THERMALLY STABLILITY OF RARE EARTH OXIDE COATED SUPERHYDROPHOBIC MICROSTRUCTURED METALLIC SURFACES

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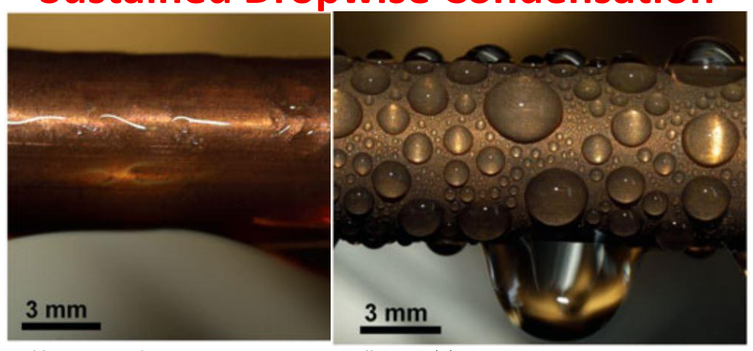
Motivation

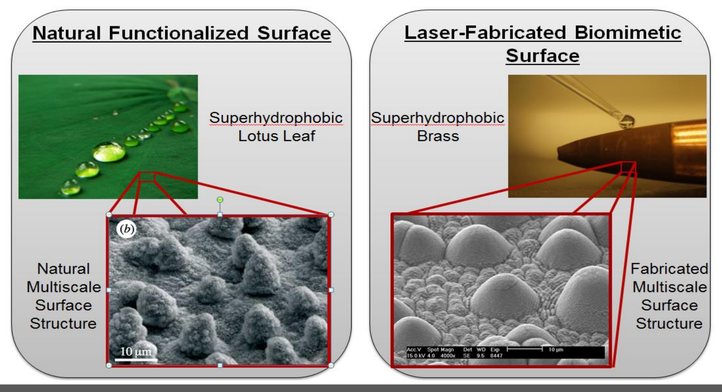
Sustained Dropwise Condensation



Miljkovic, N. and Wang, E.N., 2013. *MRS Bulletin.* 38(5). Pp. 397-406.

Filmwise (left) and dropwise condensation. Dropwise condensation has shown improvements of 5-10x for heat transfer coefficient

Thermally Stable Surfaces

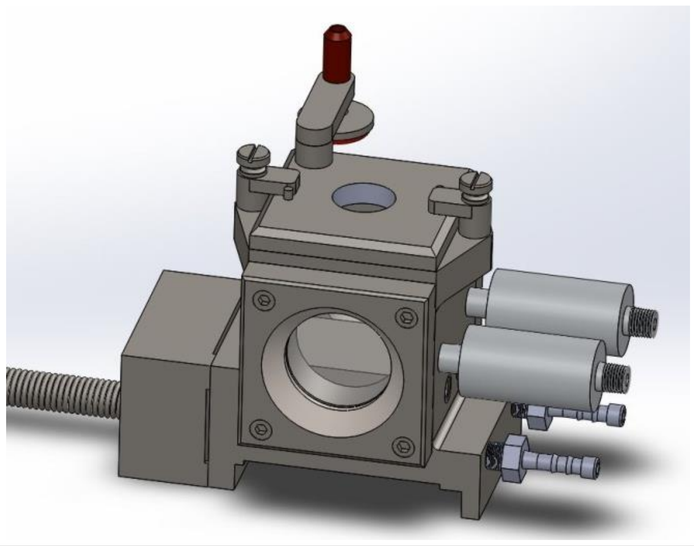


Experimental Setup

Procedure

- Femtosecond Laser Surface Processing
- Sputtering of 200nm Ceo_2
- Surface characterization via XRD/EDS/SEM
- Alternating heat treatment and contact angle measurement
- Post heating surface characterization via XRD/EDS/SEM

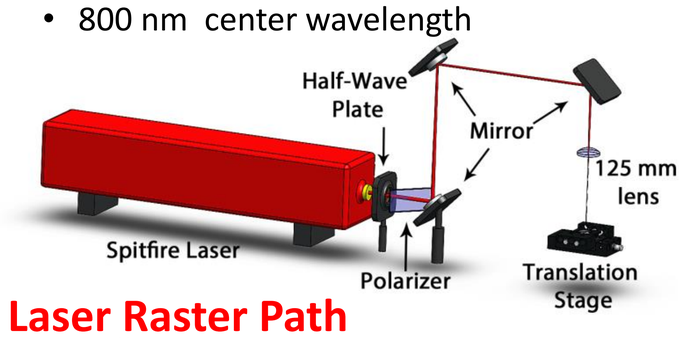
Environmental heating chamber



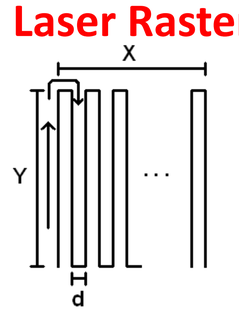
Nano and Microstructure Fabrication & Characterization

Spectra-Physics Spitfire Laser

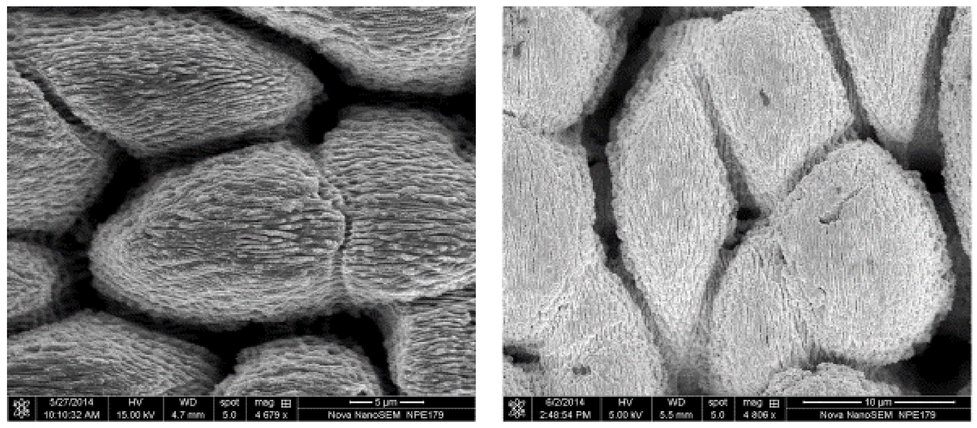
- 50 fs, 1 mJ maximum pulse energy
- 1 kHz repetition rate
- 800 nm center wavelength



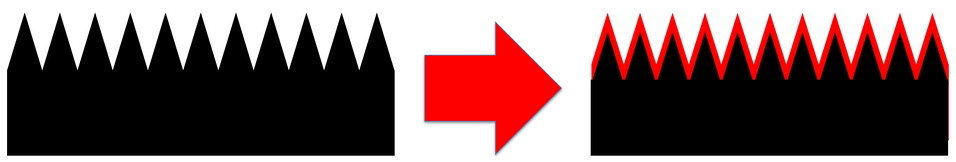
Laser Raster Path



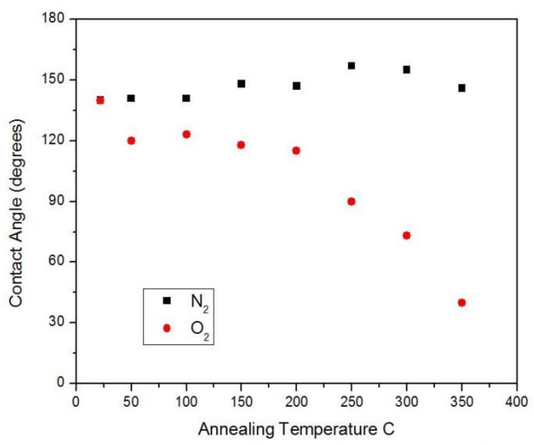
Self-assembled multiscale micro/nanostructures are formed directly on surface

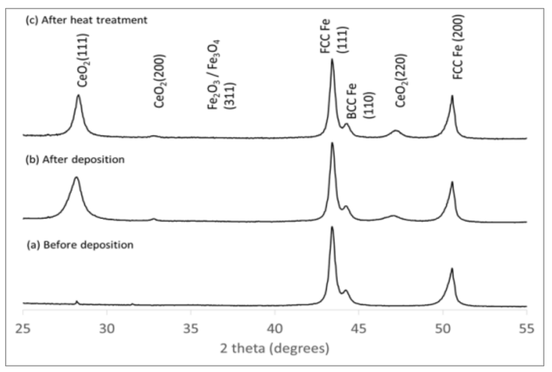


SEM before (left) , and after sputtering of ceria.

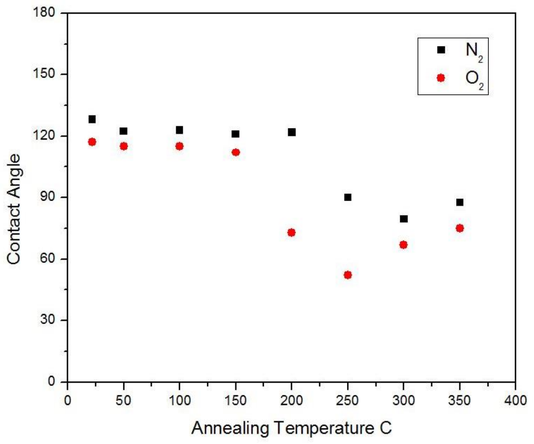


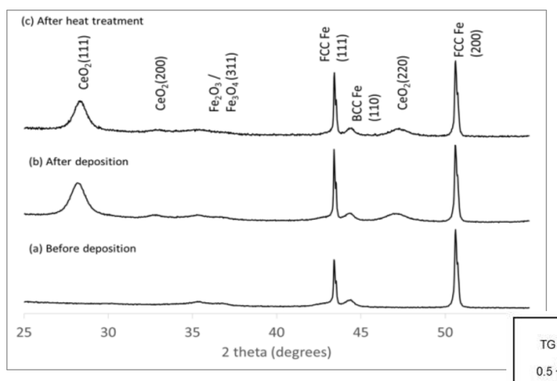
Results and Conclusions





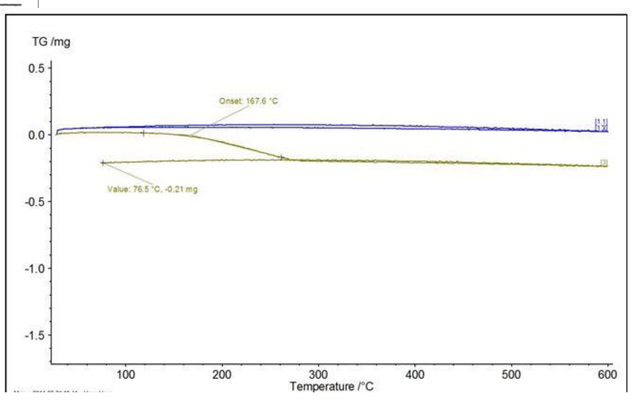
Contact Angle and XRD results after heat treatment of FLSP samples





Contact Angle and XRD results after heat treatment of Mirror-Polished samples

Right: TGA analysis shows significant mass loss from FLSP surface beginning around 160°C.



Observations & Conclusions

- No chemical changes to the surface were found in XRD analysis, while EDS analysis showed a reduction in surface carbon content for one of the polished samples
- Hydrophobicity loss occurred at temperatures corresponding to temperatures at which mass loss (thought to be hydrocarbons or other organic materials) was observed during TGA analysis
- Hydrophobicity of nearly superhydrophobic rare earth oxide surfaces was attributed to adsorption of ambient organic material such as hydrocarbons
- FLSP enhances a surfaces ability to retain adsorbed material during heating

Acknowledgements

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