Investigating Subsurface Damage for SPDT Samples

by

Deepak Ravindra
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

<table>
<thead>
<tr>
<th>Pass #</th>
<th>Actual Depth of Cut</th>
<th>Feed (µm/rev)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.3µm</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>1.2µm</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>845nm</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>255nm</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>210nm</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>160nm</td>
<td>1</td>
</tr>
</tbody>
</table>
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
The acoustic microscopy images show no 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

<table>
<thead>
<tr>
<th>Programmed Depth of Cut</th>
<th>Actual Depth of Cut</th>
<th>Feed</th>
<th>Thrust Force (Fz)</th>
<th>Cutting Force (Fx)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1µm</td>
<td>651nm</td>
<td>1µm/rev</td>
<td>115mN</td>
<td>13.17mN</td>
</tr>
<tr>
<td>500nm</td>
<td>363nm</td>
<td>1µm/rev</td>
<td>50.25mN</td>
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Quartz (Fused Silica)

- Optical Microscope

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Quartz (Fused Silica)

- Optical Microscope

The 5μm length marker indicates 5 feed marks of 1μm each.
Quartz (Fused Silica)

- Scanning Acoustic Microscopy
Laser Ablated CVD-SiC

• Machining Parameters
  – 1um depth of cut with a 1um/rev feed
Laser Ablated CVD-SiC
Question?