



Subject: Laboratory Report # OEM138-001.4
Submitter: Omar Al Taher, Johanson Dielectrics, Inc.
**Description: Tin Whisker Qualification by Temperature Cycle Stress,
Part #160S41W475KT4 PbSn**
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Problem:

Capacitors from four groups were evaluated for tin whisker growth as per iNEMI recommendations. The units were examined before and after temperature cycle stress. The units were temperature cycle stressed, -55C to 85C, 1000 cycles. The devices were inspected as per JEDEC standard JESD22A121.

Four reports detailing the tin whisker results will be issued. One report for each capacitor group. The capacitor group contained in this report is: **160S41W475KT4 lot #514-5389 PbSn**

Summary:

- Nine capacitors with a total of 18 terminations were scanned for the presence of whiskers pre- and post-temperature cycle stress. The capacitors were labeled '1' through '9'. The terminations on each capacitor were labeled 'left' and 'right'.
- These capacitors contained lead/tin solder on the terminations and were used as control samples for the three groups of capacitors with 100% tin terminations.
- No whiskers were observed before (pre) temperature cycle stress or after (post) temperature cycle stress on any of the 18 terminations.
- Representative images were made for each capacitor termination before (pre) and after (post) temperature cycle stress at magnifications of 250x and 2500x to show the general plating structure.
- The representative images include solder particles/flakes (fig. 3, 4, 34, 44), solder oxide (fig. 8, 16), and organic residue (fig. 22).

Conclusion:

All devices examined within the control capacitor group, **160S41W475KT4 lot #514-5389 PbSn** and subjected to temperature cycling stress as certified by Silicon Cert Ltd. meet the acceptance requirements for Class 2 devices as stipulated by iNEMI 'Tin Whisker Acceptance Test Requirements', July 28, 2004, paragraph 18.2.3.

160S41W475KT4 – pre Temp Cycle

Fig. 1

250x magnification

Sample 1 - left

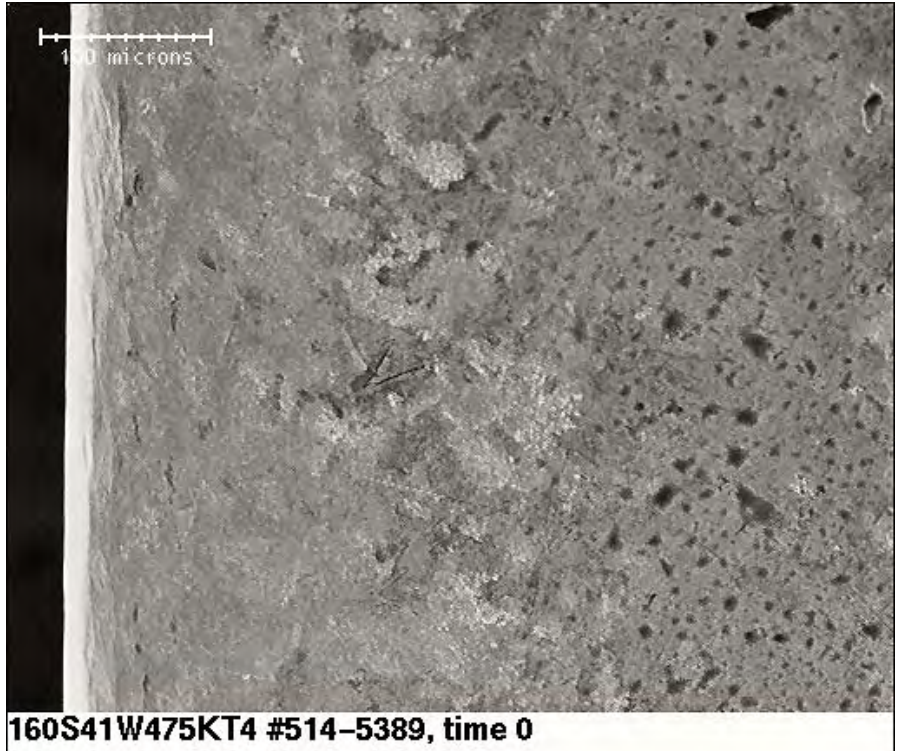


Fig. 2

2500x magnification

Sample 1 - left



160S41W475KT4 - 1000 cycles

Fig. 3

250x magnification

Sample 1 - left

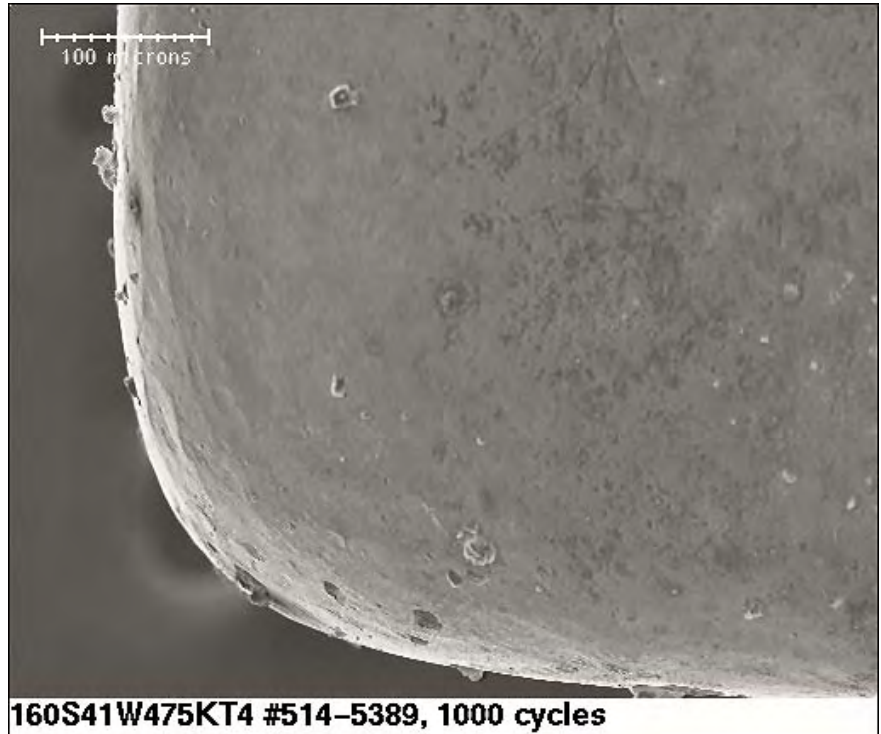
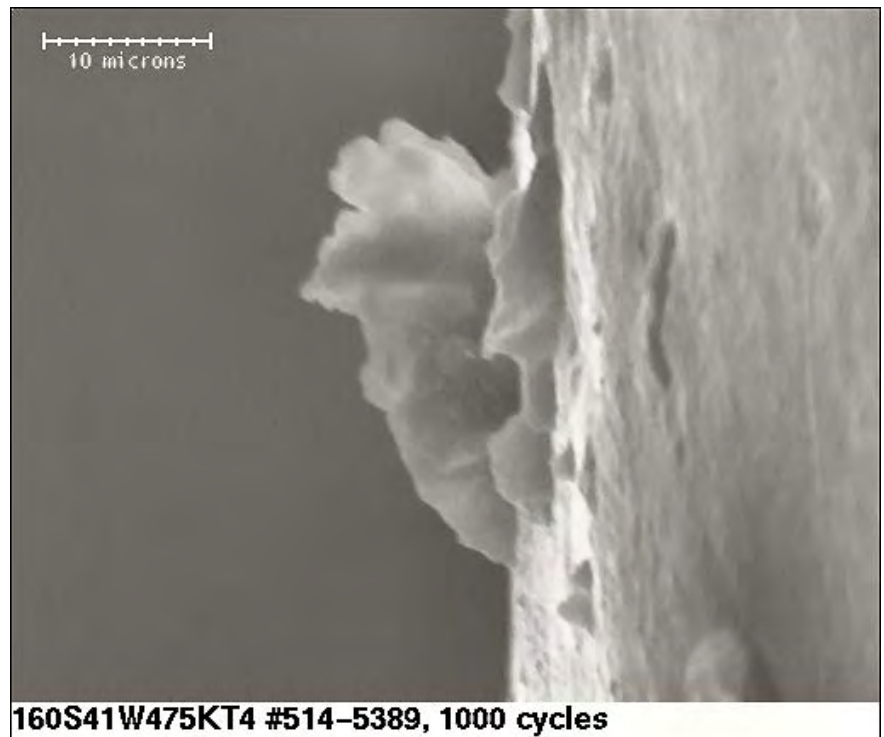


Fig. 4

2500x magnification

Sample 1 - left



160S41W475KT4 – pre Temp Cycle

Fig. 5

250x magnification

Sample 1 - right

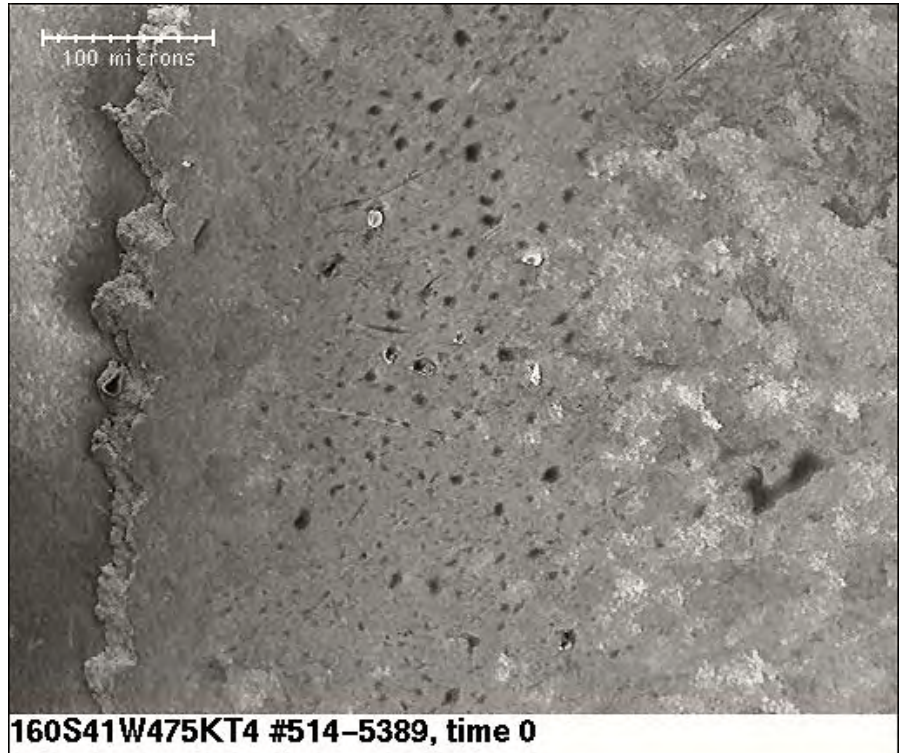


Fig. 6

2500x magnification

Sample 1 - right



160S41W475KT4 - 1000 cycles

Fig. 7

250x magnification

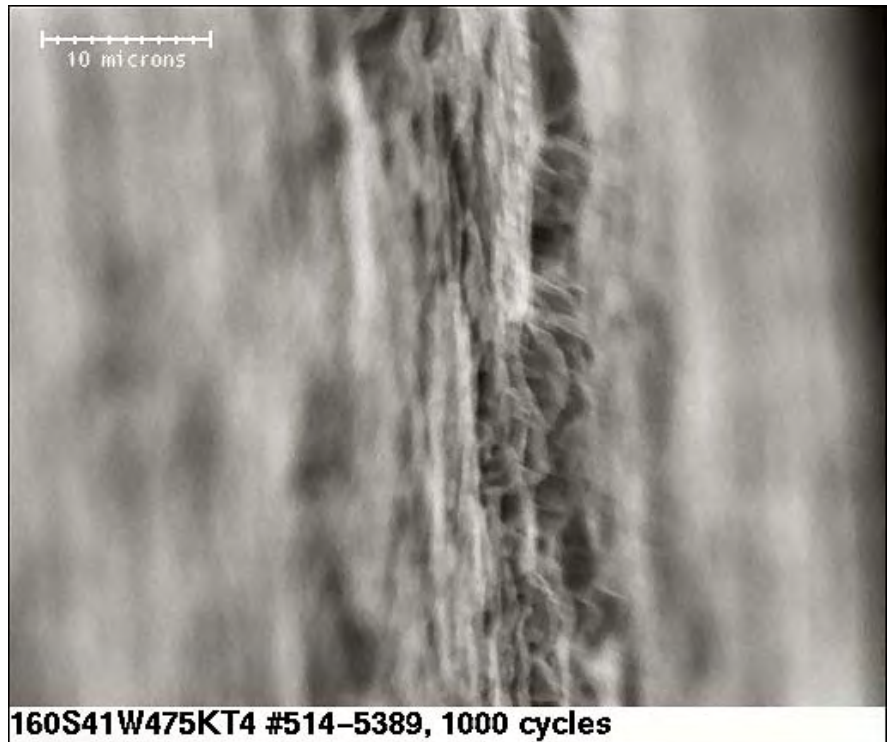
Sample 1 - right



Fig. 8

2500x magnification

Sample 1 - right



160S41W475KT4 – pre Temp Cycle

Fig. 9

250x magnification

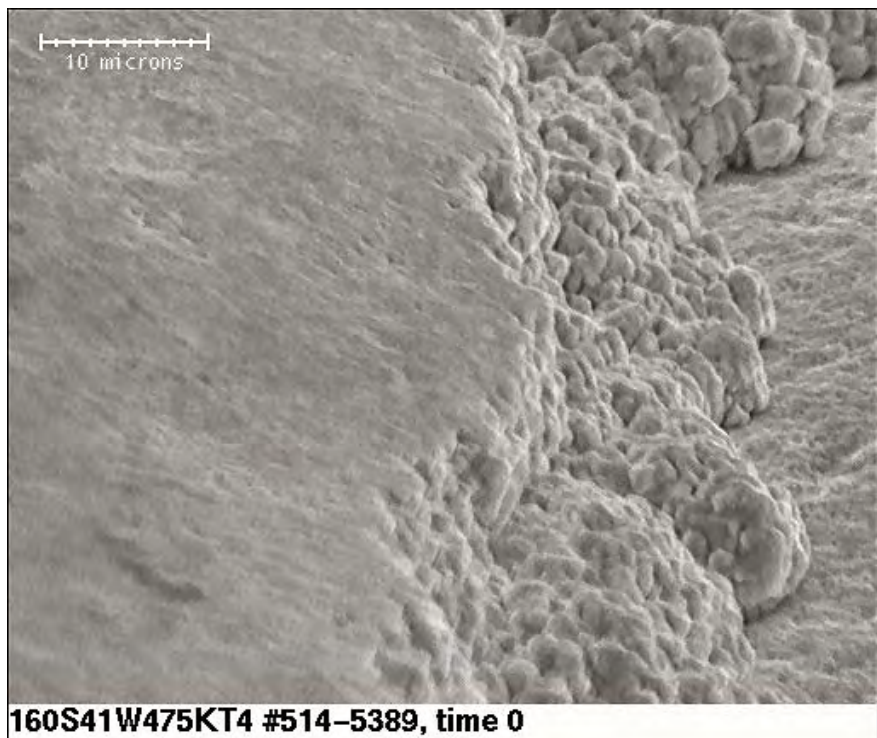
Sample 2 - left



Fig. 10

2500x magnification

Sample 2 - left



160S41W475KT4 - 1000 cycles

Fig. 11

250x magnification

Sample 2 - left

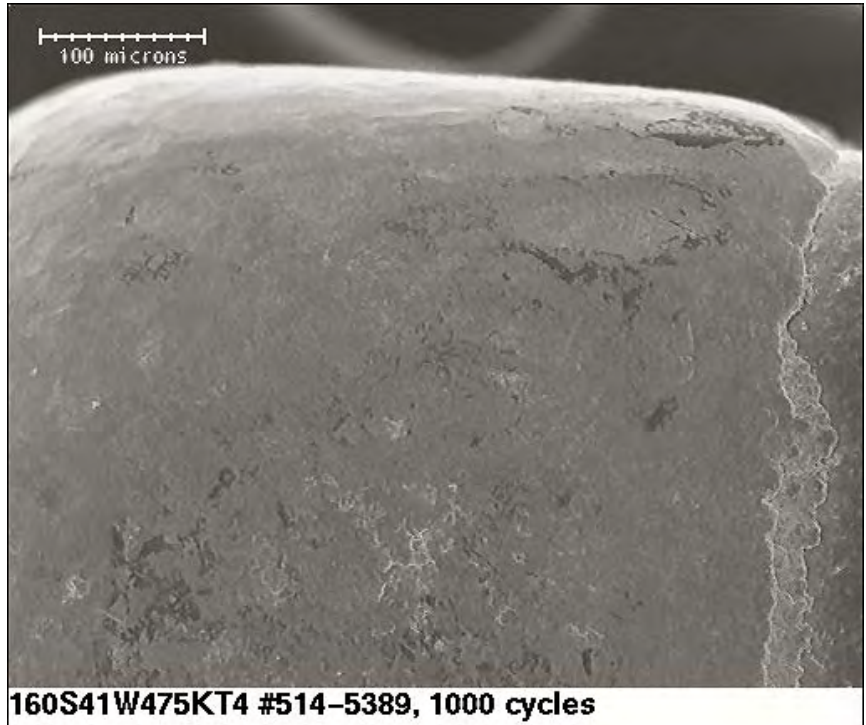
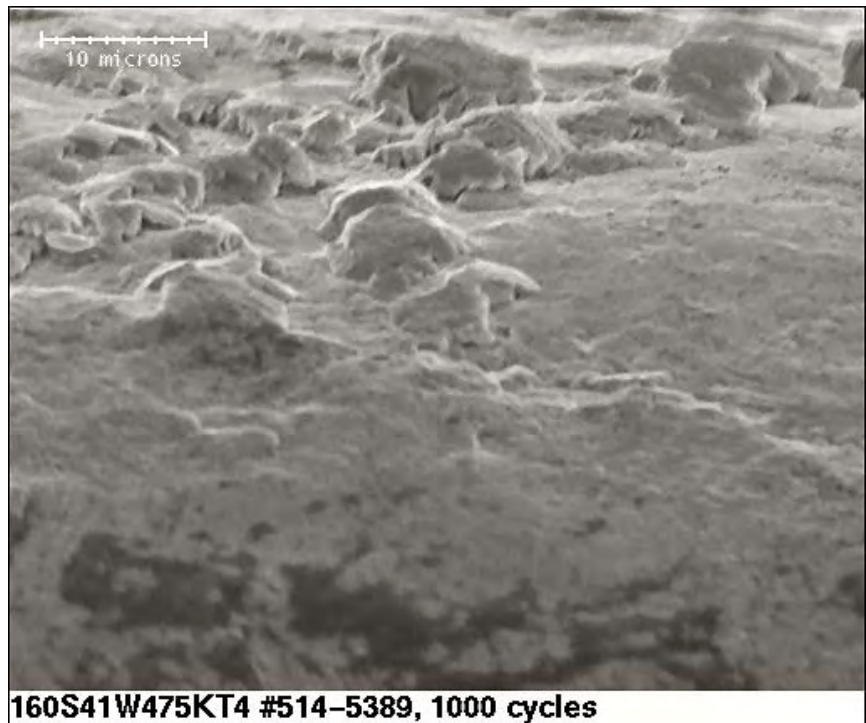


Fig. 12

2500x magnification

Sample 2 - left



160S41W475KT4 – pre Temp Cycle

Fig. 13

250x magnification

Sample 2 - right



Fig. 14

2500x magnification

Sample 2 - right



160S41W475KT4 - 1000 cycles

Fig. 15

250x magnification

Sample 2 - right

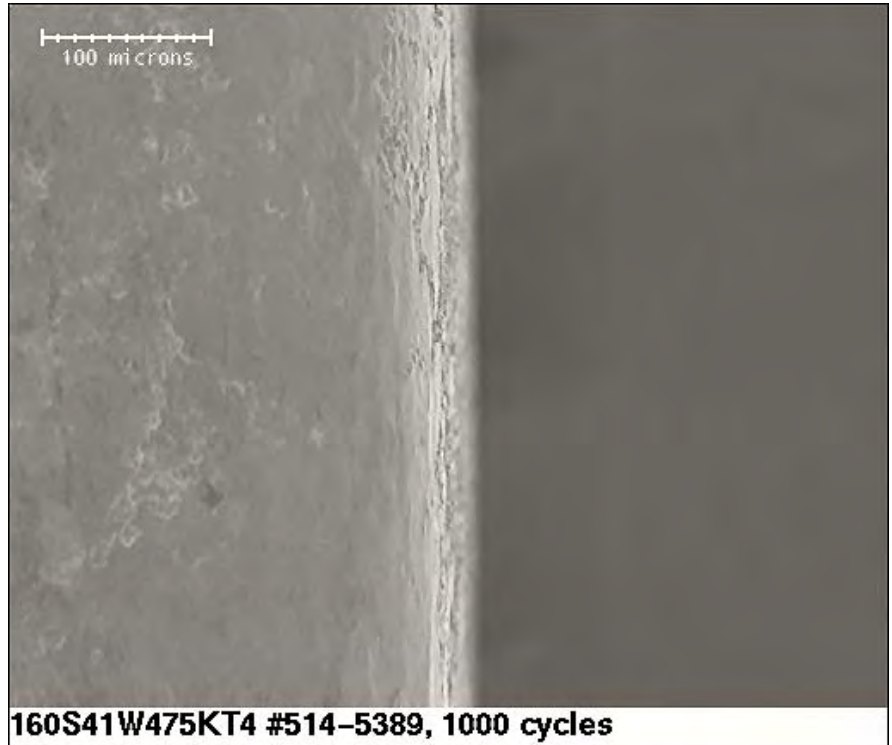
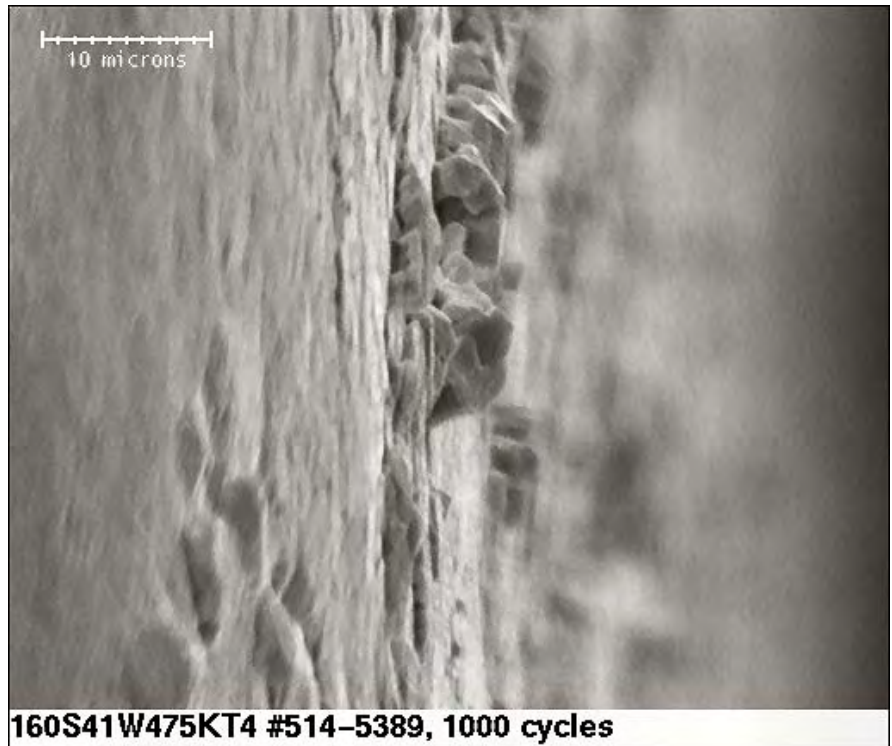


Fig. 16

2500x magnification

Sample 2 - right



160S41W475KT4 – pre Temp Cycle

Fig. 17

250x magnification

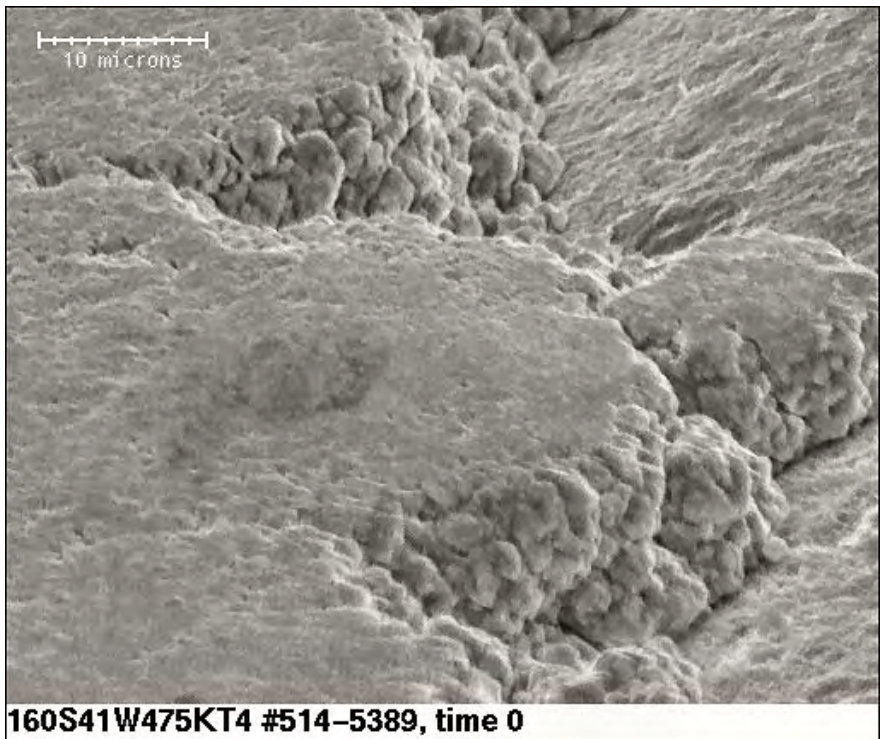
Sample 3 - left



Fig. 18

2500x magnification

Sample 3 - left



160S41W475KT4 - 1000 cycles

Fig. 19

250x magnification

Sample 3 - left

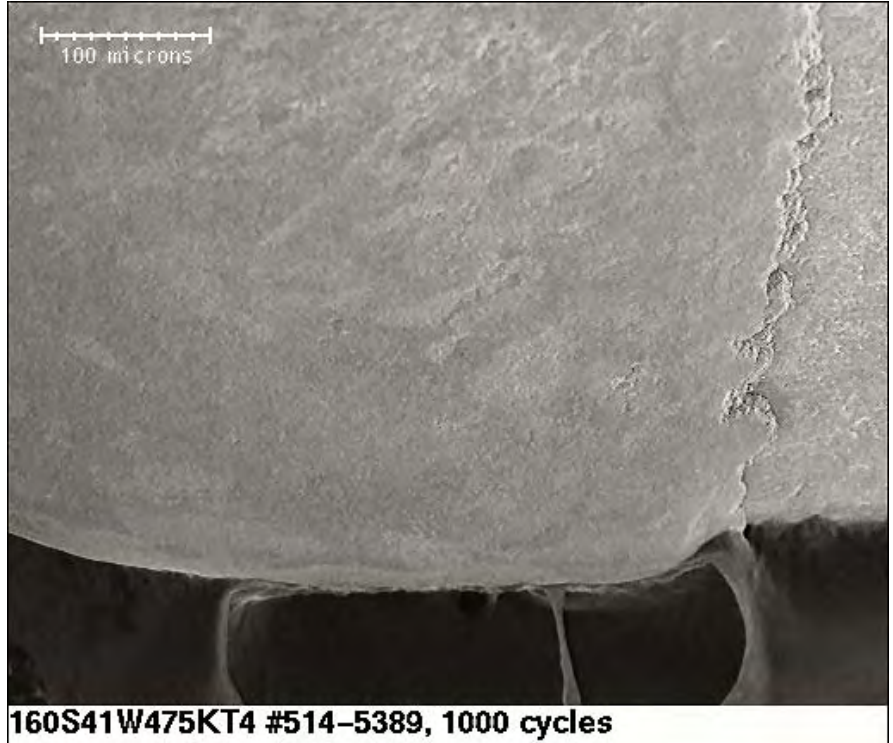
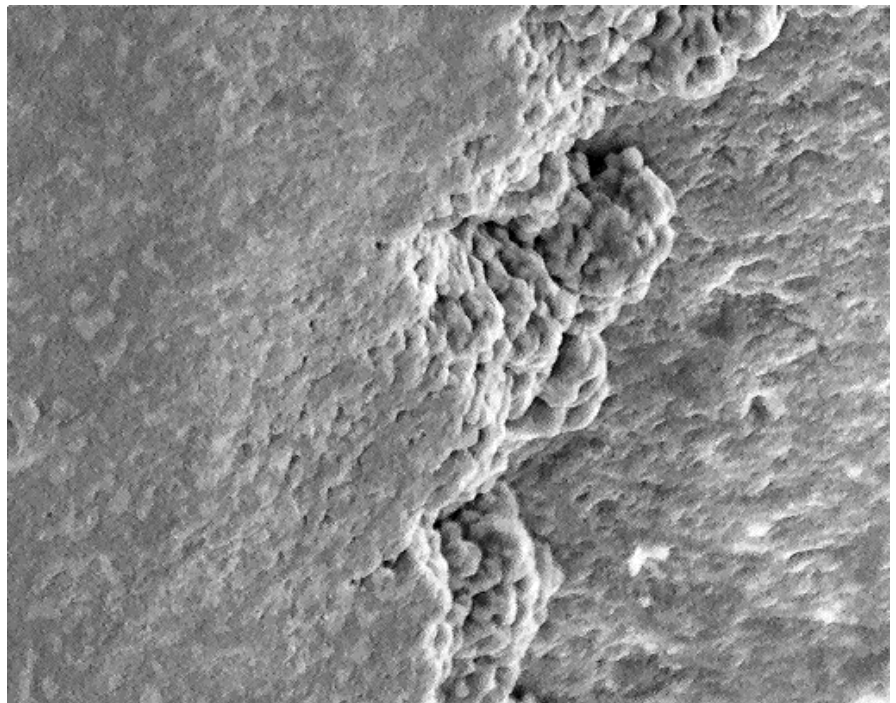


Fig. 20

2500x magnification

Sample 3 - left



160S41W475KT4 – pre Temp Cycle

Fig. 21

250x magnification

Sample 3 - right



Fig. 22

2500x magnification

Sample 3 - right



160S41W475KT4 - 1000 cycles

Fig. 23

250x magnification

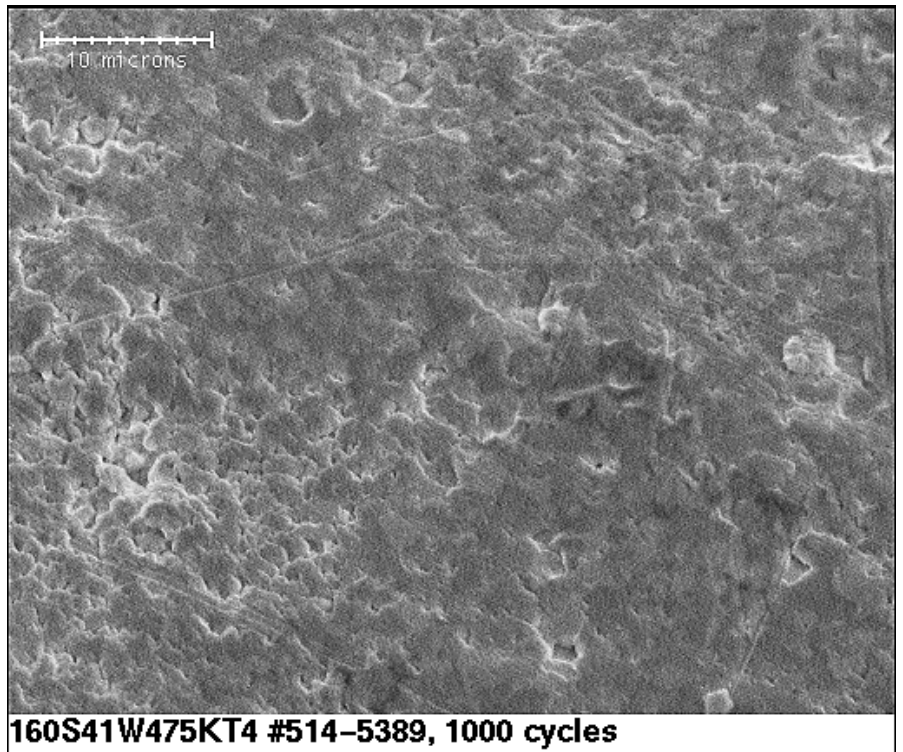
Sample 3 - right



Fig. 24

2500x magnification

Sample 3 - right



160S41W475KT4 – pre Temp Cycle

Fig. 25

250x magnification

Sample 4 - left



Fig. 26

2500x magnification

Sample 4 - left



160S41W475KT4 - 1000 cycles

Fig. 27

250x magnification

Sample 4 - left

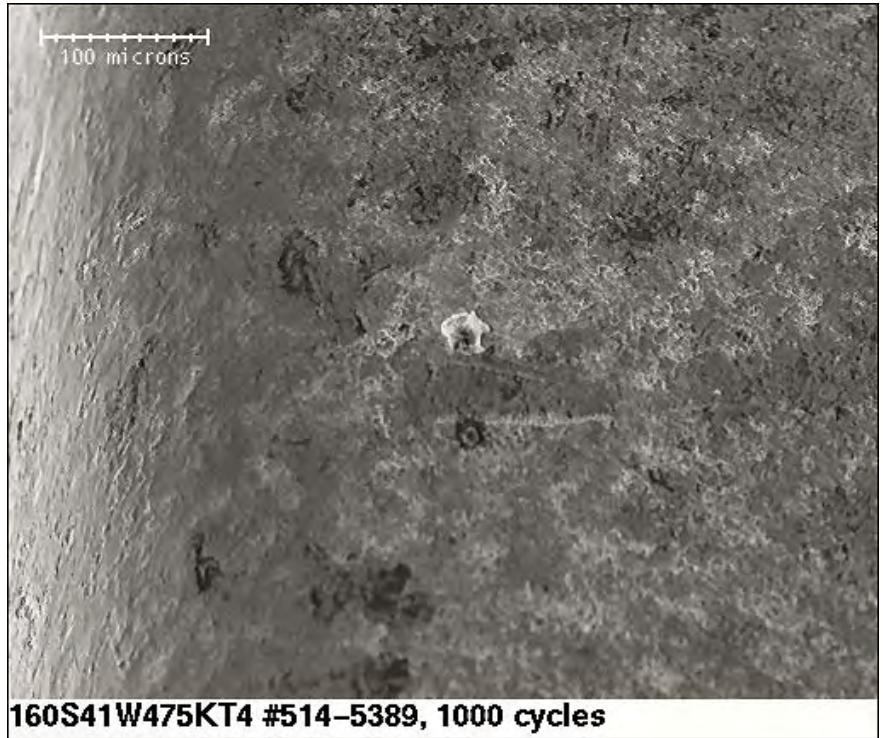


Fig. 28

2500x magnification

Sample 4 - left



160S41W475KT4 – pre Temp Cycle

Fig. 29

250x magnification

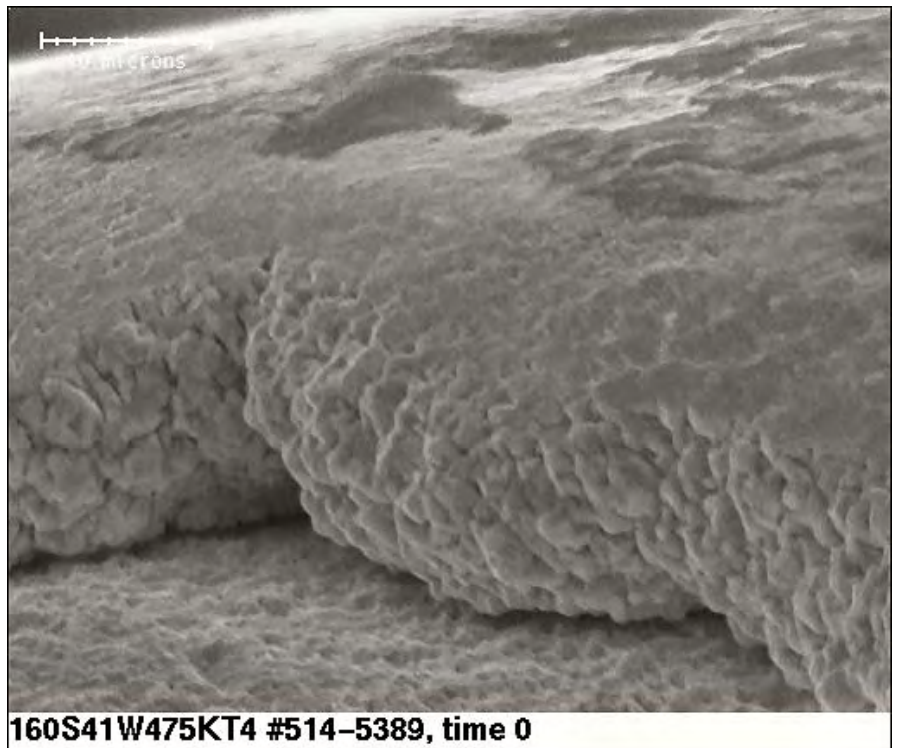
Sample 4 - right



Fig. 30

2500x magnification

Sample 4 - right



160S41W475KT4 - 1000 cycles

Fig. 31

250x magnification

Sample 4 - right

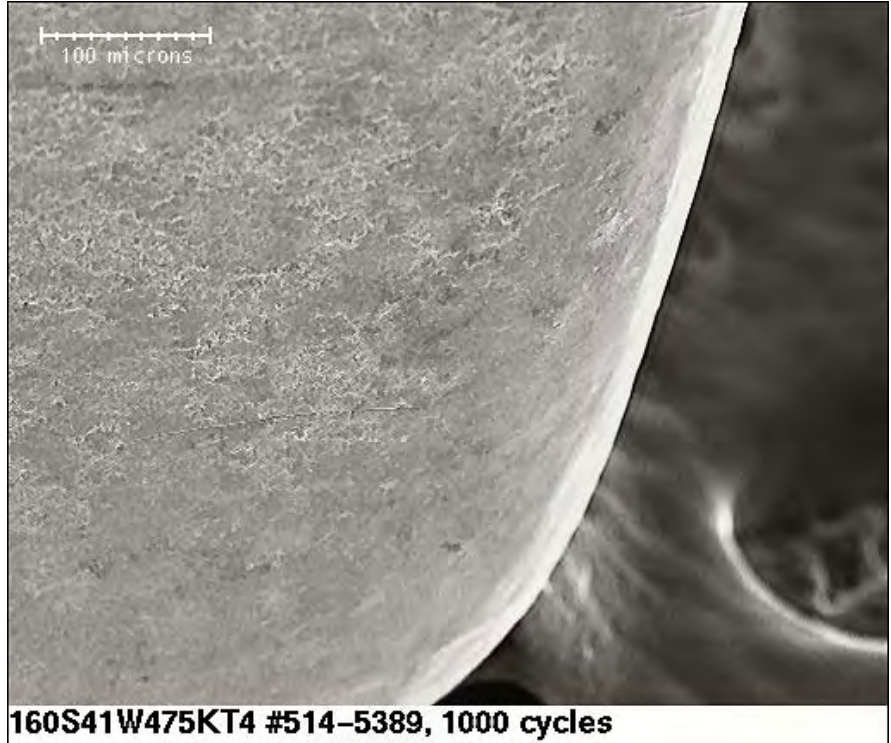


Fig. 32

2500x magnification

Sample 4 - right



160S41W475KT4 – pre Temp Cycle

Fig. 33

250x magnification

Sample 5 - left



Fig. 34

2500x magnification

Sample 5 - left



160S41W475KT4 - 1000 cycles

Fig. 35

250x magnification

Sample 5 - left

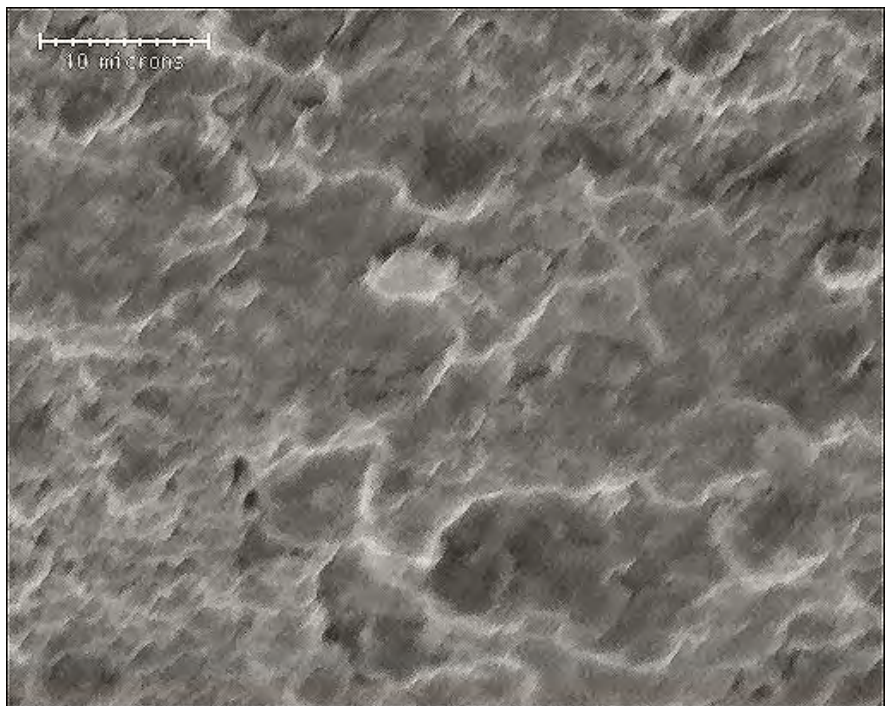


160S41W475KT4 #514-5389, 1000 cycles

Fig. 36

2500x magnification

Sample 5 - left



160S41W475KT4 #514-5389, 1000 cycles

160S41W475KT4 – pre Temp Cycle

Fig. 37

250x magnification

Sample 5 - right



Fig. 38

2500x magnification

Sample 5 - right



160S41W475KT4 - 1000 cycles

Fig. 39

250x magnification

Sample 5 - right

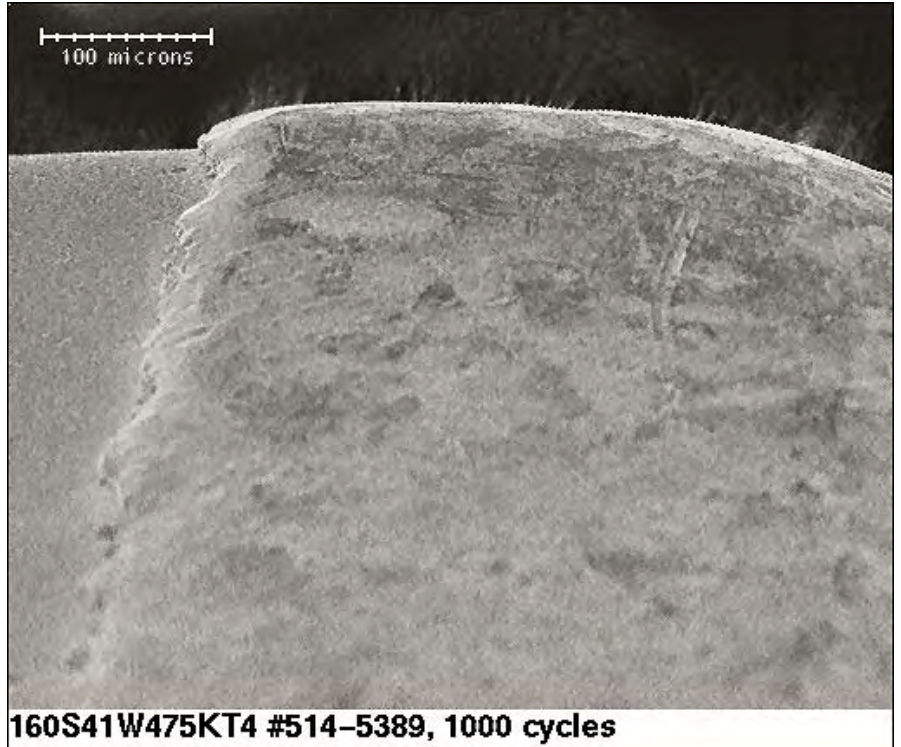


Fig. 40

2500x magnification

Sample 5 - right



160S41W475KT4 – pre Temp Cycle

Fig. 41

250x magnification

Sample 6 - left



Fig. 42

2500x magnification

Sample 6 - left



160S41W475KT4 - 1000 cycles

Fig. 43

250x magnification

Sample 6 - left

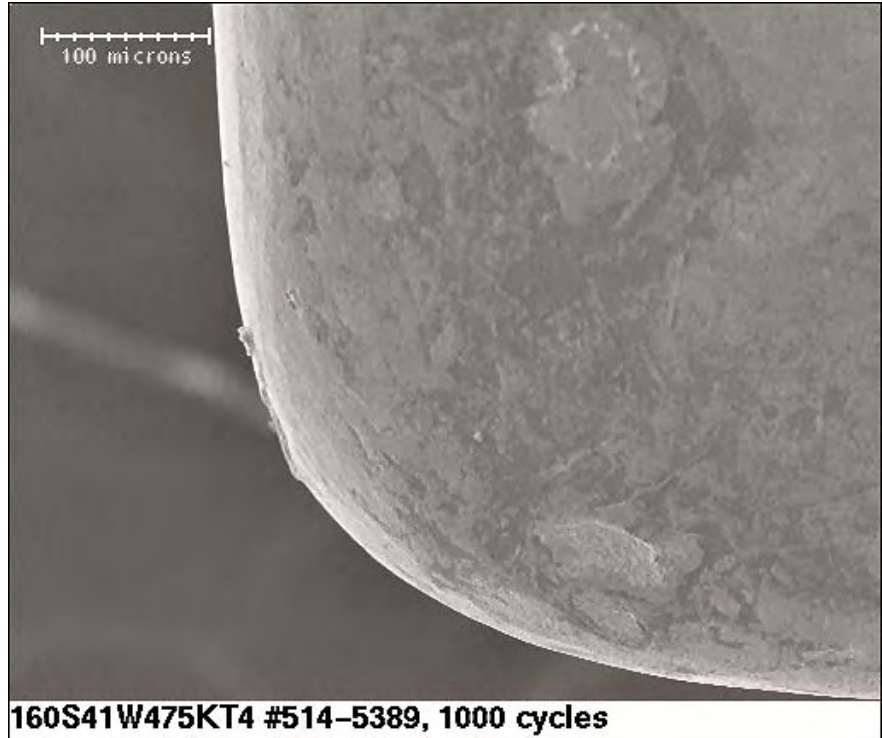
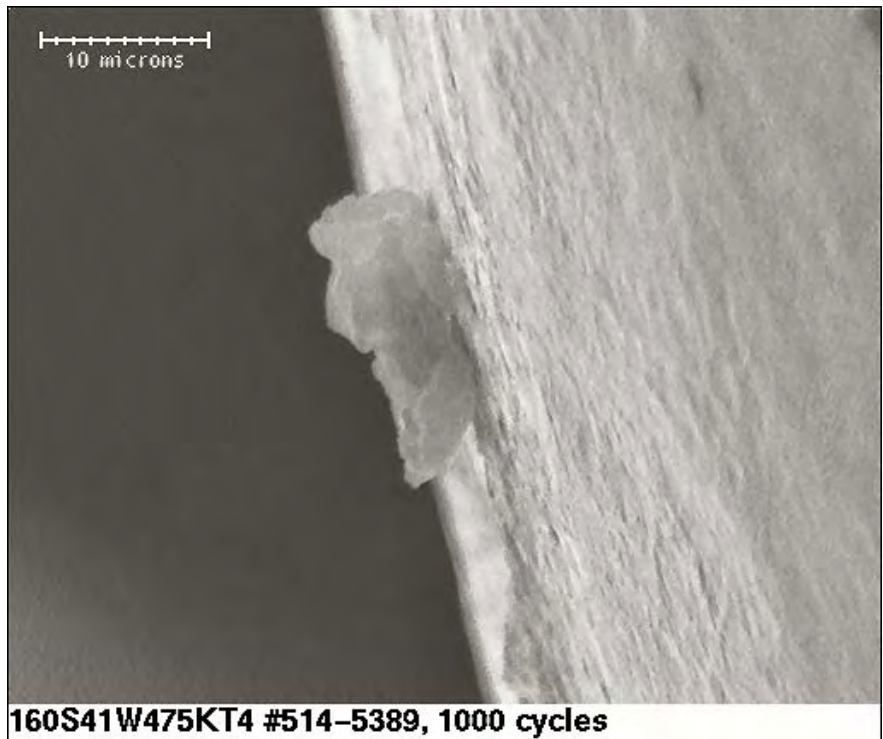


Fig. 44

2500x magnification

Sample 6 - left



160S41W475KT4 – pre Temp Cycle

Fig. 45

250x magnification

Sample 6 - right

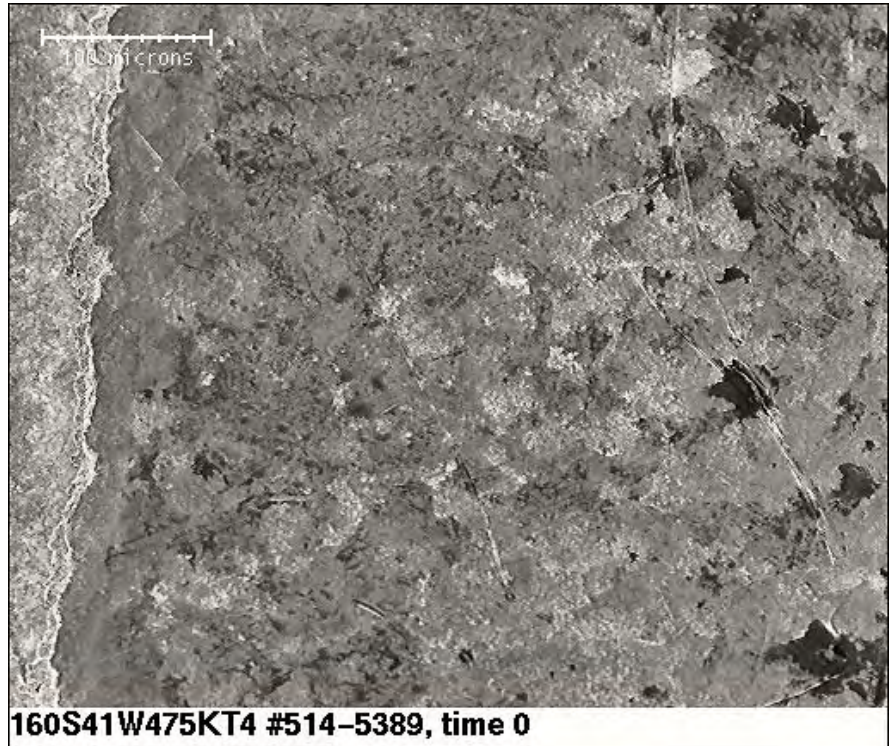


Fig. 46

2500x magnification

Sample 6 - right



160S41W475KT4 - 1000 cycles

Fig. 47

250x magnification

Sample 6 - right

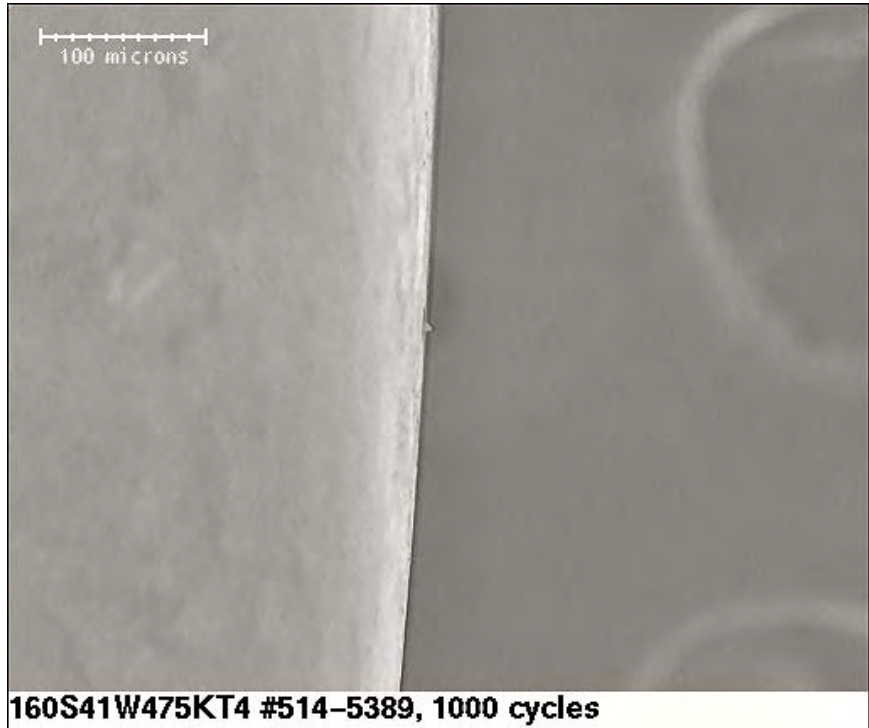
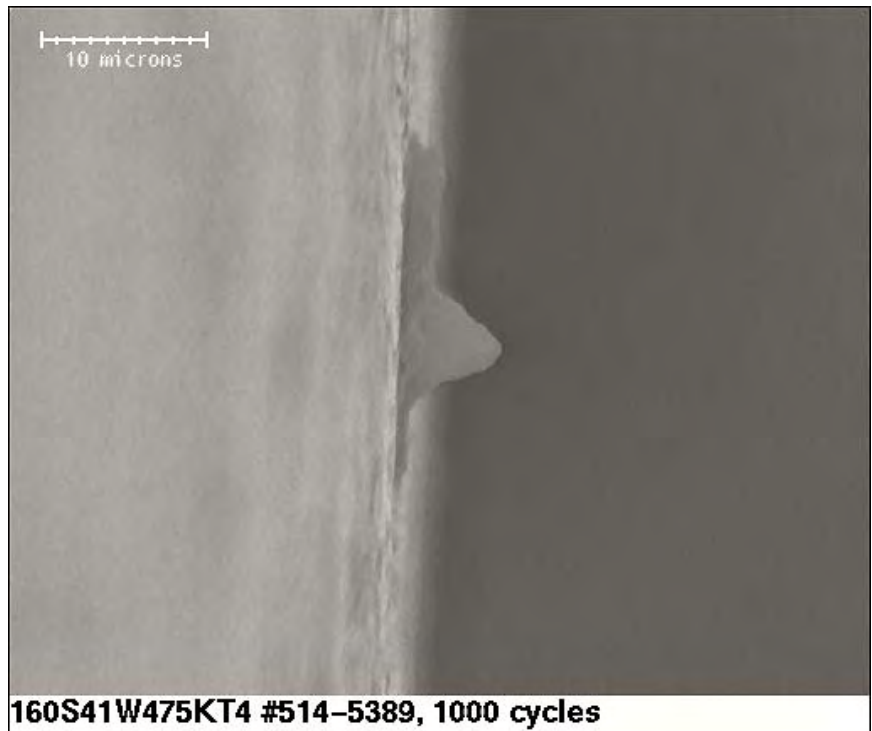


Fig. 48

2500x magnification

Sample 6 - right



160S41W475KT4 – pre Temp Cycle

Fig. 49

250x magnification

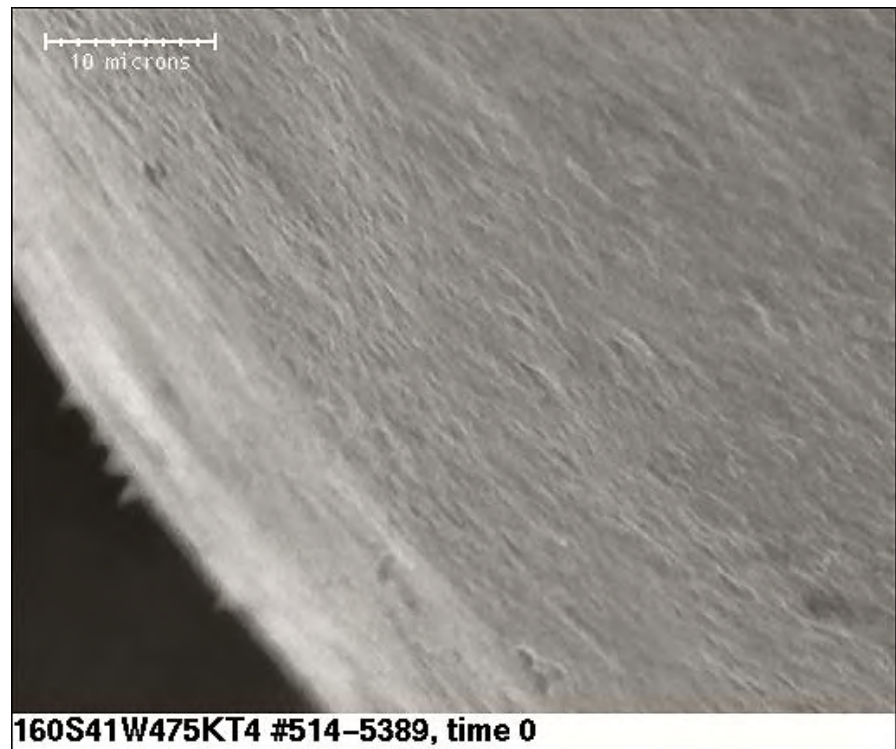
Sample 7 - left



Fig. 50

2500x magnification

Sample 7 - left

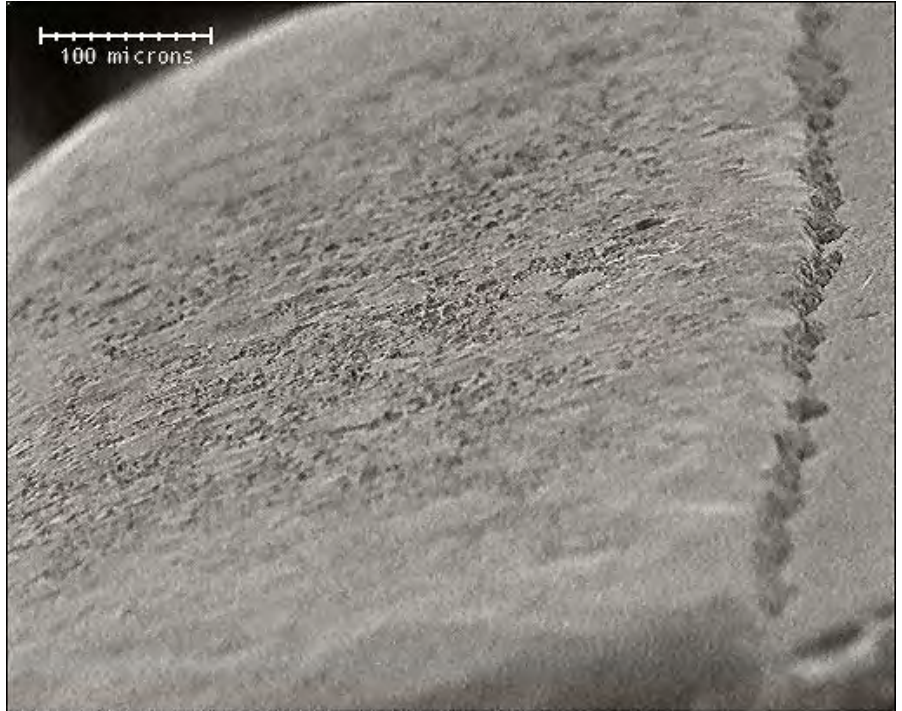


160S41W475KT4 - 1000 cycles

Fig. 51

250x magnification

Sample 7 - left

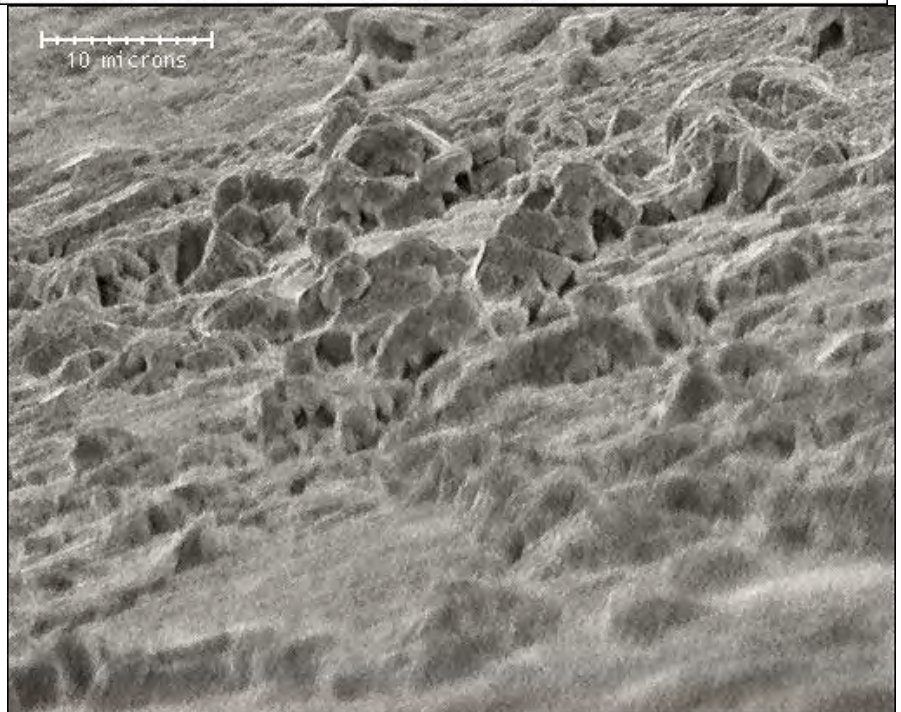


160S41W475KT4 #514-5389, 1000 cycles

Fig. 52

2500x magnification

Sample 7 - left



160S41W475KT4 #514-5389, 1000 cycles

160S41W475KT4 – pre Temp Cycle

Fig. 53

250x magnification

Sample 7 - right

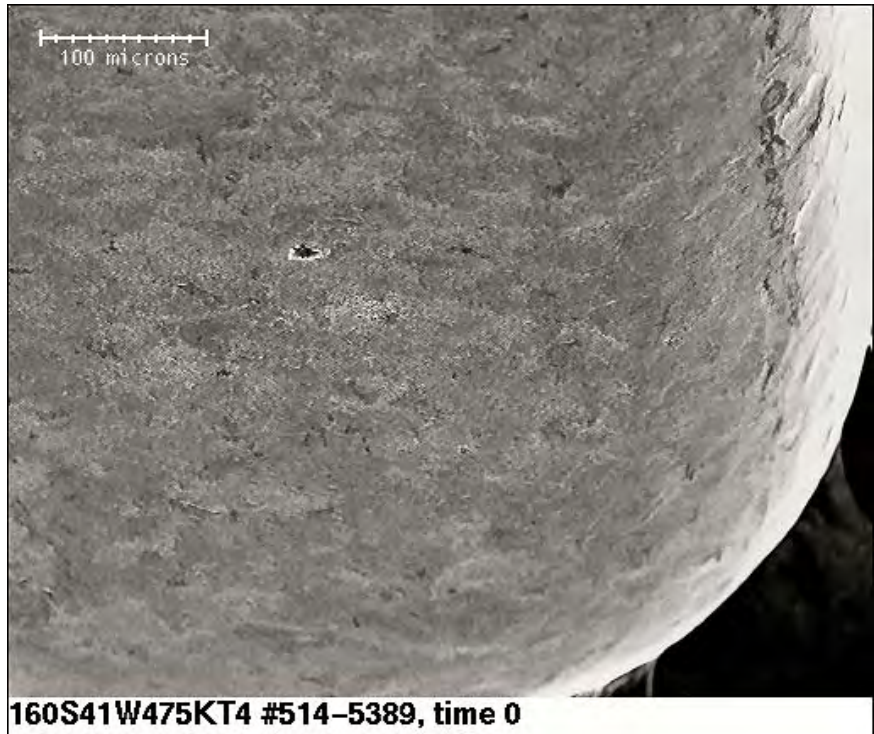


Fig. 54

2500x magnification

Sample 7 - right



160S41W475KT4 - 1000 cycles

Fig. 55

250x magnification

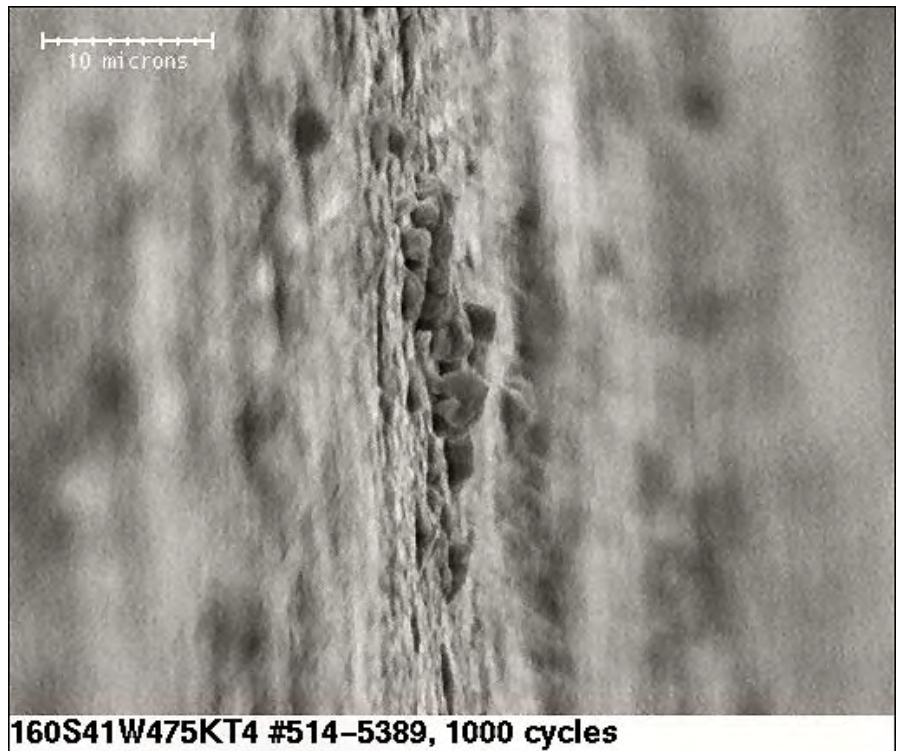
Sample 7 - right



Fig. 56

2500x magnification

Sample 7 - right



160S41W475KT4 – pre Temp Cycle

Fig. 57

250x magnification

Sample 8 - left

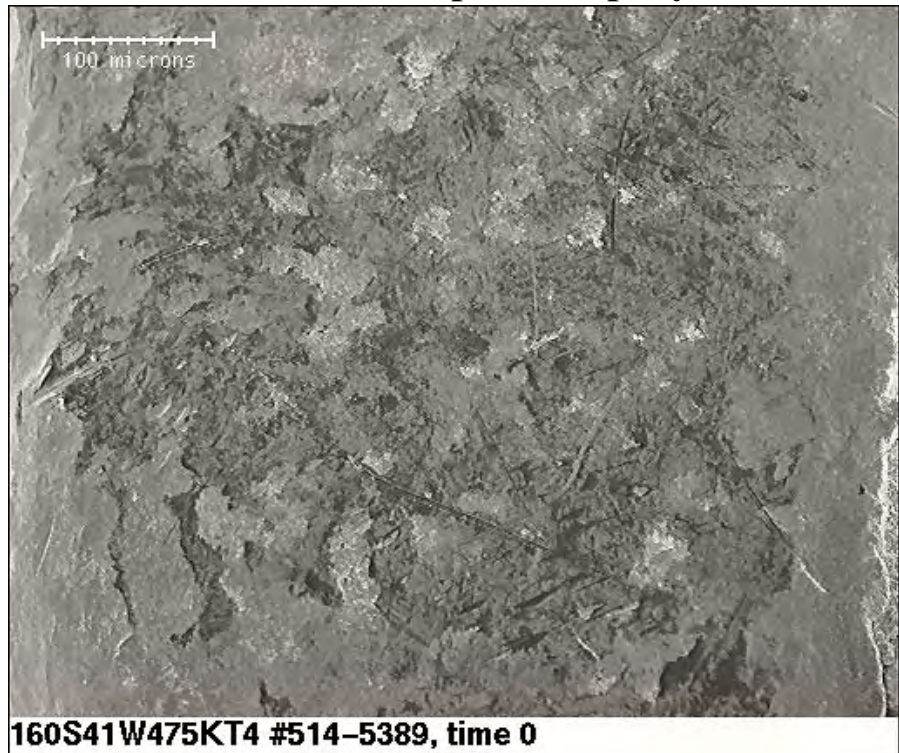


Fig. 58

2500x magnification

Sample 8 - left



160S41W475KT4 - 1000 cycles

Fig. 59

250x magnification

Sample 8 - left



Fig. 60

2500x magnification

Sample 8 - left



160S41W475KT4 – pre Temp Cycle

Fig. 61

250x magnification

Sample 8 - right

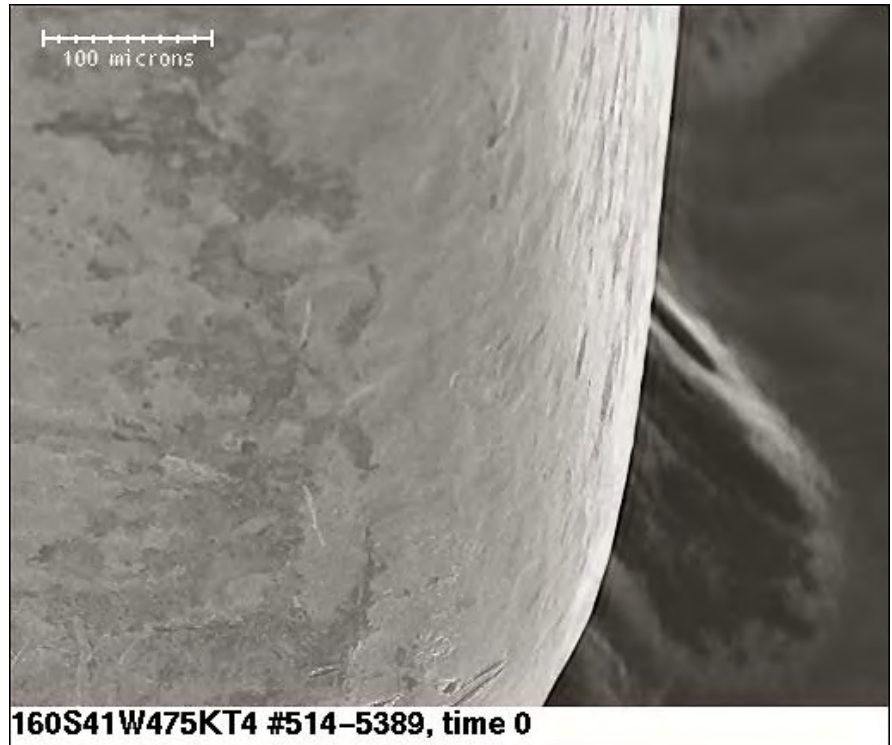
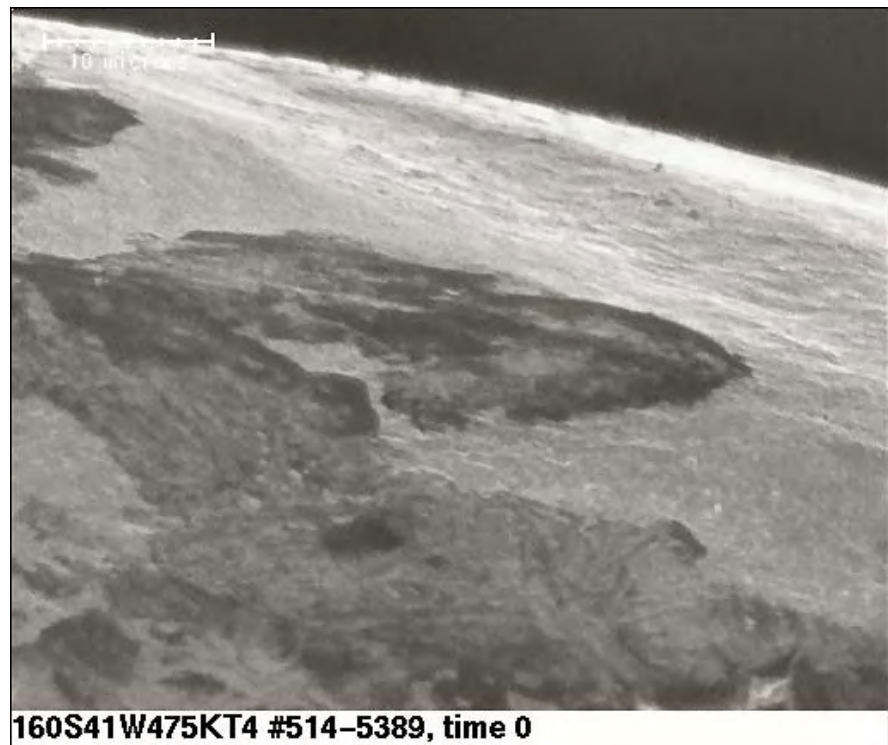


Fig. 62

2500x magnification

Sample 8 - right



160S41W475KT4 - 1000 cycles

Fig. 63

250x magnification

Sample 8 - right

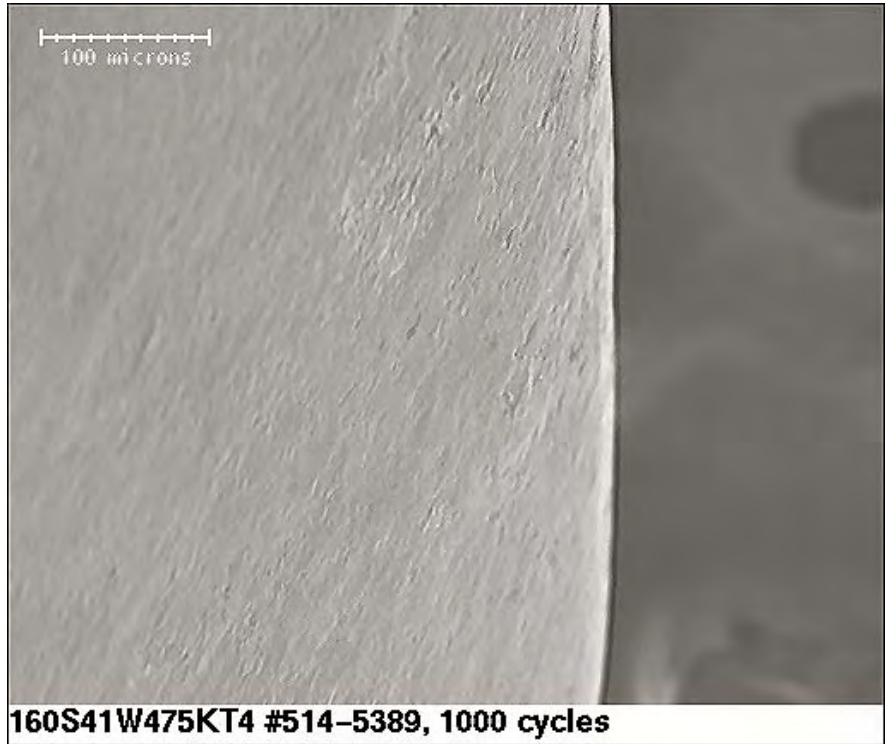
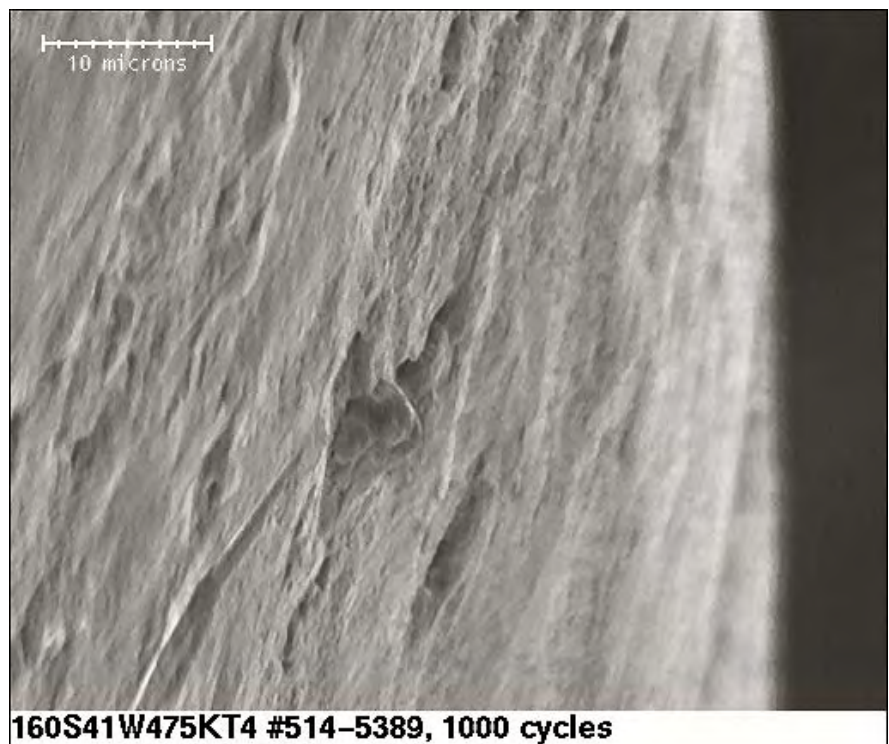


Fig. 64

2500x magnification

Sample 8 - right



160S41W475KT4 – pre Temp Cycle

Fig. 65

250x magnification

Sample 9 - left



Fig. 66

2500x magnification

Sample 9 - left



160S41W475KT4 - 1000 cycles

Fig. 67

250x magnification

Sample 9 - left

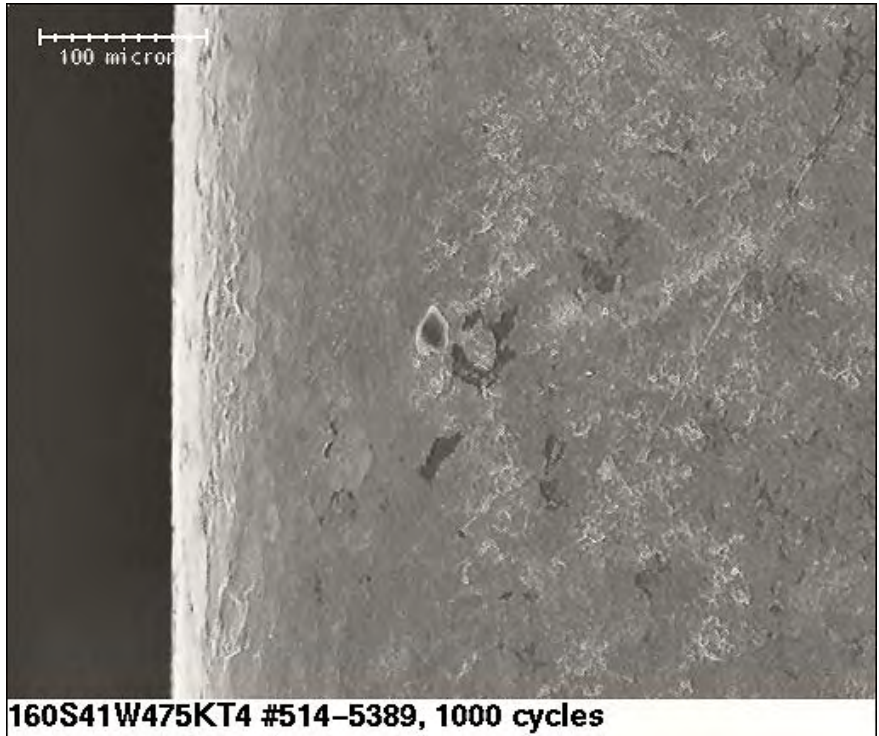
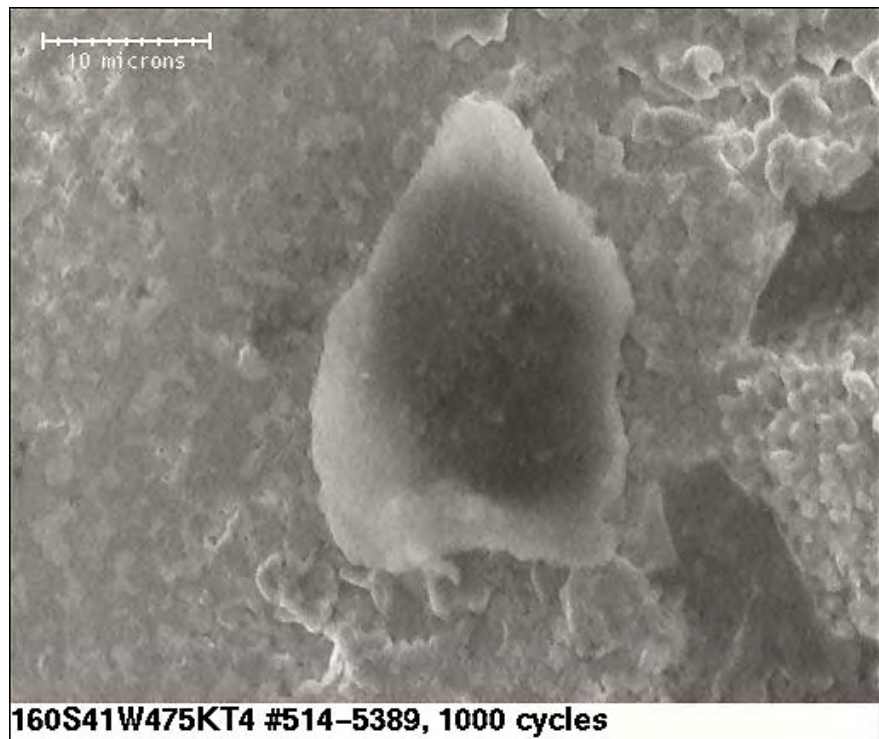


Fig. 68

2500x magnification

Sample 9 - left



160S41W475KT4 – pre Temp Cycle

Fig. 69

250x magnification

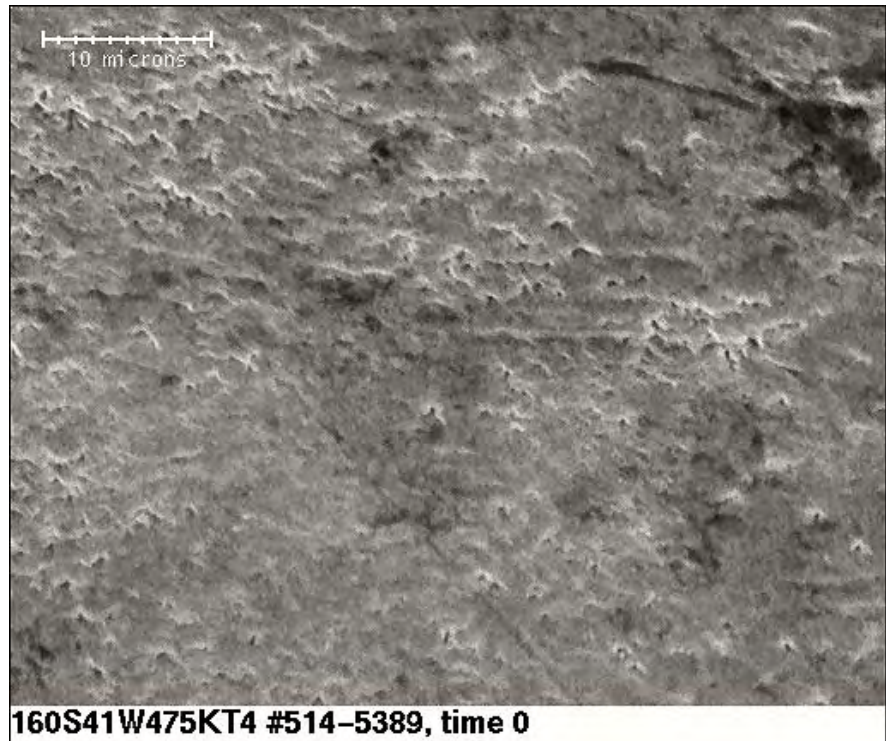
Sample 9 - right



Fig. 70

2500x magnification

Sample 9 - right



160S41W475KT4 - 1000 cycles

Fig. 71

250x magnification

Sample 9 - right

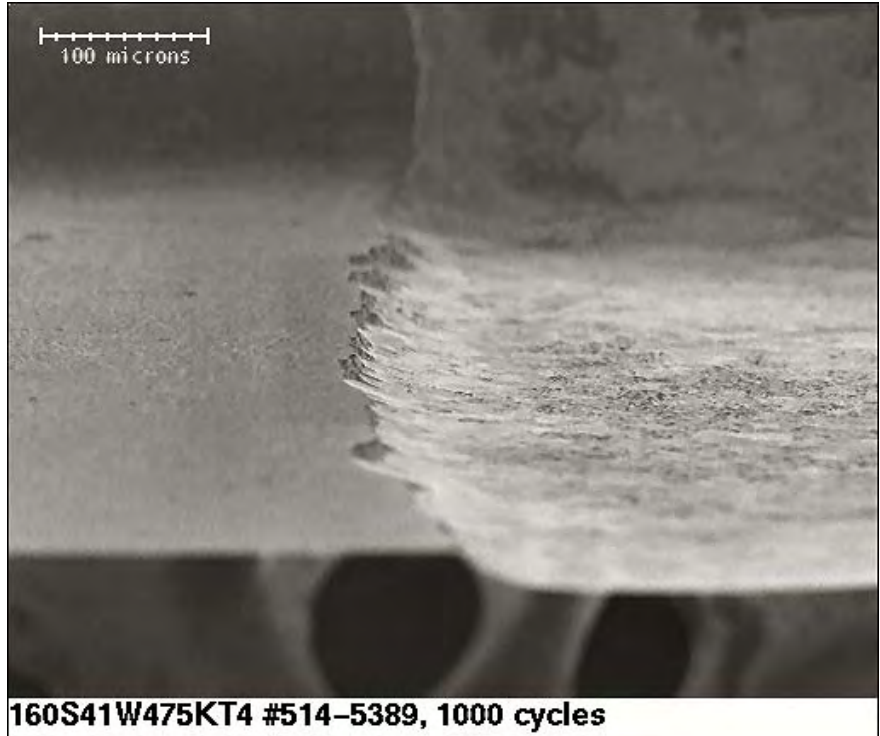


Fig. 72

2500x magnification

Sample 9 - right

