

Application Note #05

Cutting with Long Pulse Fiber Lasers YLR 150/1500-QCW-AC

Introduction

The work presented in this Application note summarizes cutting of different materials with IPG's long-pulse YLR-150/1500-QCW-AC laser. Although alternative fiber diameters are available in this series for other applications, only a single 50 μm diameter fiber was employed for these cutting trials. This laser can be run in pulsed and CW mode; however, this note focuses on pulsed performance related to cutting.

Experimental

Cutting test trials were carried out on a 3-axis CNC machine center with a cutting head using a co-axial assist gas and incorporating autofocus control. A 100 mm focal length was used producing a theoretical spot size of 50 μm at the workpiece.

Results

High quality cuts up to 4 mm thick in steel, aluminum and in highly reflective copper have been achieved with only 150 W average power. Industry data indicates it has not been previously possible to cut this range of materials without using much higher average power fiber lasers.

CUTTING APPLICATION

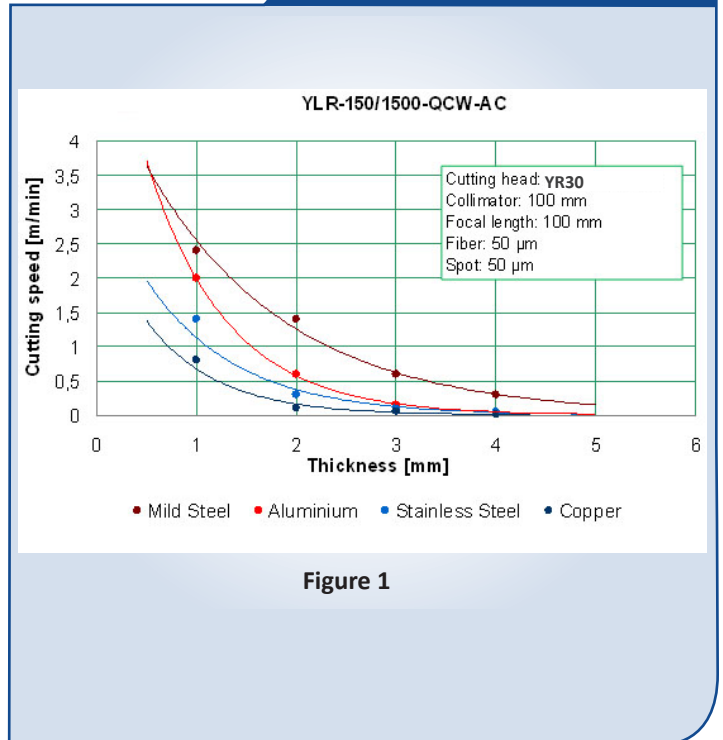


Figure 2: Sharp-edges, dross free, low roughness

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Stainless Steel

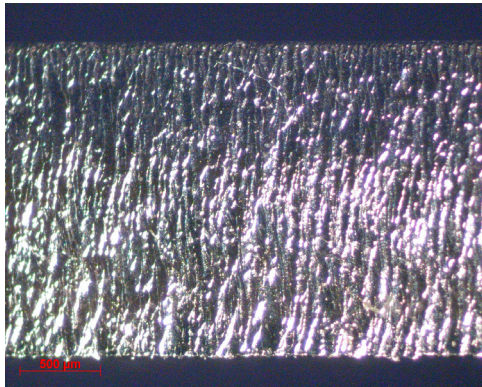


Figure 3a

2 mm P_{av} : 150 W
Frequency: 500 Hz
Cutting Speed: 0.3 m/min

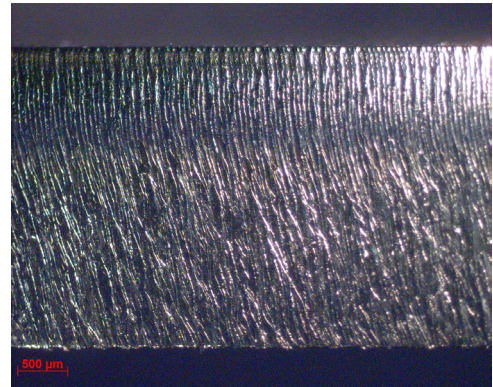


Figure 3b

3 mm P_{av} : 150 W
Frequency: 200 Hz
Cutting Speed: 0.1 m/min

Mild Steel

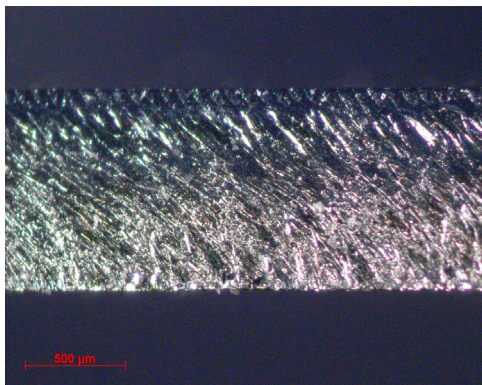


Figure 4a

1 mm P_{av} : 150 W
Frequency: 500 Hz
Cutting Speed: 2.4 m/min

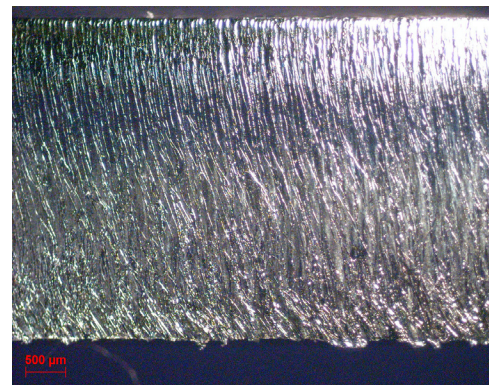


Figure 4b

4 mm P_{av} : 150 W
Frequency: 200 Hz
Cutting Speed: 0.3 m/min

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Aluminium

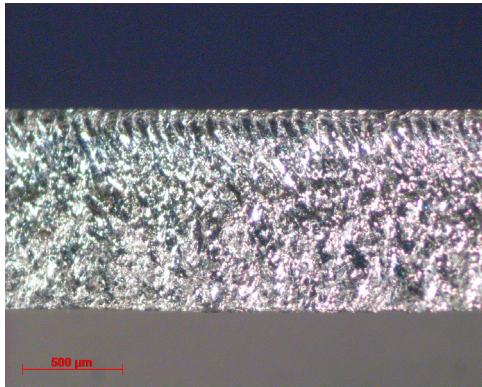


Figure 5a

1 mm P_{av} : 150 W
 Frequency: 500 Hz
 Cutting Speed: 2.0 m/min

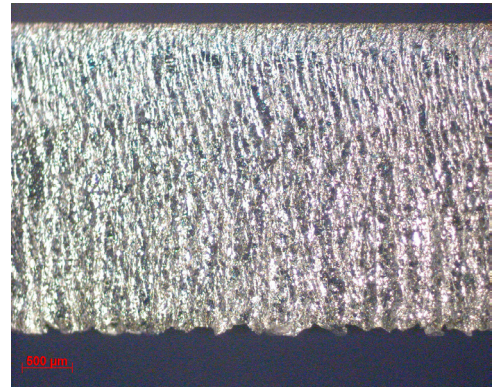


Figure 5b

3 mm P_{av} : 150 W
 Frequency: 10 Hz
 Cutting Speed: 0.05 m/min

Copper

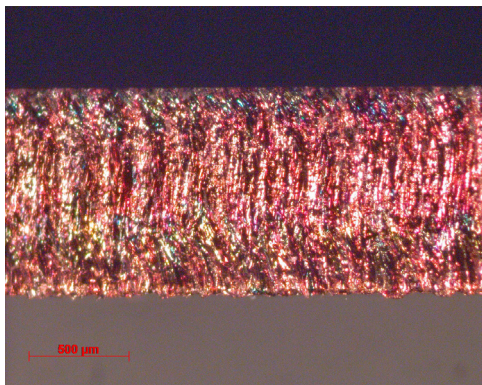


Figure 6a

1 mm P_{av} : 150 W
 Frequency: 500 Hz
 Cutting Speed: 0.8 m/min

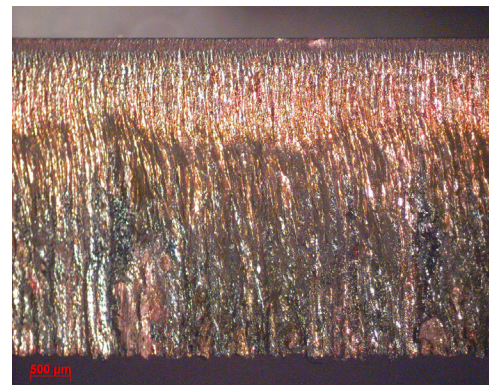


Figure 6b

4 mm P_{av} : 150 W
 Frequency: 10 Hz
 Cutting Speed: 0.007 m/min

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Conclusions

- The range of materials and thicknesses cut to a high quality standard by low average power & lower cost lasers is significantly increased.
- The gap between single mode fiber lasers for high speed cutting of thin materials and higher power multimode lasers for cutting of thicker materials has now been filled.
- This high pulse energy, high brightness fiber laser is a more efficient, compact & maintenance-free laser alternative to lamp-pumped Nd:YAG lasers for cutting these materials.

Summary

IPG Photonics looks forward to helping our customers with their laser applications; our Application Facilities will work with end users and systems integration partners from proof-of-concept through process development for all materials processing applications. Contact any of IPG's worldwide application facilities to arrange complimentary sample processing, evaluation and project planning. Go to www.ipgphotonics.com for more information on all of IPG's products.

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