

Ultrashort Pulsed Laser Micromachining of Sapphire

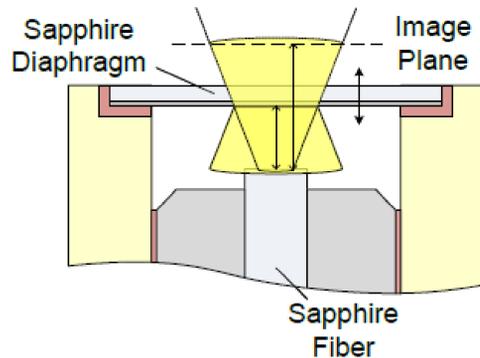
D. Blood¹, D. Mills¹, M. Sheplak¹, W. Oates²

¹University of Florida, Gainesville, Florida, USA

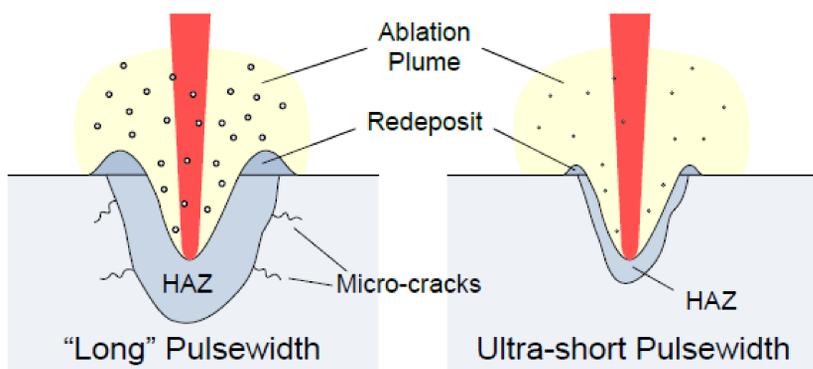
²Florida State University, Tallahassee, Florida, USA

Introduction

- Sapphire is a promising material for high temperature pressure sensor fabrication due to its material properties
- Sapphire's chemical inertness does not allow for effective dry or wet etching methods; consequently, another process must be utilized
- Laser ablation, or material removal by vaporization due to localized heat input, is one potential solution to that problem
- Picosecond lasers are an attractive option because the duration of the pulse is so short that it does not allow for thermal conduction into the crystal lattice of the material
- Research must be done to determine what parameters most effectively produce the least damaged components



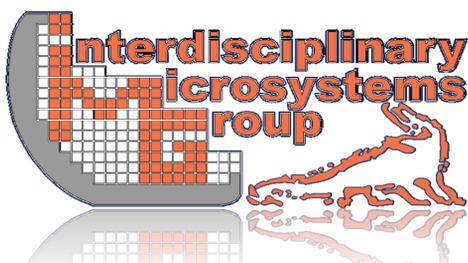
Ultrashort Pulsed Lasers



Ultra-short pulses reduce the heat affected zone (HAZ), redeposit, and thermal energy imparted into the workpiece

Material	Pulse Length
Metals	1 ps
Ceramics	10 ps
Plastics	1 ns

Approximate maximum pulse lengths for material removal by ionization to dominate

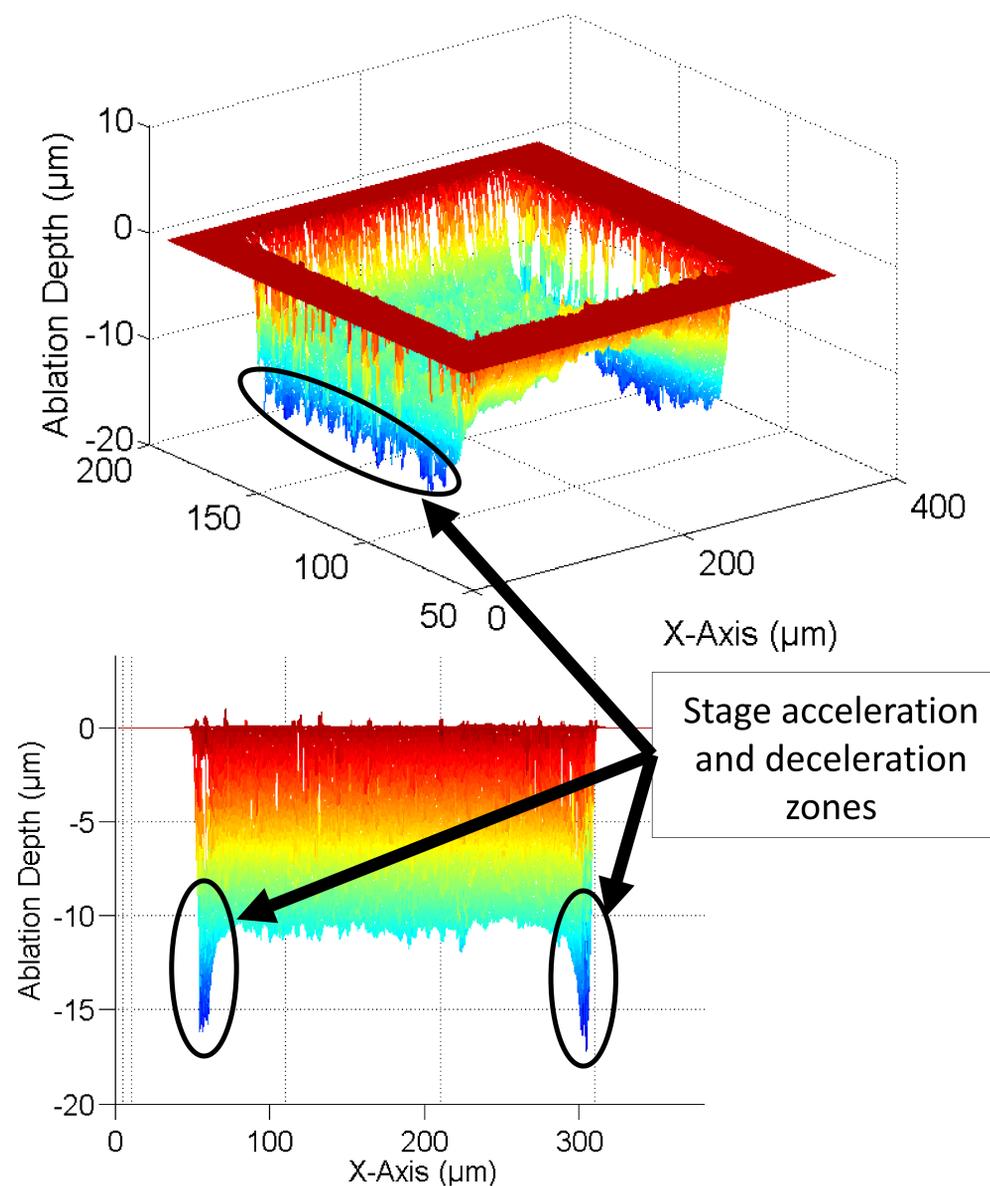


Experimental Setup

Coherent Talisker Ultra Industrial Picosecond Laser System

- 355 nm diode pumped solid state laser (Nd:YAG)
- 4 W max power at 200 kHz
- Pulse Length 10-15 ps nominal
- Pulse Frequency 0-200 kHz capable
- Beam Attenuator 0-100% in 0.5% increments
- Galvanometer scanner capable of feeds up to 1000 mm/s
- X-Y Stages with 200 mm x 200 mm travel
- Z Stage with 100 mm travel for focal depth adjustment

Stage Acceleration Regions



Acknowledgement

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