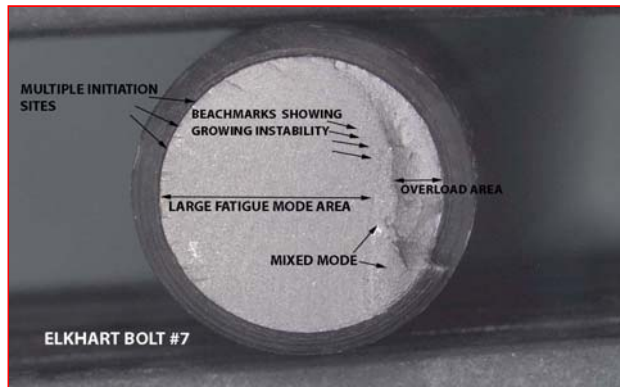


METALLURGICAL LABORATORY

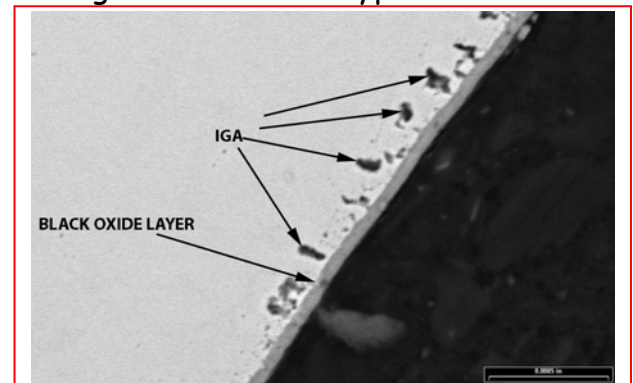
FAILURE ANALYSIS CASE STUDY

Description	Analysis of metallurgical and mechanical bolt failure mechanisms
Problem	Premature failure of end cap bolts resulting in excessive down time.
Analysis	IGA and laps were present on all surfaces. The IGA from improper heat treatment, not the laps, coupled with cyclic axial loading that resulted in multiple crack initiation sites propagated until overload failure occurred.
Resolution & Recommendations	Purchase high quality manufactured bolts with fatigue resistant design features. Both IGA control and additional/larger bolts need to be implemented to achieve desired fatigue life.

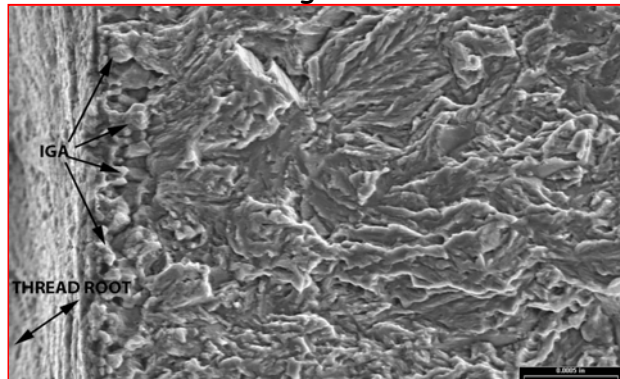
Fracture surface overview



Intergranular Attack-type corrosion



SEM section showing IGA at thread root



SEM fracture surface showing IGA.

