the material on a molecular level, creating an inert Iron Epsilon layer, 10—50 microns thick with an empirical hardness up to 1600 HK. It is also nitrogen enrich diffused to a depth up to 500 microns, nitrogen imparts fatigue resistance. The process enhances durability and wear resistance without sacrificing corrosion resistance. Note: the process can be applied to all ferrous and stainless steel materials.

Mechanical properties

Age Condition in Fahrenheit	Ultimate Tensile Strength (KSI)	Yield Strength (KSI)	Elongation %	Reduction in Area	Rockwell C
H900	190	170	6	15	C40
H1025	155	125	8	27	C35
H1075	145	125	9		C32
H1150	135	105	12	30	C28



15-5 Martensitic Stainless Steel – 500 X

Common Failures in Fluid Ends

- Fatigue Cracking
- Corrosion on Surface
- Decreasing Endurance