

MSi Testing & Engineering, Inc.

Your Source for Metallurgical Testing and Failure Analysis

1390 N. 25th Avenue
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“A small surface indication exposed by a machining operation was not a material defect as determined by failure analysis service performed by MSi Testing & engineering.”

Key word – Failure Analysis Service

Secondary key words – failure analysis testing, metal test lab

MSi Investigative Summary

BACKGROUND

One (1) cold drawn and machined part exhibiting a linear defect indication on the machined ID surface was submitted to our laboratory for a metallurgical failure analysis service investigation. We were requested to determine the source cause of the ID surface defect indication. The material identification is shown in the table below.

SAMPLE IDENTIFICATION

Part Description	Heat No.	HR Size	CD Size	Grade
Machined Part	██████████	██████████" RD	██████████" RD	C-1215

PERFORMED TESTING

Scanning Electron Microscopy (SEM) Examination
Metallographic (Microstructure) Examination
Chemical Analysis

CONCLUSIONS

1. Based upon the performed examinations, it is our opinion the ID surface of the part, as identified by the failure analysis testing, contained a faint, intermittent, tool mark that was induced during the machining operation.
2. No evidence was observed of a pre-existing internal steel defect or inclusion stringer on the ID surface that could have caused the defect indication.
3. The microstructure as determined by the metal test lab was typical of AISI 1215 steel.

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TESTING CERT #0510-01

4. The chemical composition was typical of AISI 1215 steel.

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SUMMARY of TEST RESULTS

Scanning Electron Microscopy Examination

1. SEM examination of the ID surface revealed a faint, intermittent, linear surface defect indication along the .234" diameter ID surface. (See arrows in Photos 1 - 2).
2. Examination at higher magnification showed evidence of disturbed metal, most likely from the machining tool (see Photos 3 - 4). No evidence was observed of a pre-existing internal steel defect or inclusion stringer on the ID surface.

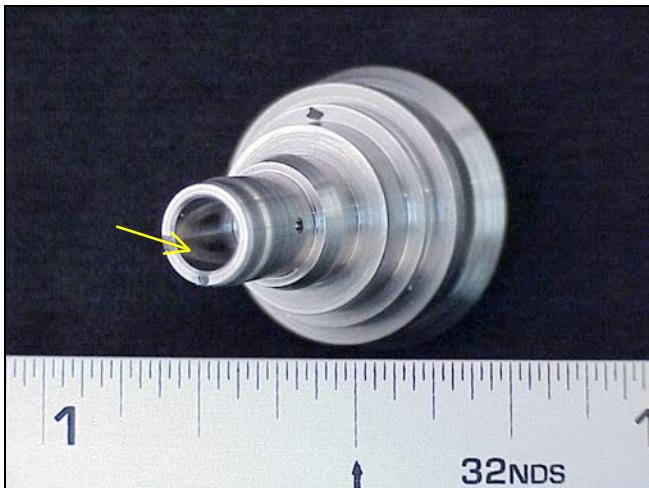


Photo 1: Submitted part with surface defect indication on the ID surface, denoted by the yellow arrow. 1.5X

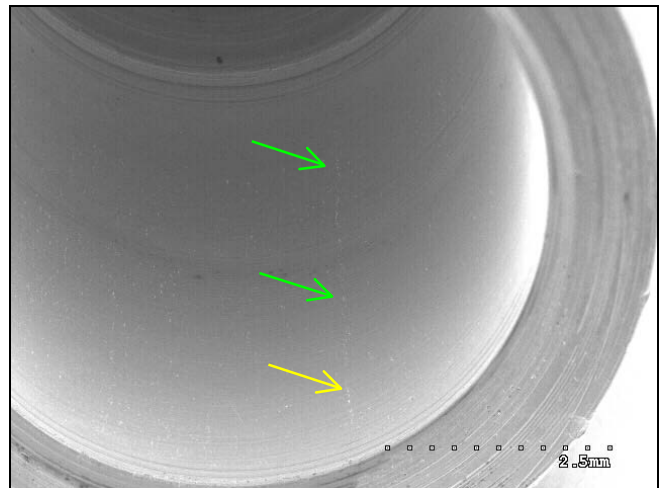


Photo 2: SEM image showing the faint linear defect indication on the machined ID surface. 10X

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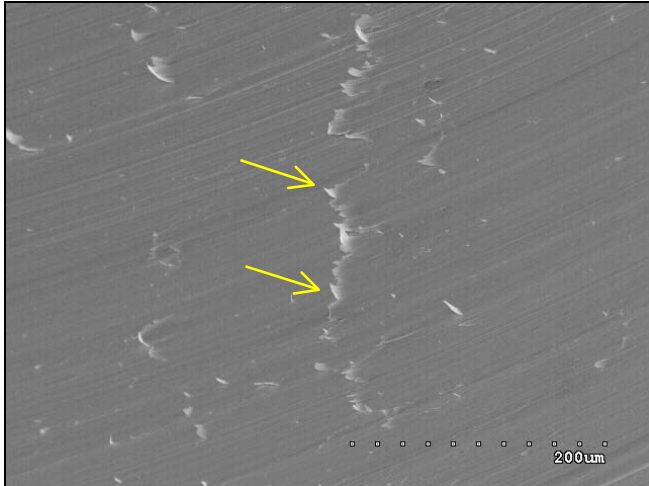


Photo 3: Close-up view of linear defect indication denoted by the yellow arrow in Photo 2. 165X

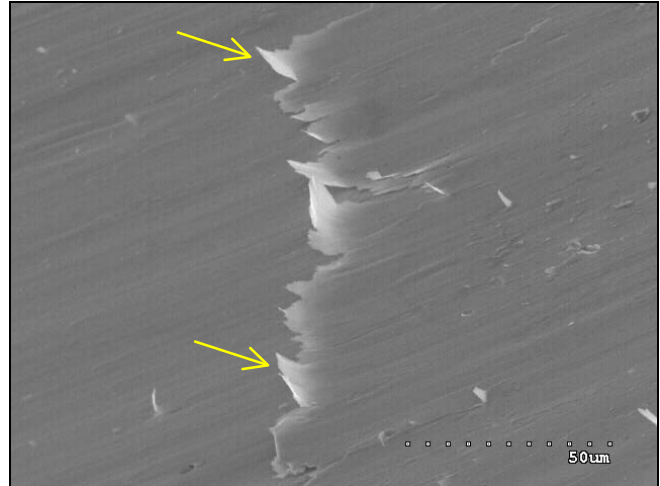


Photo 4: Higher magnification view of Photo 3 showing a tool mark from the machining operation. 1350X

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Metallographic Examination

1. A transverse section removed from the region containing the ID surface defect indication confirmed the presence of a tool mark that was induced during the machining operation. (See arrow in Photos 5 - 6)
2. No evidence was observed of an abnormal inclusion content or any other detrimental internal conditions that could have caused the defect indication.
3. The microstructure consisted of pearlite and grain boundary cementite in a matrix of ferrite, typical of AISI 1215 steel.

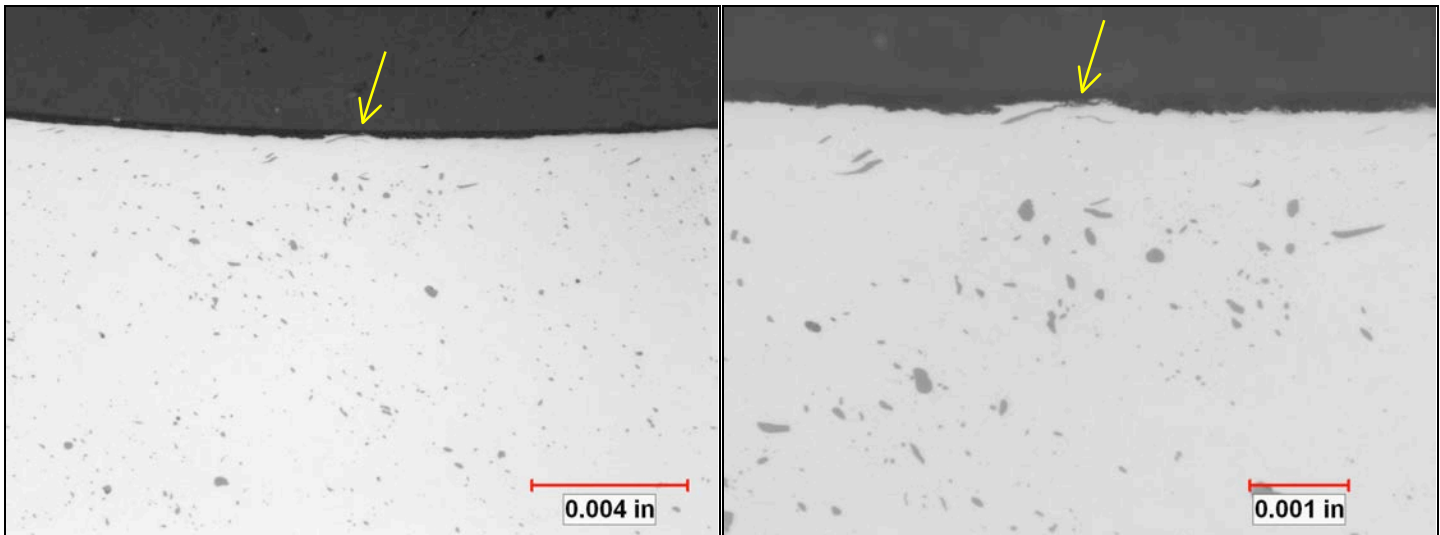


Photo 5: Mag: 200X; Etchant: None
Cross-sectional view of stress crack initiating from .037" deep seam (at arrow).

Photo 6: Mag: 500X; Etchant: None
High magnification view of seam profile showing decarburization and dispersed oxides.

Chemical Testing

1. Chemical testing revealed the sample classified as AISI 1215 steel.
2. The results are shown in Table 1 attached.

Respectfully Submitted,
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Table 1 – Chemical Testing*

Element	Results
Carbon	.06 %
Manganese	.96
Phosphorus	.05
Sulfur	.31
Silicon	.02
Nickel	.03
Chromium	.03
Molybdenum	.01
Copper	.06

* Testing performed in accordance with ASTM E415.