APPLICATION NOTE

CO₂ Laser Cutting of Holes in Polypropylene (PP) for Automobile Bumper Covers

Introduction

Polypropylene (PP) is a type of thermoplastic polymer widely used in automobile bumper covers due to its unusual resistance to chemical solvents, acid, and bases. PP bumper covers house a variety of sensors in custom locations. Those sensors are mounted in precision-cut "option" holes. That precision is achieved through the use of CO_2 lasers with great flexibility for hole size, high throughput, and attractive appearance after laser cutting.

Process

PP has good absorption in the 9-11 µm spectral range, especially at wavelength of 10.2 µm. During this process, the CO_2 laser beam was steered by galvanometer mirrors into telecentric scan optics (which always deliver a normal angle of incidence at the material surface). The laser was focused at the center of the PP plate with spot size of about 130 µm. The PP material was heated and melted by laser, and the melted material was simultaneously blown away with a coaxial assist gas delivered from cutting head.

Comparison of results using 10.2 µm and 10.6 µm CO_2 lasers having the same power levels (ranging from 100 W to 150 W) was performed. Both lasers utilized the same optical path, and therefore had only a slight difference in spot size caused by the wavelength difference.

Results

With 100 W from the 10.2 µm laser, 3.5 mm thick PP was cut at rate of 35 mm/s. This cutting speed is expected to scale up with high powers. The cutting speed achieved with the 10.2 µm laser is 50% higher than that realized with the 10.6 µm laser having the same power level. The surfaces and edges of holes cut in the PP were smooth, with minimal burrs and discoloration, at both wavelengths.

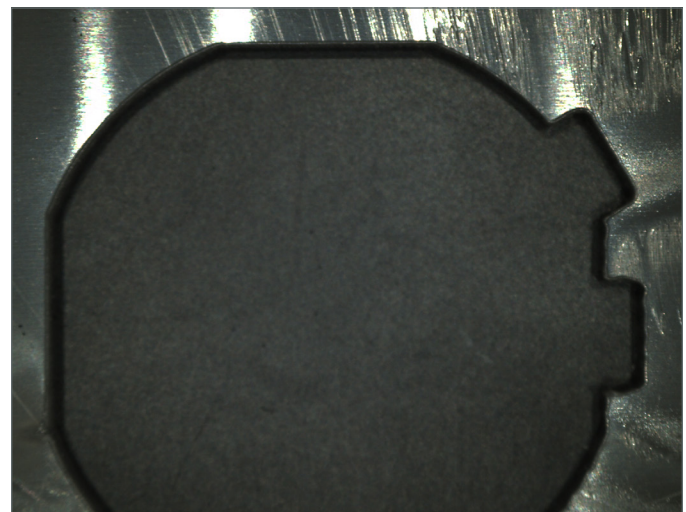Coherent Diamond CO_2 lasers: J-3 (>225 W) and Cx-10 (>100 W)

Inner edge of cut holes with 100 W, 10.2 µm wavelength CO_2 laser

Top view of cut hole with 100 W, 10.2 µm wavelength CO_2 laser

Application Field

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Contact

Coherent Applications Lab: Bloomfield, CT
Email: appslab@coherent.com

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