



WESTERN MICHIGAN UNIVERSITY

College of Engineering and Applied Sciences

Investigating Subsurface Damage for SPDT Samples

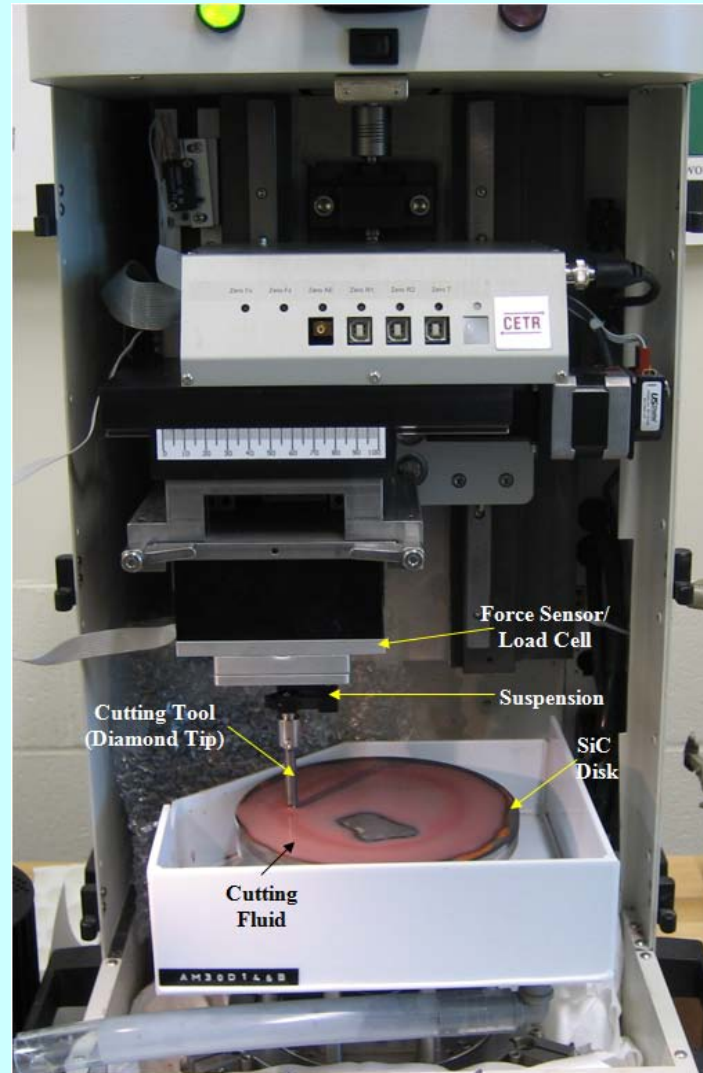
by

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Overview

- CVD Coated SiC (3C Polycrystalline)
 - Single Point Diamond Turned
 - Optical Microscopy
 - Raman Spectroscopy
 - Scanning Acoustic Microscopy (SAcM)
- Laser Ablated CVD Coated SiC (3C Polycrystalline)
 - Single Point Diamond Turned
 - Optical Microscopy
 - Scanning Acoustic Microscopy (SAcM)
- Quartz (Fused Silica)
 - Single Point Diamond Turned
 - Optical Microscopy
 - Scanning Acoustic Microscopy (SAcM)

SPDT Setup



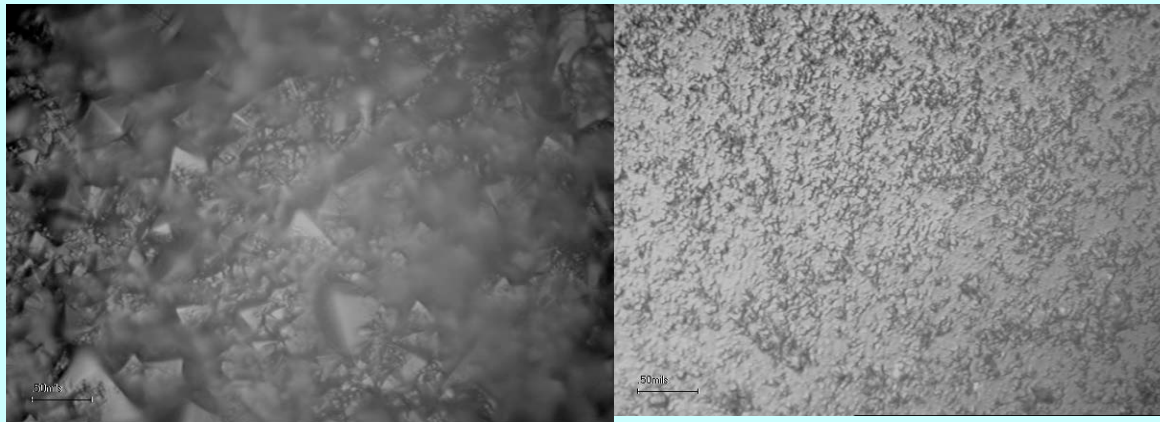
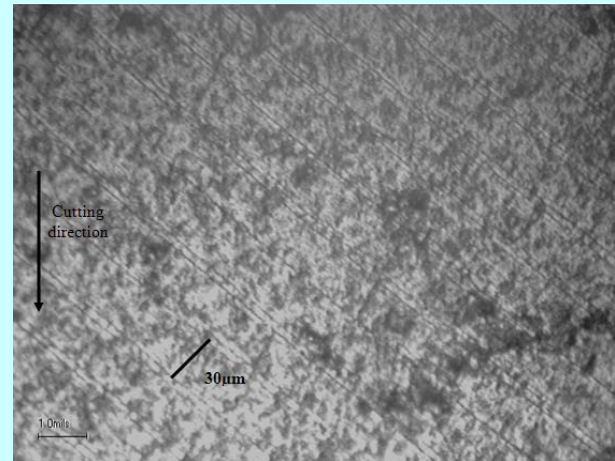
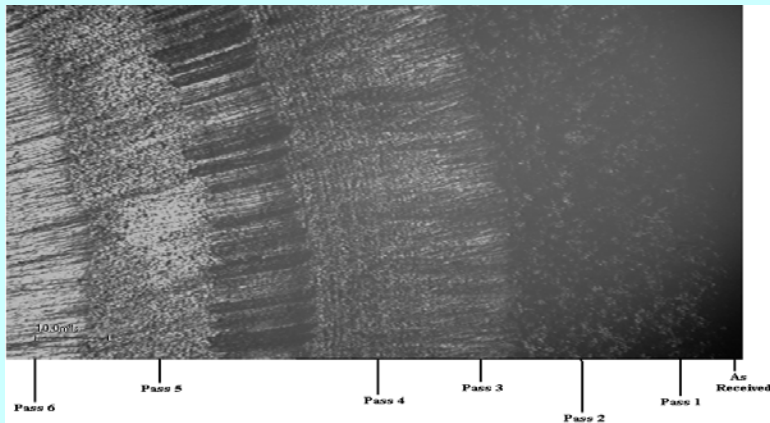
CVD SiC

- Machining Parameters

Pass #	Actual Depth of Cut	Feed ($\mu\text{m}/\text{rev}$)
1	1.3 μm	30
2	1.2 μm	30
3	845nm	5
4	255nm	1
5	210nm	1
6	160nm	1

CVD SiC

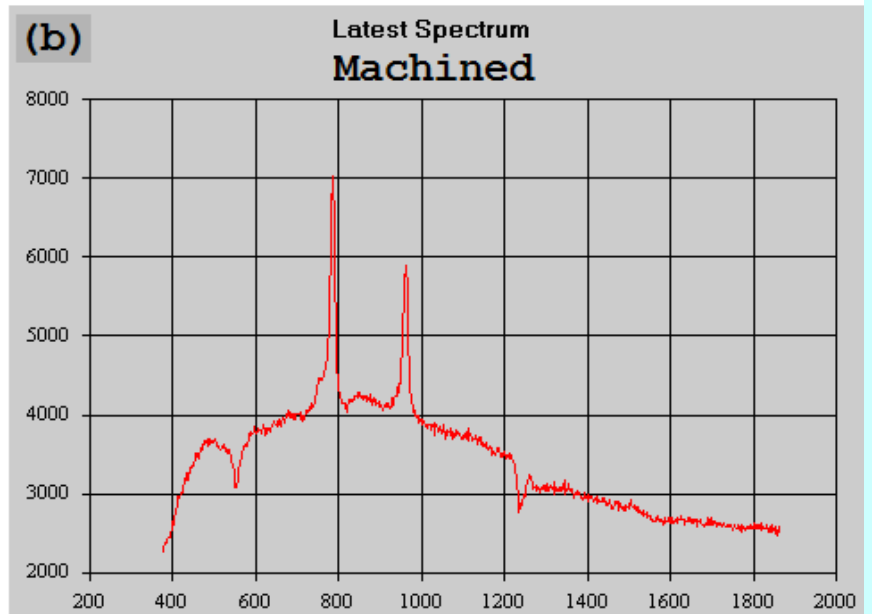
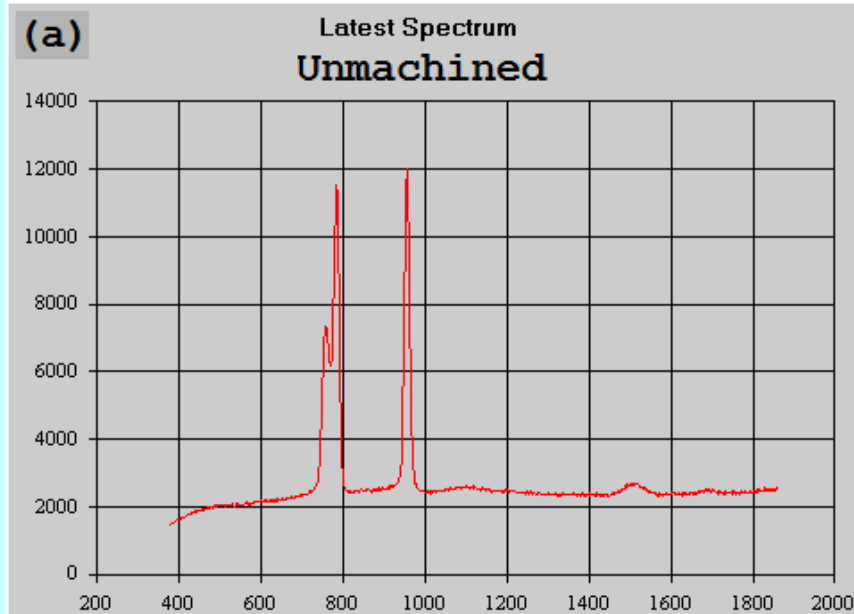
- Optical Microscope



Optical images comparing the surface finish of the as received workpiece (left) and the surface after pass 3(right). This image was taken at 1000x magnification

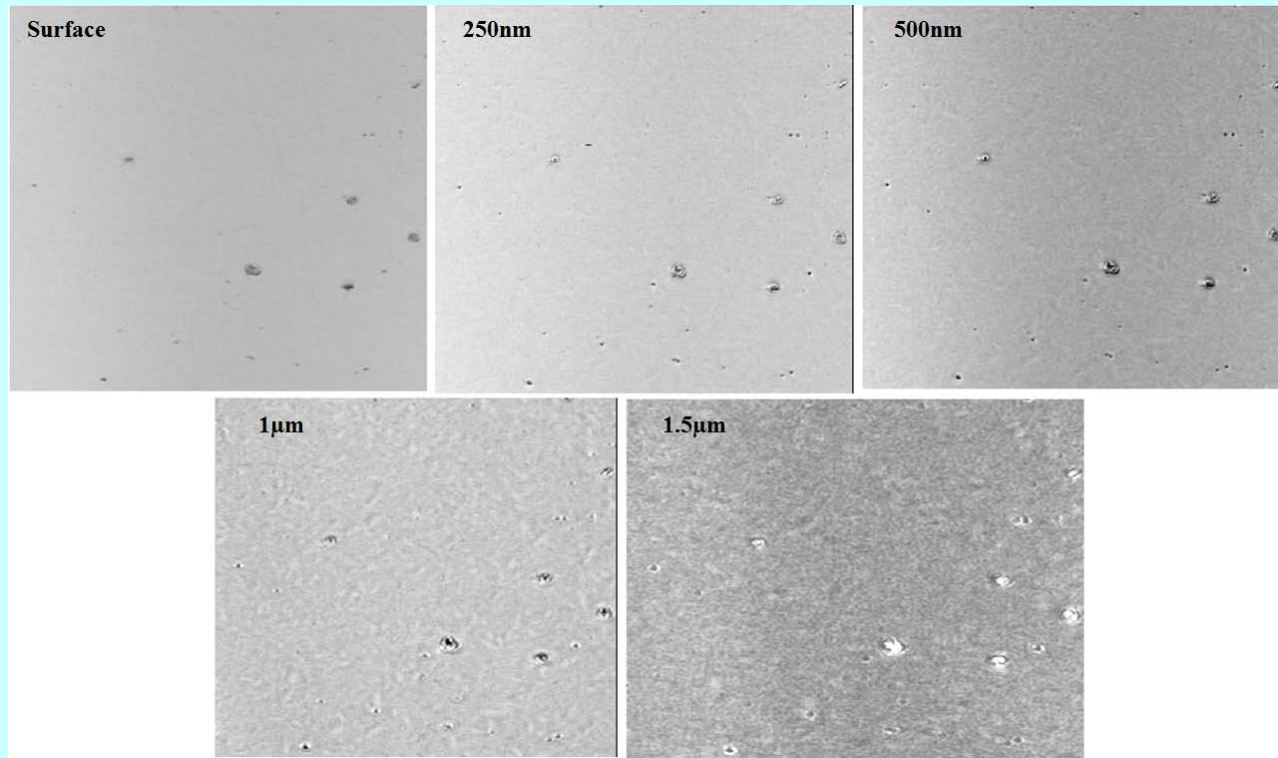
CVD SiC

- Raman Spectroscopy



CVD SiC

- Scanning Acoustic Microscopy



The acoustic microscopy images show now signs of subsurface cracks or damage. The surface features seen in the images in the *Figure* are pits and voids that existed in the as received material and were not caused by the SPDT operation

Quartz (Fused Silica)

- Machining Parameters

Programmed Depth of Cut	Actual Depth of Cut	Feed	Thrust Force (Fz)	Cutting Force (Fx)
1 μ m	651nm	1 μ m/rev	115mN	13.17mN
500nm	363nm	1 μ m/rev	50.25mN	5.65mN

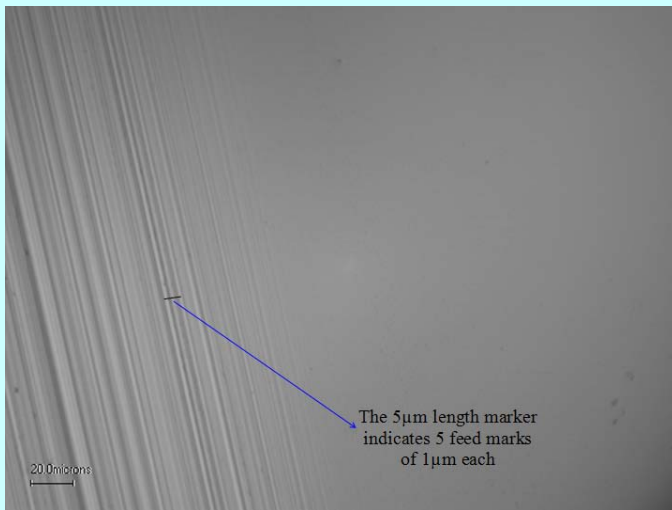
Quartz (Fused Silica)

- Optical Microscope

Programmed Depth of Cut	Actual Depth of Cut	Feed	Thrust Force (Fz)	Cutting Force (Fx)
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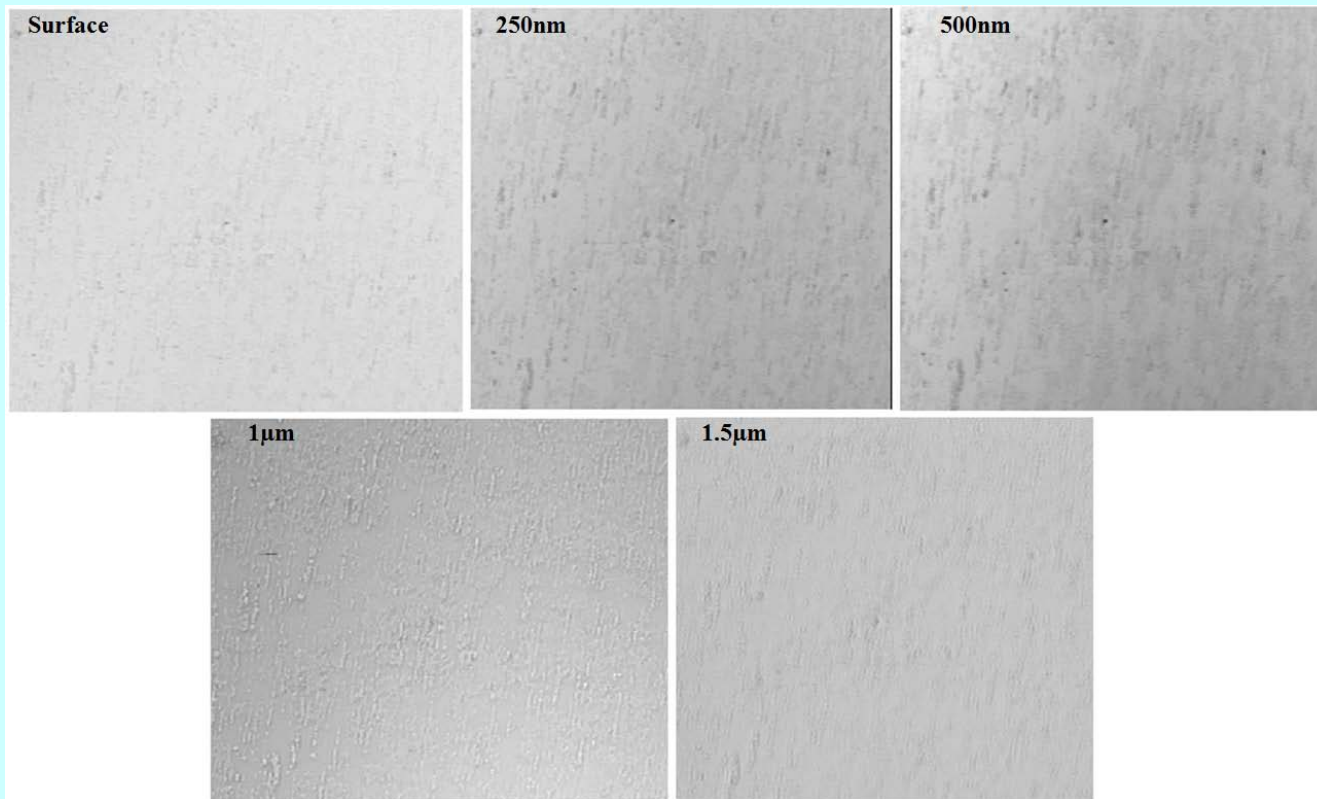
Quartz (Fused Silica)

- Optical Microscope



Quartz (Fused Silica)

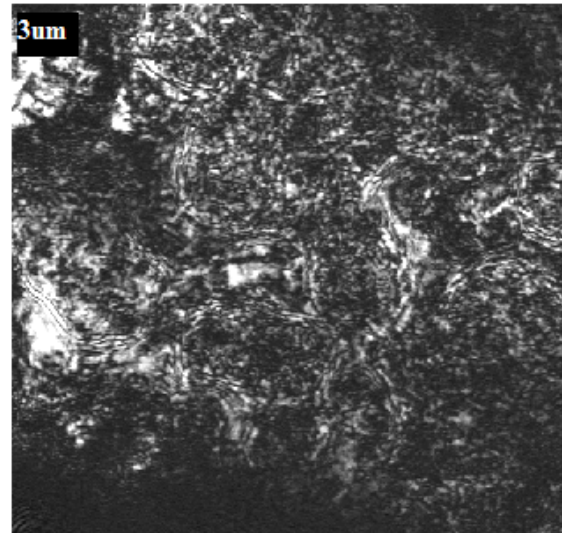
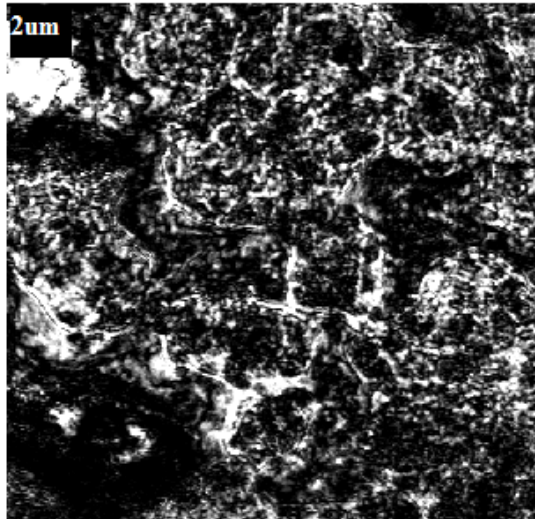
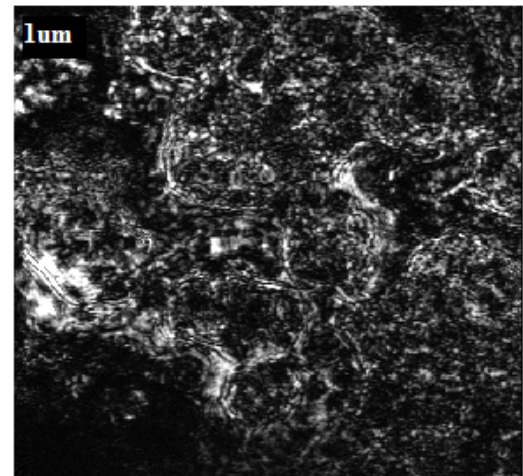
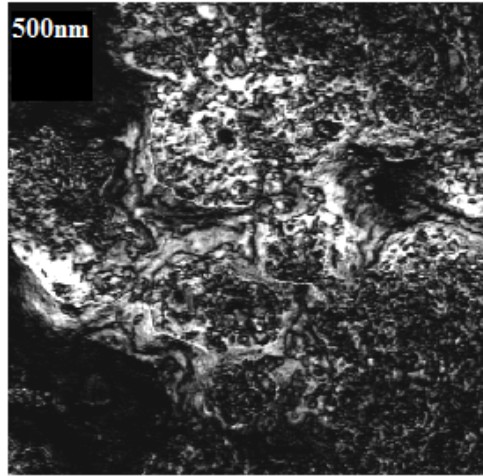
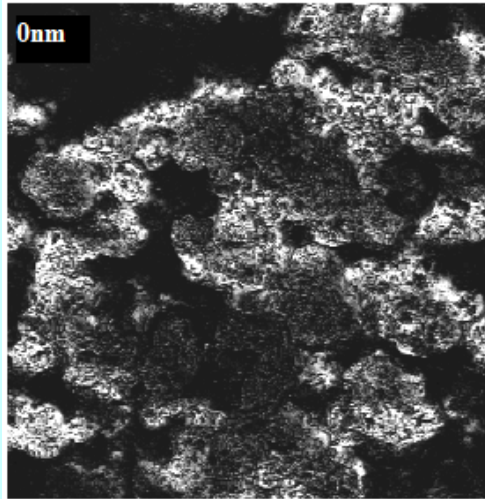
- Scanning Acoustic Microscopy



Laser Ablated CVD-SiC

- Machining Parameters
 - 1 μm depth of cut with a 1 $\mu\text{m}/\text{rev}$ feed

Laser Ablated CVD-SiC



Question?