Evaluating the Microstructure of Your Sucker Rods for Fatigue Resistance
Exceeding API in granularity
I can already tell you that grain size and heat treatment processes are definitely some of the biggest variables to combat SCC. The three conditions for Stress Corrosion Cracking are:

1. Susceptible Material
2. Corrosive Environment
3. Residual Stress

Changing the susceptibility of the material through the microstructure will certainly eliminate SCC.

-A.L, PHD
At CTO, G2MT, LLC and G2MT Laboratories, LLC
Sucker Rod Microstructural Analysis

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Exceeding API in granularity

As-Received Sucker Rods

All rods shown pulled randomly from Permian, Eagle Ford & Bakken.

All samples chemically-etched in the same solution, resulting in red-tint.
As-Received Sucker Rods
Microstructures of As-Received Sucker Rods at 1000X

A. 4138 Normalized and Tempered

B. 4138 Normalized and Tempered

C. 4320 Normalized and Tempered

D. 3130 Quench and Tempered (??)

E. 4138 Normalized and Tempered

F. 4720 Normalized and Tempered
Fine Tempered Martensitic Microstructures
D Grade Microstructure Comparison

AISI 3130 EKD-Strength Q&T

Fine tempered martensite

25 µm

AISI 4320 KD-Strength N&T

Bands of ferrite/pearlite with martensite

25 µm
EKD vs. the field

AISI 3130 EKD

AISI 4320 N&T

AISI 4720 N&T

25 μm

25 μm

25 μm

25 μm
EHK vs. the field

3130 Quenched & Tempered

4138 Normalized & Tempered Rods
Why the industry is changing from N&T to Q&T:

- Q&T steels have better resistance to stress corrosion cracking than N&T steels\(^1\)

- N&T steels are less homogeneous with larger grain size than Q&T steels.

In all steels, grain boundaries, precipitates and dislocations act as hydrogen traps, affecting the hydrogen embrittlement susceptibility of materials.

- Q&T steels are more effective at providing hydrogen traps that reduce hydrogen embrittlement susceptibility.

- Decreasing the grain size with the Q&T steels increases the density of hydrogen traps, reduces harmful impurity segregation, and improves materials performance in hydrogen.
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