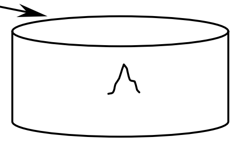
Summary on the surface absorption study of a 1x0.25" FS substrate one surface of which was treated by Ion-Beam Figuring (IBF) technique after cleaning

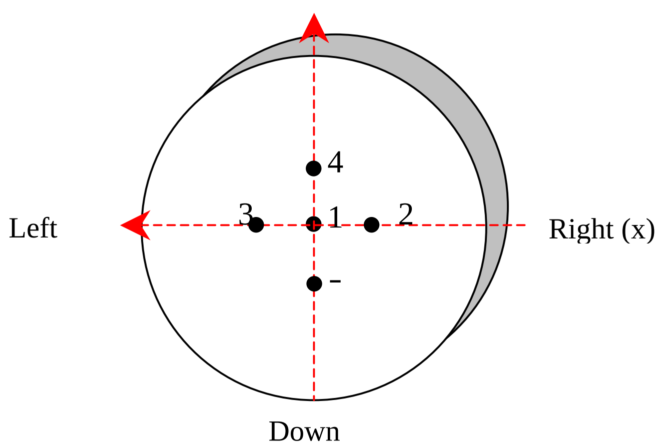
01/25/2010.

The surface absorption was investigated by a photothermal common-path interferometer (PCI) method based on the effect of thermal lensing. The geometry and measurement conditions were as in previous report: pump beam, 1.064 μm, had a power 9.00 W and waist 25 μ at the measured point. So the power density used was 4.2 kW/mm^2 (CW mode).
Five points were measured for averaging the data.
The positions of the points were lost after the sample was removed from the holder.

IBF treated surface (with mark)



The "center" point has (x,y) coordinates (0,0) with an accuracy +/- 0.5 mm.



Point names:

1	Center point	C (center)
2	3000 μm to the right from the center point	R (right
3	3000 μm to the left from the center point	L (left)
4	3000 μm above the center point	U (up)
5	3000 μm below the center point	D (down)

The sample was 1) softly washed with soap, 2) wiped with lens paper moistened in acetone, 3) wiped several times with lens paper moistened in methanol, 4) covered by "First Contact" polymer (both sides. The polymer was removed after complete drying), 5) Cleaned several times with lens paper + methanol by drug-and-drop "method".

As a result, the data obtained were substantially less scattered. Both surfaces are not absorptive. Two typical z-scans are shown below.

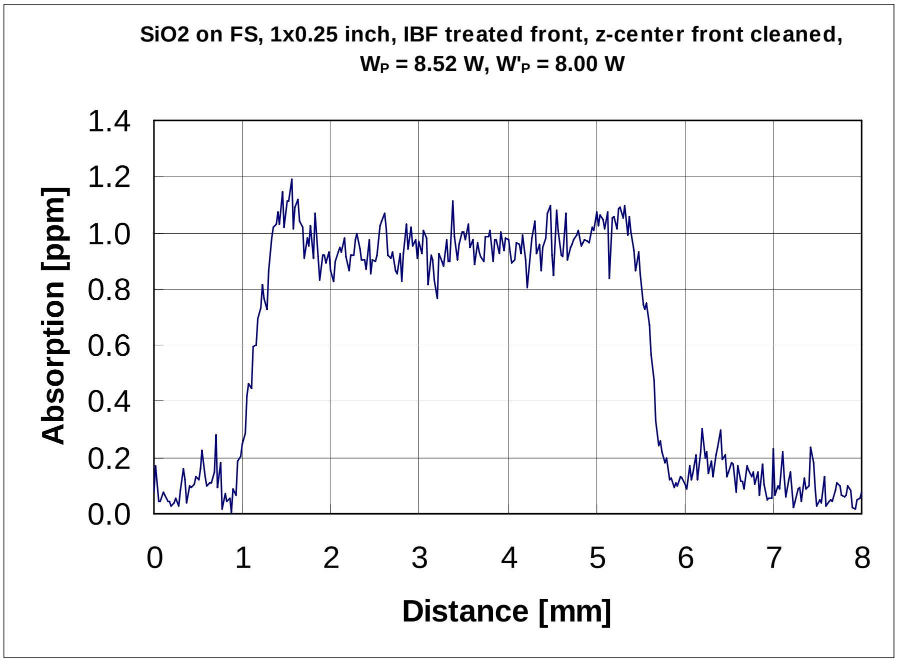


Fig.1. A z-scan through the central area. Front surface is IBF treated. Treatment of the small horns on the surfaces as a real surface absorption is somewhat ambiguous. A rough estimate tells that Alpha(surface) is definitely less than 0.6 ppm.

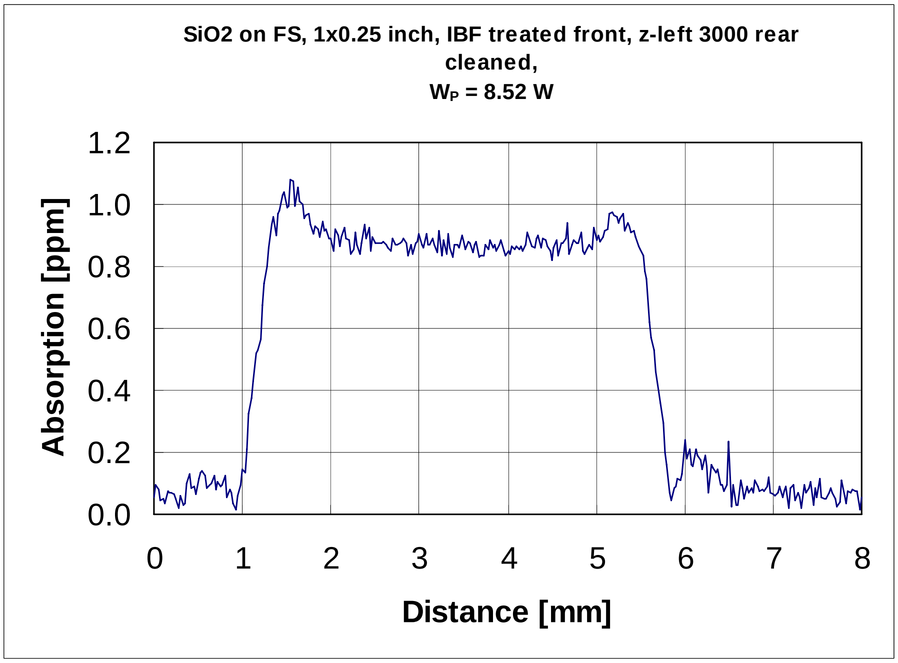


Fig.2. A z-scan through the central area (3 mm left). Rear surface is IBF treated. Treatment of the small horns on the surfaces as a real surface absorption is somewhat ambiguous. A rough estimate tells that Alpha(surface) is definitely less than 0.6 ppm.

The other 8 scans (four from each surface) are similar.

As an example, Fig.3 shows a scan where one surface shows a deviated signal.

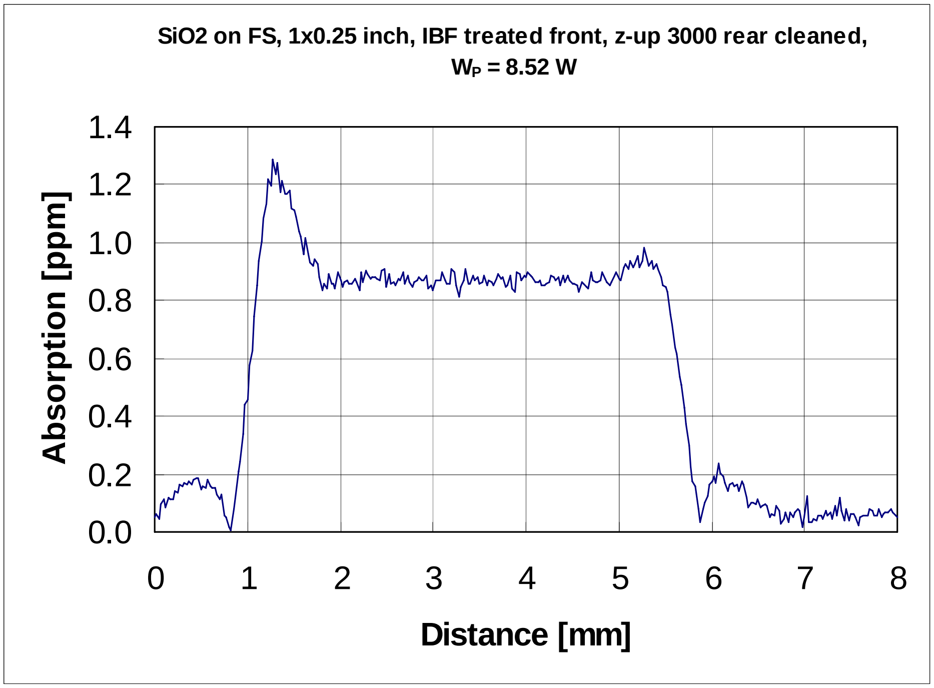


Fig.3. A z-scan through the central area (3 mm up). Front surface is IBF treated. This measurements gives c.a. 0.85 ppm, which is however a small spike.

The average signal from both surfaces was evaluated from in-plane x-scans.

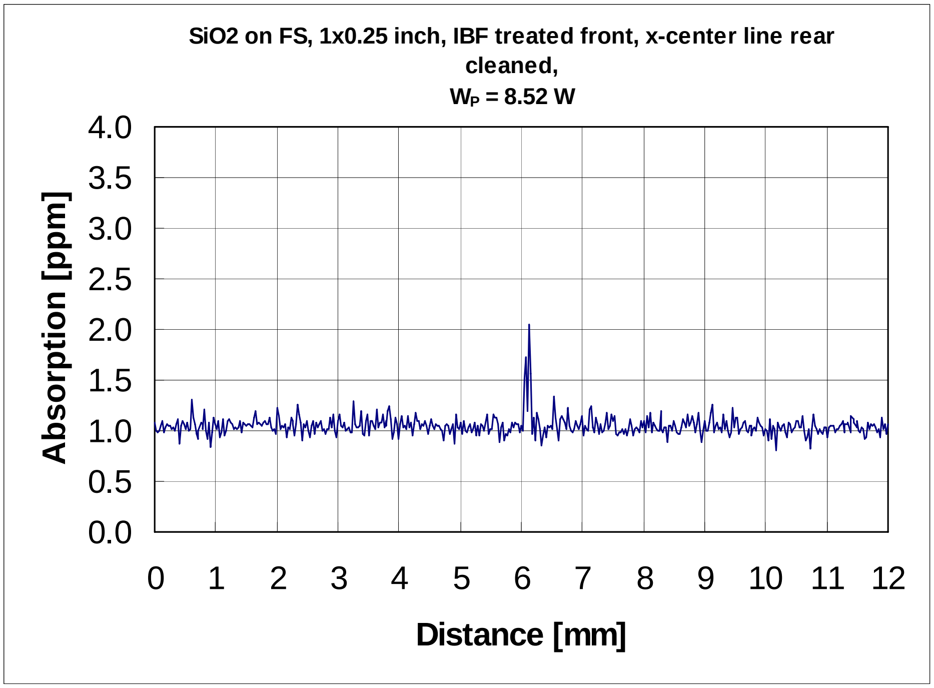


Fig.4. An x-scan along the central area (+/- 6mm from the central point). Untreated surface. As can be seen, the average signal corresponds to what is observed in the z-scans, see figs 1-3. The spike near 6.1 mm (in center actually) is a surface defect since it is accompanied by spikes of other parameters monitored during the scan.

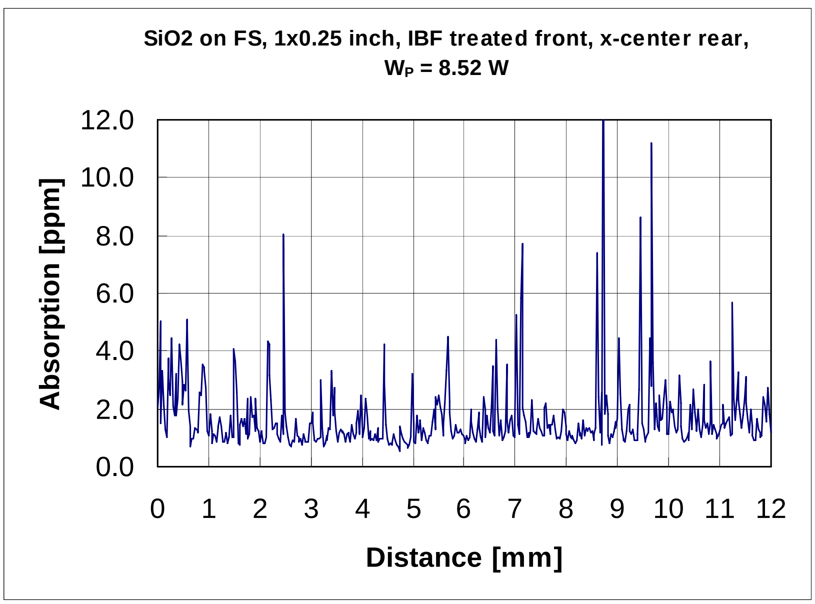


Fig.5. For comparison. Untreated surface before cleaning (from previous report).

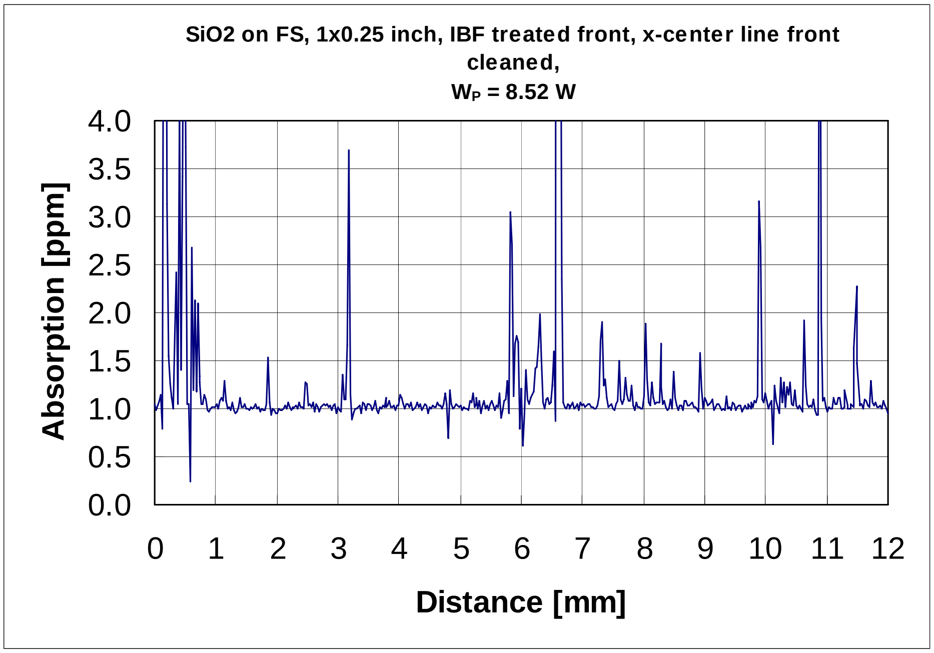


Fig.6. An x-scan along the central area (+/- 6mm from the central point). IBF treated surface. As can be seen, the average signal corresponds to what is observed in the z-scans, see figs 1-3. Several spike are observed though the surface substantially cleaner than before (see figure 7 below). This scan was repeated several times after the scanned line was wiped by a cotton + methanol.

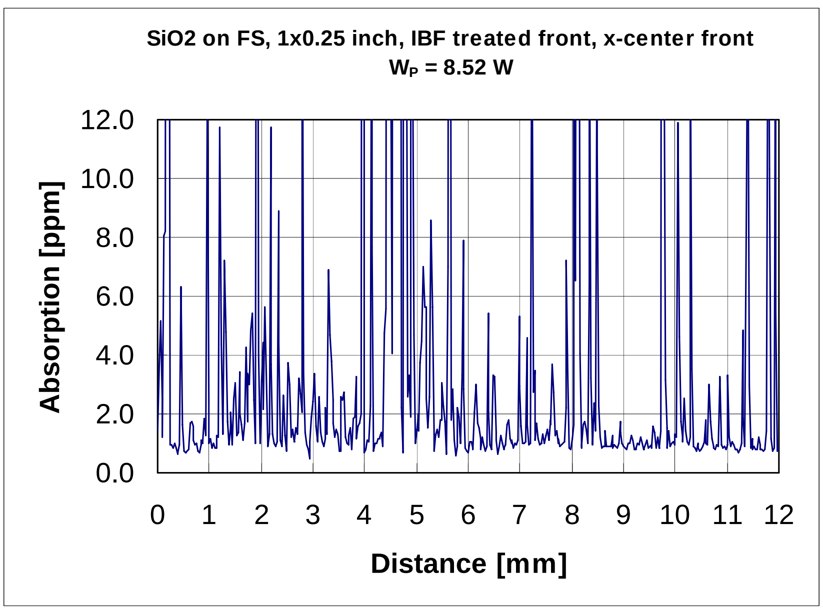


Fig.7. For comparison. IBF treated surface before cleaning (from previous report).

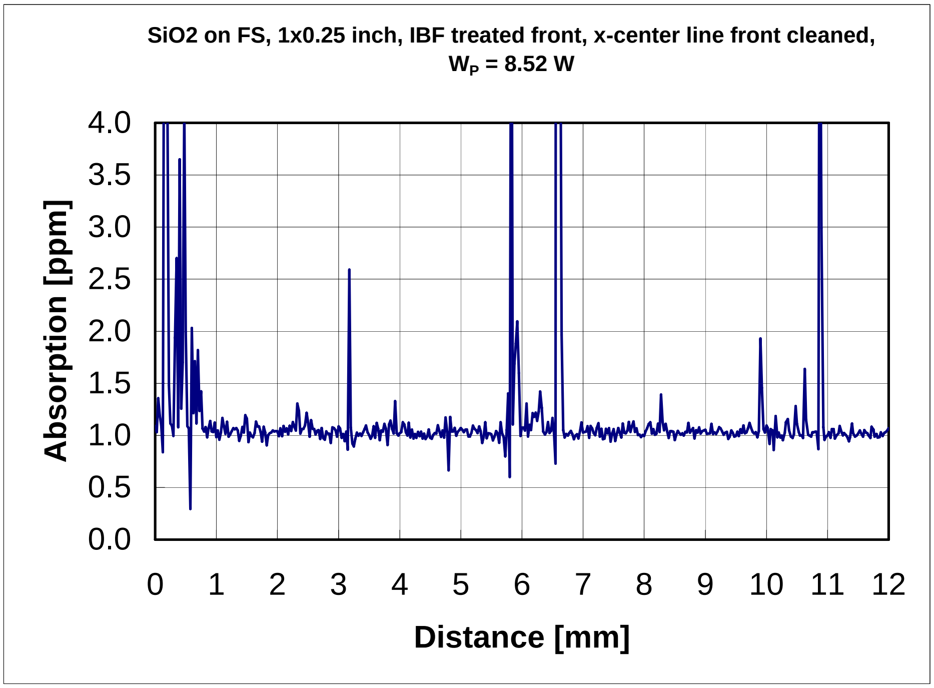


Fig.8. An x-scan along the central area (+/- 6mm from the central point). IBF treated surface after 3several quite hard wiping by a cotton pad damped in methanol. There seems to be a slight improvement compared with figure 6.

The conclusion is as before. IBF treatment does not increase the surface absorption in general. However the surface seems to become more receptive to sticking foreign particles on it. It might also be that foreign particles are sticked to the surface mainly during the IBF treatment (then the ion beam melts the “hills”.

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