

BETA LAB NO.M10198- CS4-02	TESORO REFINING AND MARKETING COMPANY ANACORTES REFINERY 10200 W. MARCH POINT ROAD T91WA4428 ANACORTES, WA 98221	CUSTOMER P.O. NO.: 4501667904
PART: 6600-E HEAT EXCHANGER CS4 PART 19 & 20		DATE: AUGUST 5, 2010
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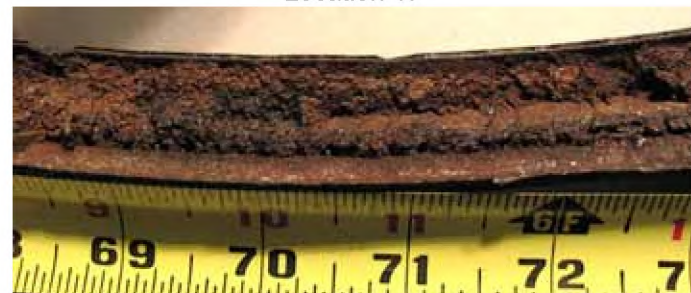
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Location 17



Location 18



Location 19



Location 20



Location 21



Location 22

FIGURE 6 Photos of the fracture along CS4 with the locations as shown in the upper left (ID on top)

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23 24 25 26



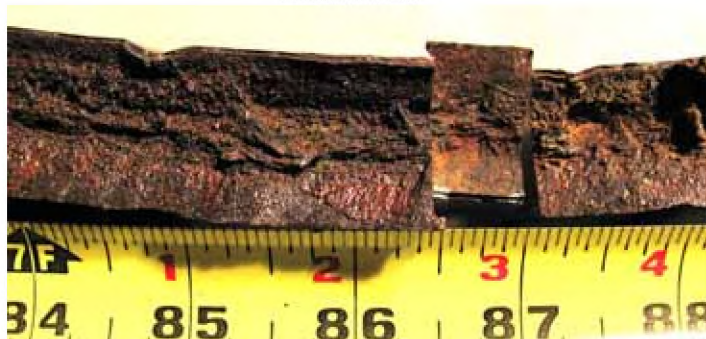
25 26 27 28



Location 23



Location 24



Location 25-notice the M4 cuts



Location 26-notice the M4 cuts



Location 27



Location 28

FIGURE 7 Photos of the fracture along CS4 with the locations as shown in the upper left (ID on top)

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Location 29



Location 30



Location 31



Location 32

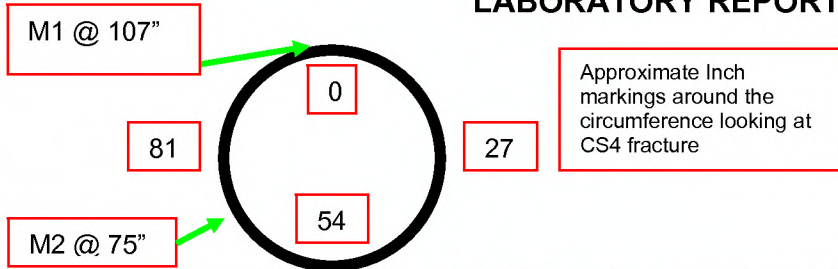


Location 33

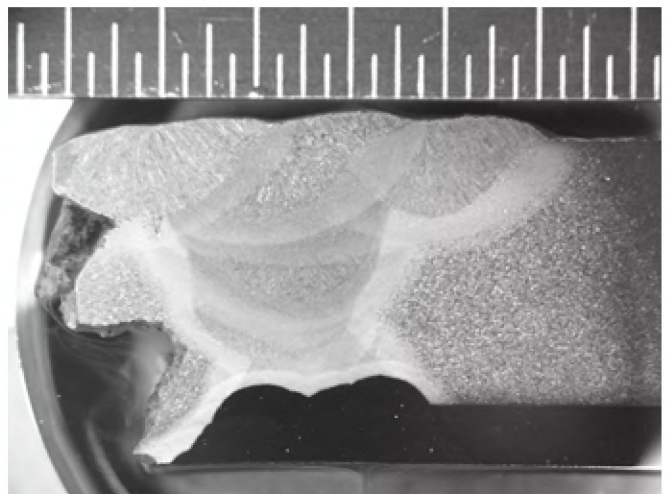
FIGURE 8 Photos of the fracture along CS4 with the locations as shown in the upper left (ID on top)

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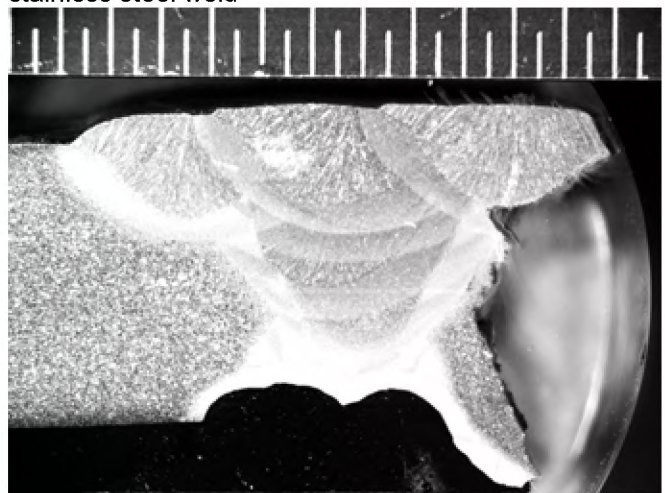
Looking at OD surface CS4 top and Can 4 at bottom



Mount M1 transverse through CS4 can 3 fracture on left and can 4 on right – ID on bottom- Black is clad or stainless steel weld



Looking at OD surface CS4 top and Can 4 at bottom

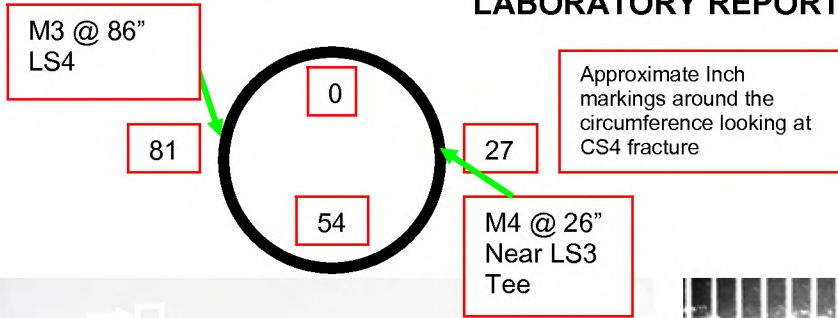


Mount M 2 transverse through CS4 can 4 on left and can 3 fracture on right- ID on bottom- Black is clad or stainless steel weld

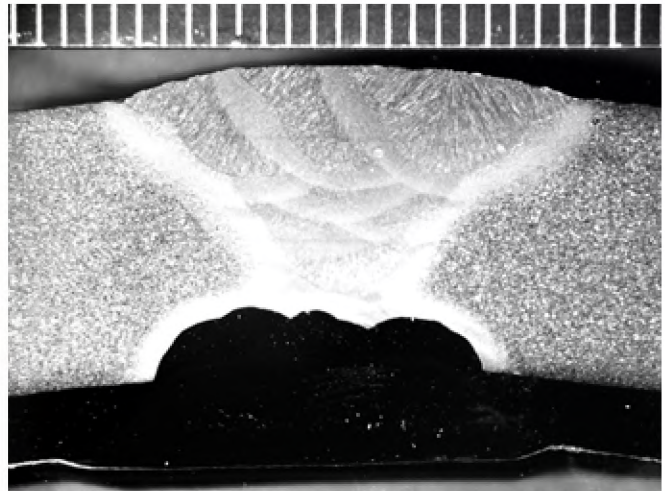
FIGURE 9 Mounts M1 and M2 transverse CS4 with ID on the bottom of each mount

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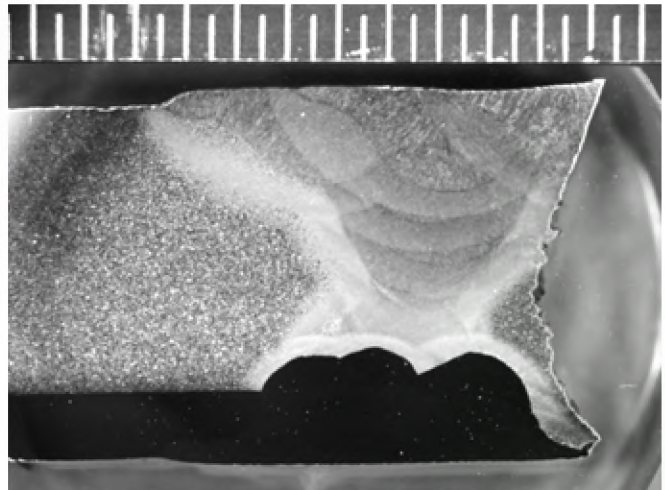
Looking at OD surface CS4 top with LS4 the vertical weld at the Tee into CS4



Mount M3 transverse through LS4 can 4 on both sides – ID on bottom- Black is clad and stainless steel weld



Looking at OD surface CS4 top at junction of LS3



Mount M4 transverse through CS4 can 3 fracture on right and can 4 on left – ID on bottom- Black is clad and stainless steel weld

FIGURE 10 Mounts M3 and M4 transverse to LS4 top and CS4 bottom- ID on the bottom of each mount

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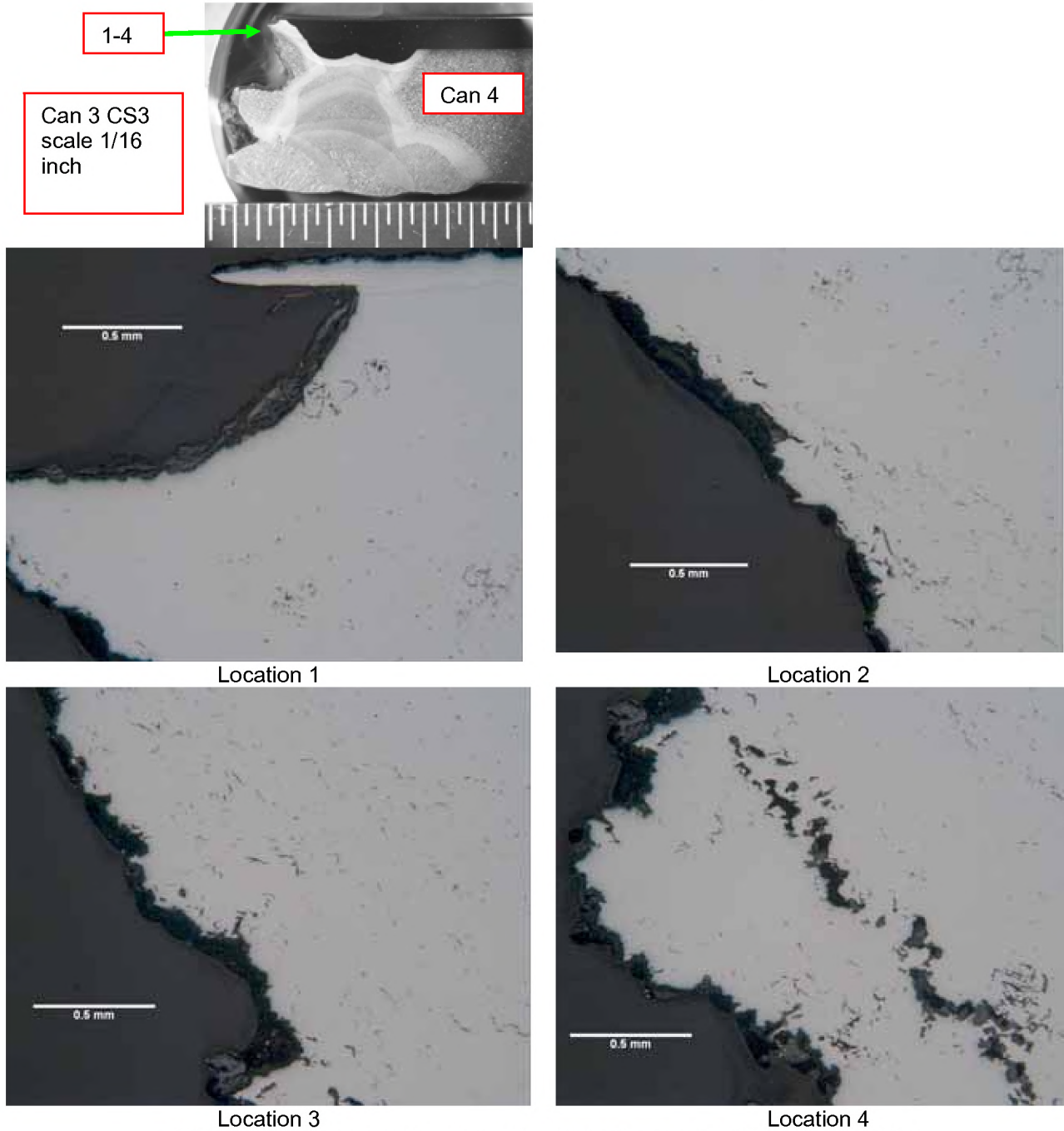


FIGURE 11 Un-etched fracture edge from ID towards OD for mount M1

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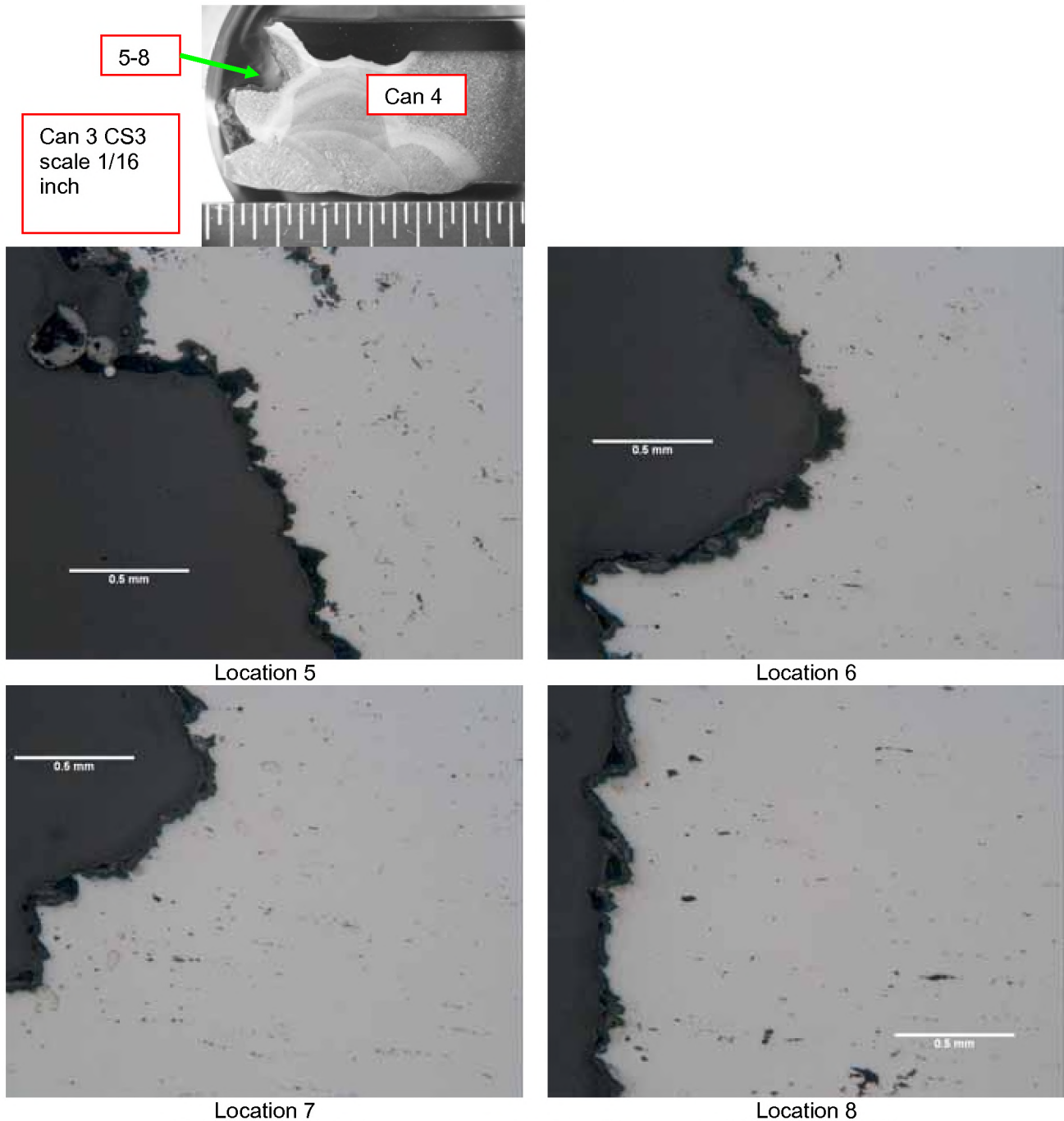


FIGURE 12 Un-etched fracture edge from ID towards OD for mount M1

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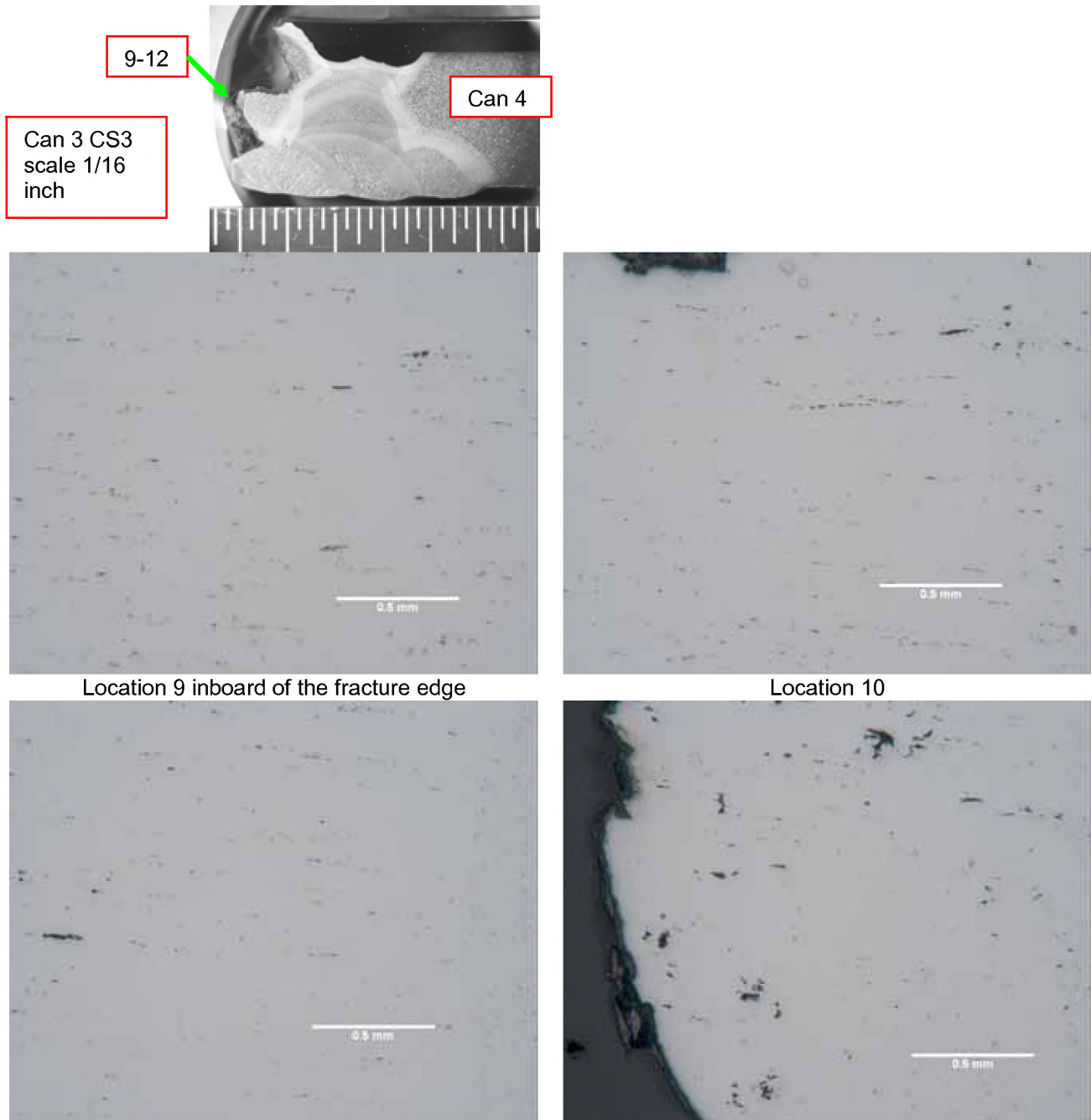
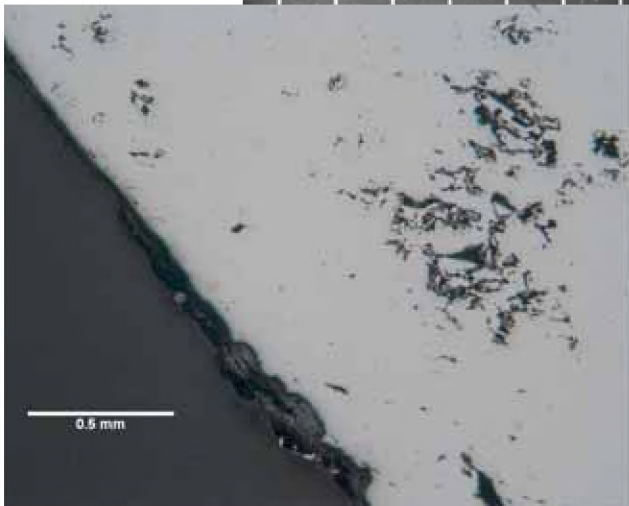
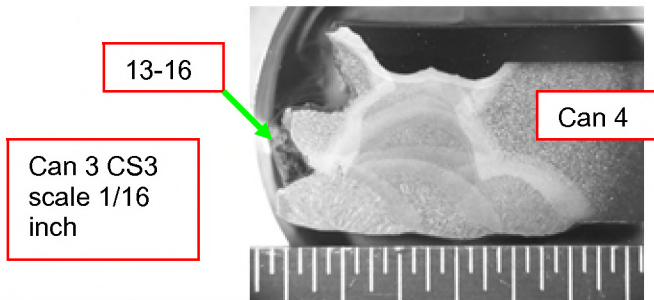


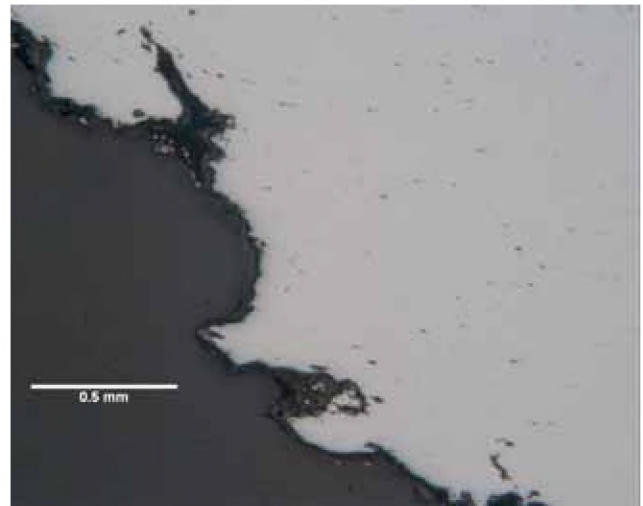
FIGURE 13 Un-etched fracture edge from ID towards OD for mount M1

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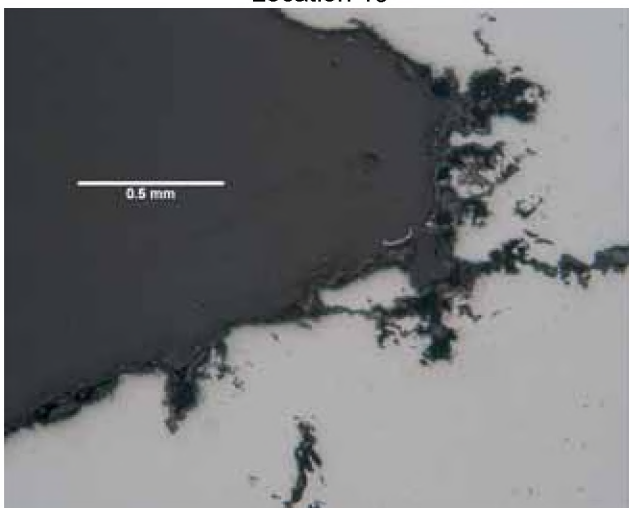
LABORATORY REPORT-CS4



Location 13



Location 14



Location 15

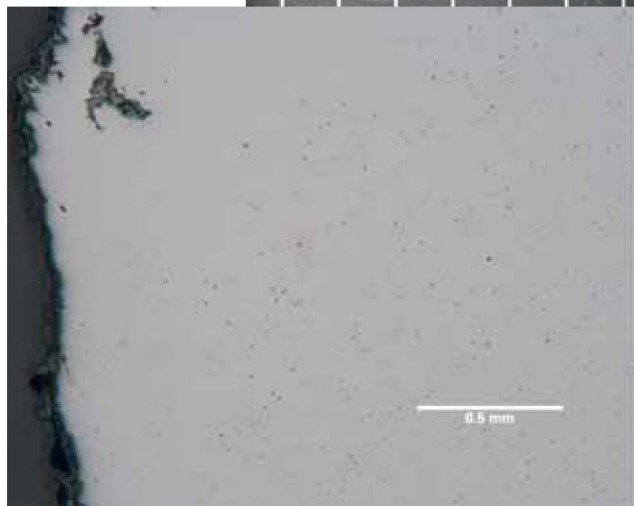
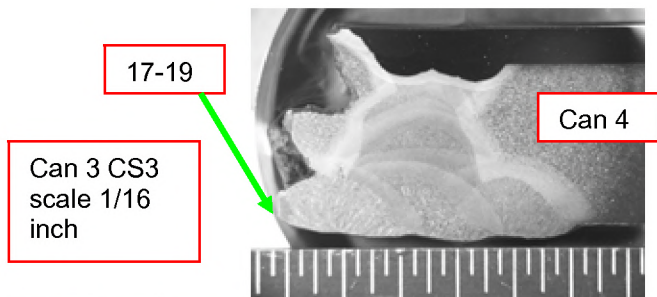


Location 16

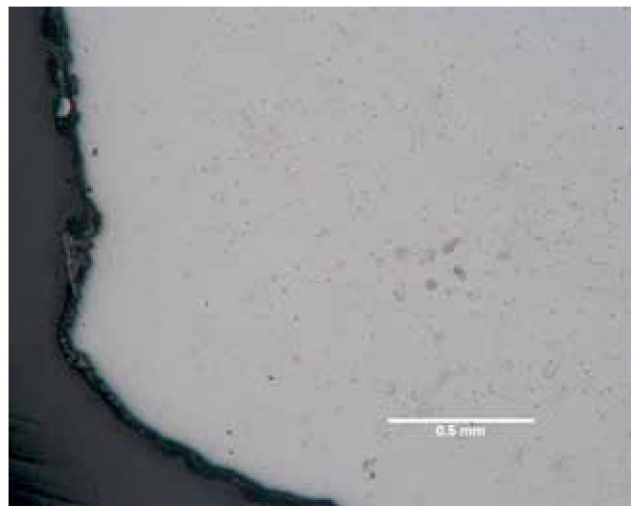
FIGURE 14 Un-etched fracture edge from ID towards OD for mount M1

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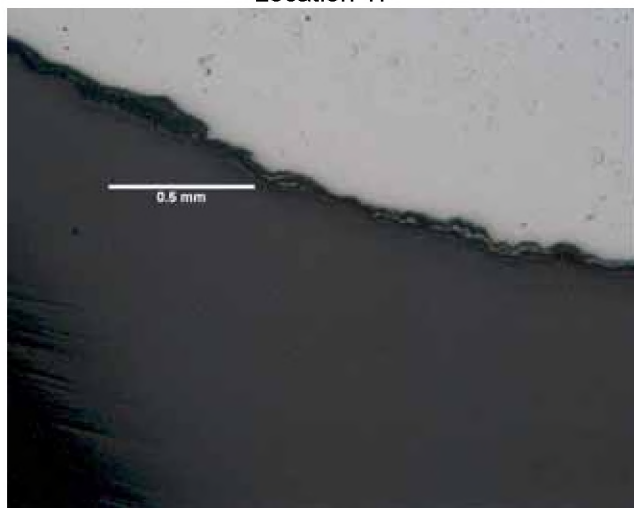
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Location 17



Location 18



Location 19

Location 20

FIGURE 15 Un-etched fracture edge from ID towards OD for mount M1

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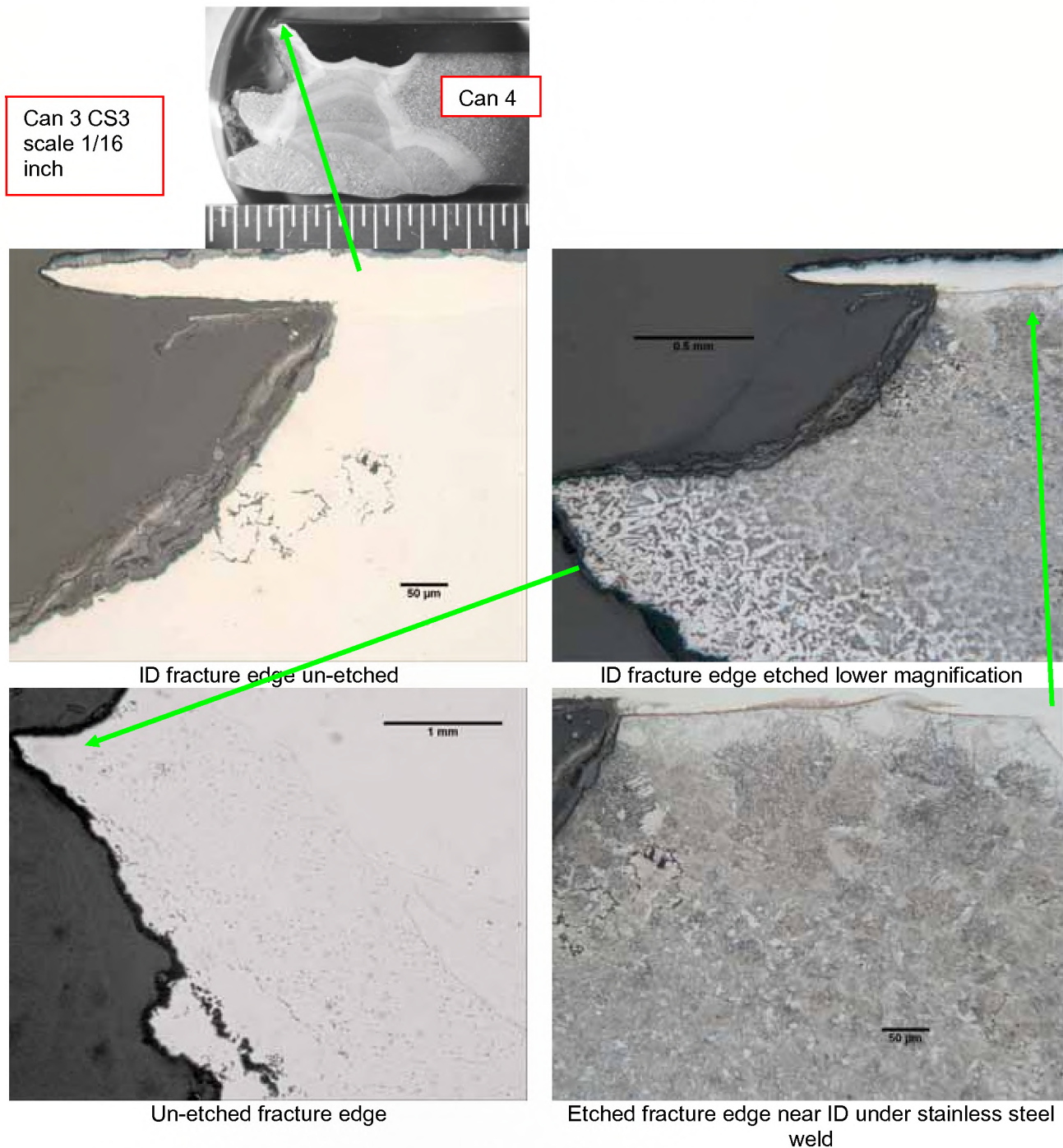


FIGURE 16 Un-etched and etched fracture edge near ID and under stainless steel weld for mount M1

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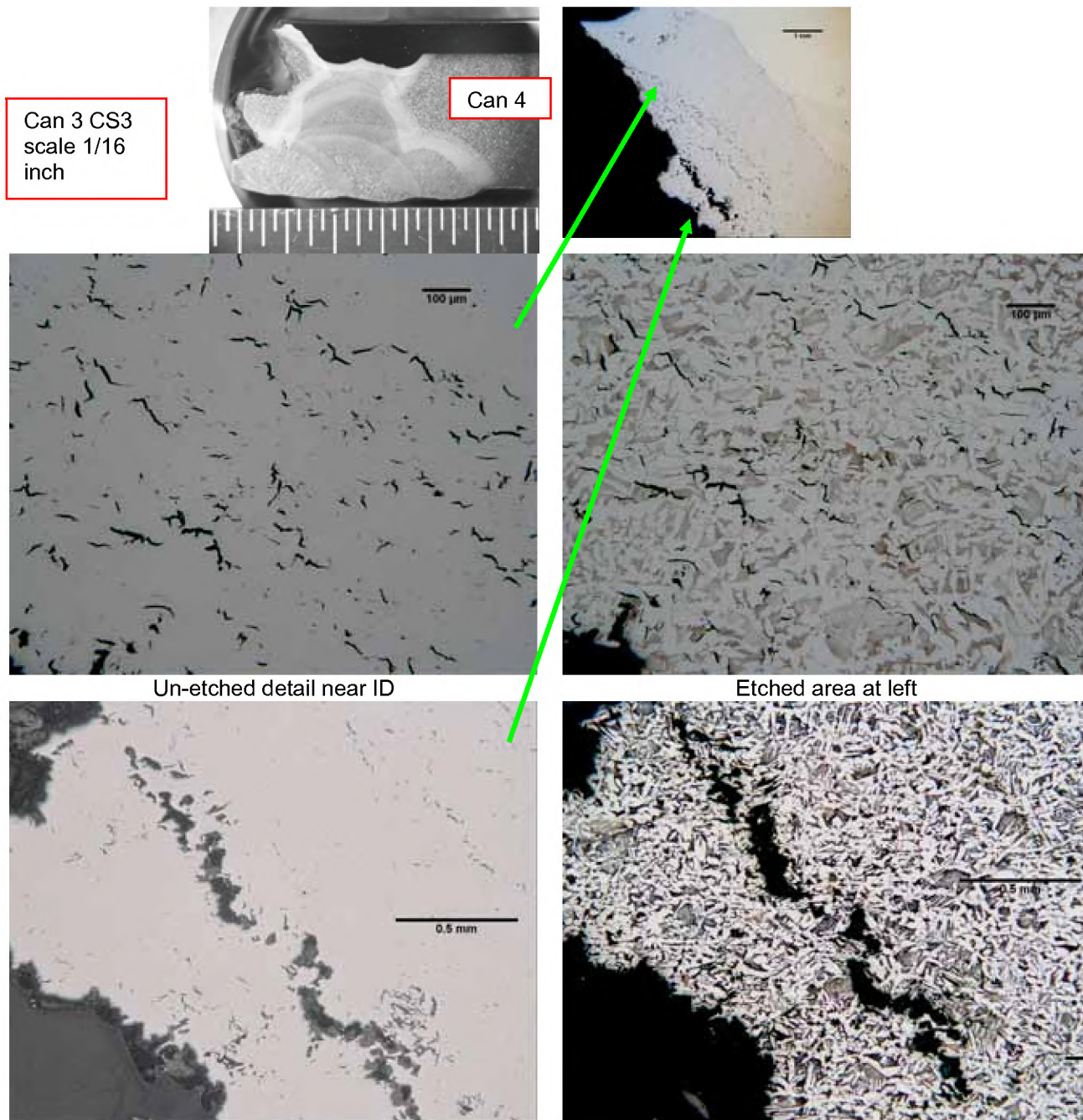
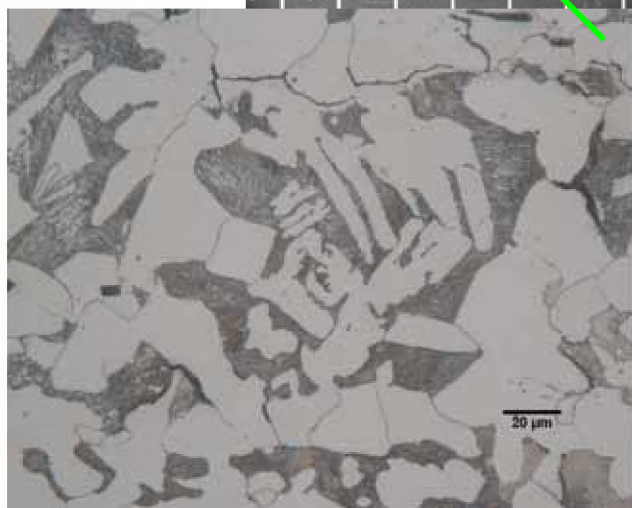
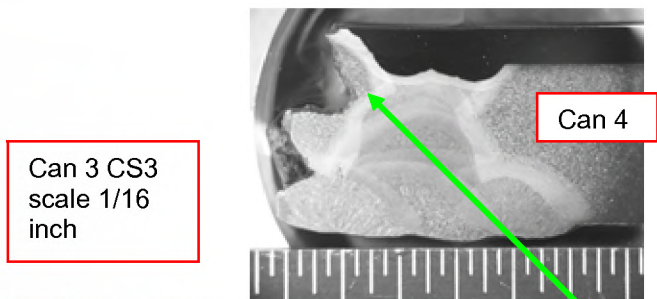


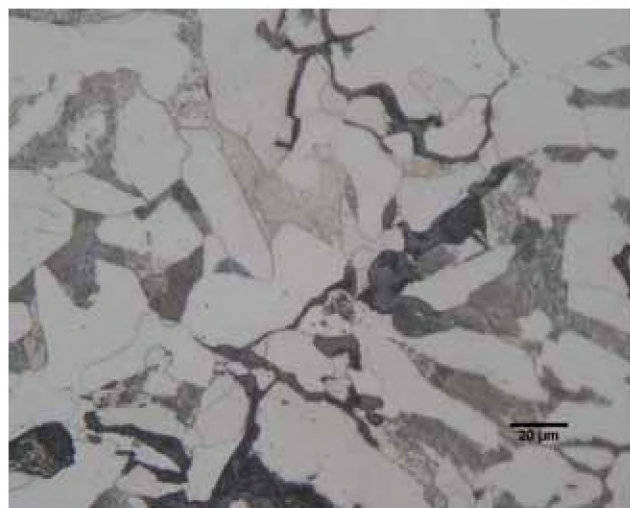
FIGURE 18 Un-etched and etched fracture edge proceeding along the fracture surface for mount M1

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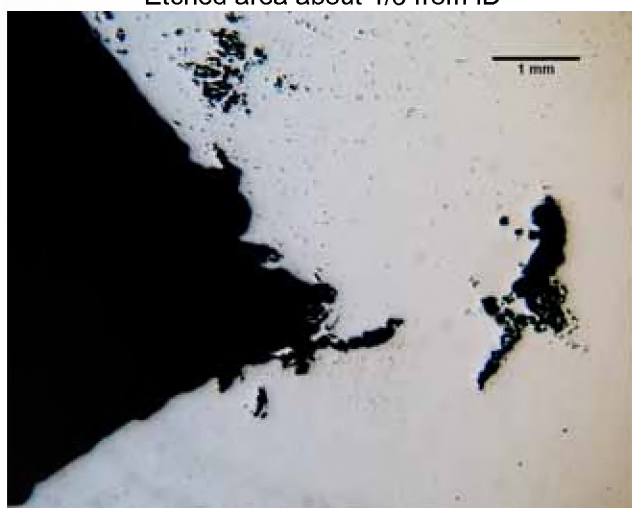
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Etched area about 1/3 from ID



Etched area about 1/3 from ID



Un-etched near OD fracture edge, under OD cap



Etched near OD fracture edge, under OD cap

FIGURE 19 Un-etched fracture edge from ID towards OD for mount M1