Improving solar radiation absorbance of high refractory ceramics by fs Ti:sapphire laser surface treatment

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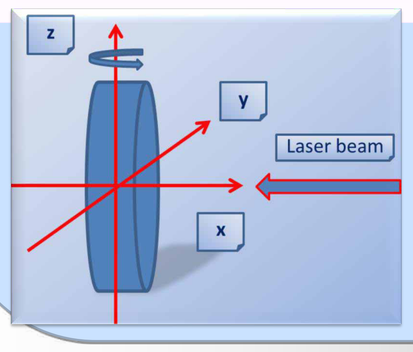
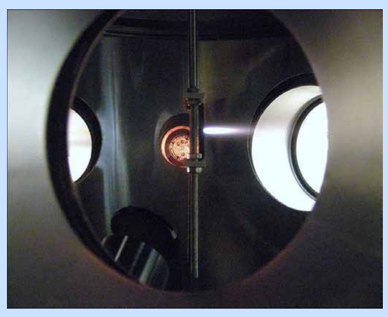
fs Ti:sapphire laser treatment

- Ultra -short Ti:Sapphire pulsed laser source, (Spectra Physics Spitfire Pro XP, 800 nm, 2.7 mJ, 100 fs) operating at
- 800 nm, repetition rate 1000 Hz.
- The beam was perpendicular to the ceramic sample surface
- Focused by a plano -convex lens, focal distance of 300mm.
- An x,y,z translation stage (computer controlled) was employed to obtain a pattern of parallel lines, over square or circular areas.
- All treatments has been carried out in vacuum ($10^{-6} \div 10^{-7}$ mbar)

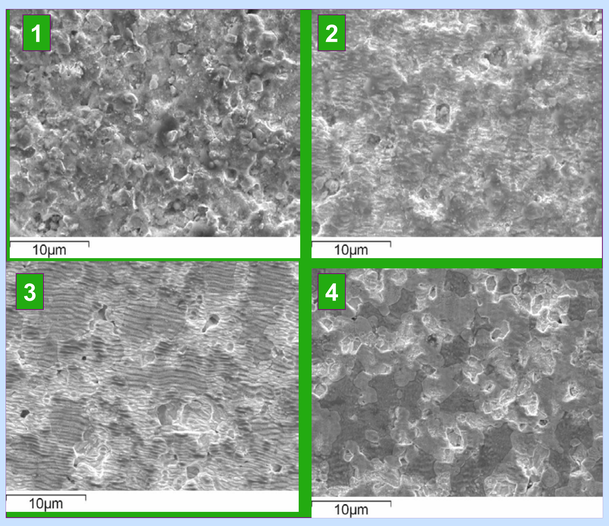


The vacuum chamber with the translation stage (x,y,z)

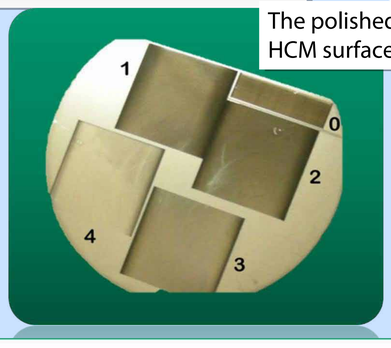


The square areas with different laser treatments

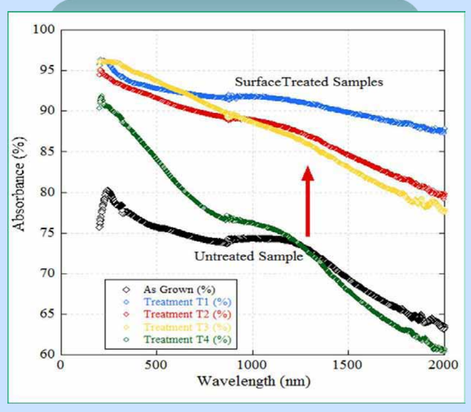
The different surface laser treatments: preliminary experiments



low -resolution SEM images of the corresponding treated areas

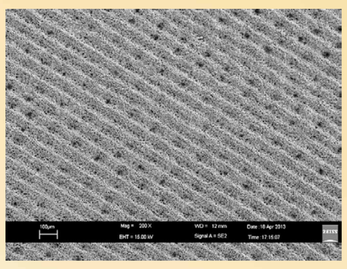


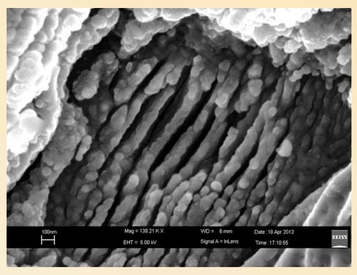
The polished HCM surface

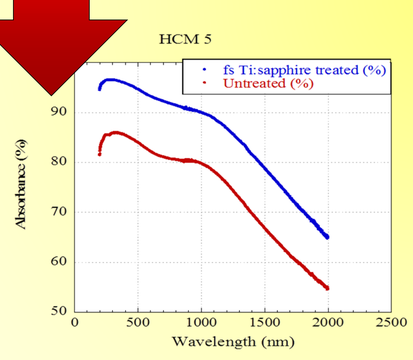


Light absorbance

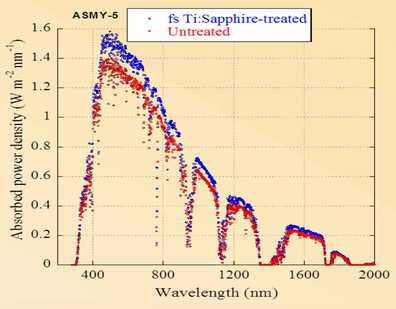
The fs-laser patterned surface of HCM absorber



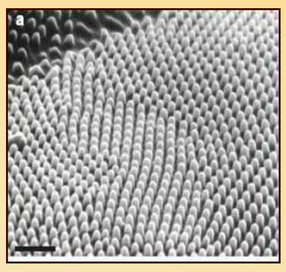




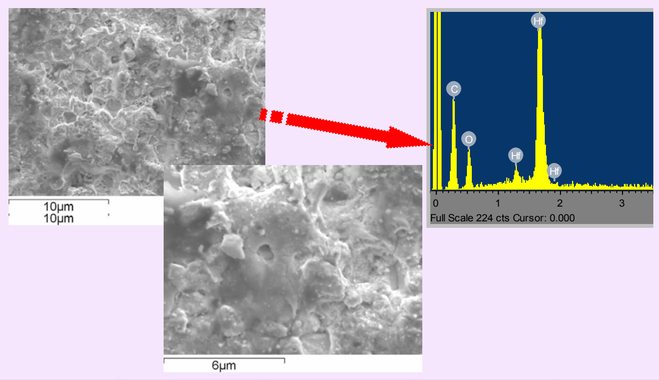
Increased solar radiation absorbance



The mott eye effect



Details of track 1

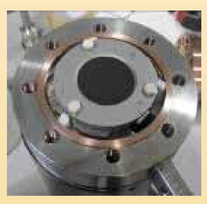


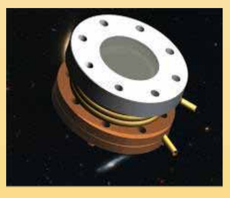
SEM -EDS analysis

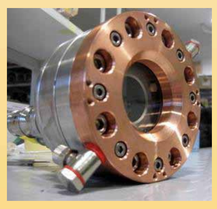
Oxygen enrichment after the laser treatment, but no well -defined pattern, rather a process of surface damage and roughnening due to effect s of ablation / redeposition.

From the fs-laser treated HCM ($HfC + MoSi_2$) sintered ceramic absorber to the Vacuum Encapsulated Conversion Modulus installed at the Solar Test Platform

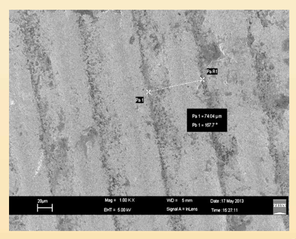
d = 30 mm

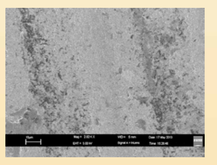


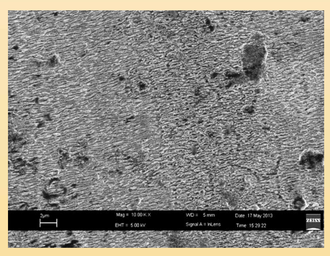


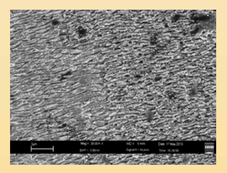


FE -SEM microscopy

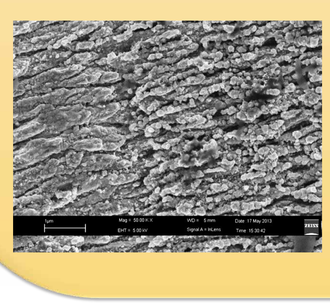


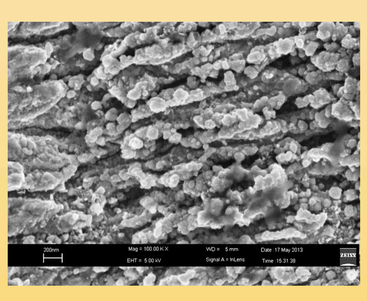






Ripple generation perpendicular to the laser path





Details of ripples with ~ 1/4 and 1/8 perpendicular to the laser path

Acknowledgements

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