# STUDY ON EFFECTS OF $CO_2$ LASER ABLATION CONDITIONS ON CUT PARAMETERS AND MICROSTRUCTURES

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## Abstract

Laser ablation is a technique that is highly embraced in many applications and especially in Micro-Electro-Mechanical Systems (MEMS) industry. This work focused on development of a Carbo-dioxide gas ($CO_2$) laser system, a control program to run the system and determination of the effect of machining conditions such as machining time and the number of passes on cut parameters. Effect of compressed air as the assisting gas on hole profiles and glass cracking were also investigated. The materials experimented with included wood, perspex, ceramics, glass, mild steel and aluminium. These materials were first prepared and the number of passes and machining time varied. It was observed that due to the low power of the laser, mild steel could not be machined. A coating was applied on the surface and left to dry before machining. Cut parameters (kerf widths, inner and outer hole diameters, heat-affected-zone (HAZ), taper, depths machined) and microstructural changes were measured as an indication of the cut quality. Profile Projector was used for perspex and glass measurements and a travelling microscope on wood. Wood and perspex were easily laser cut although wood produced charred edges. Mild steel was hard to machine due to its high reflectance to $CO_2$ laser wavelength but visible marks were made after coating. After coating, mild steel specimens were exposed to the beam for 30-500 s and their microstructural changes observed. It was observed that there were microstructural changes on all the cases. Another factor observed was the tapering effect on the holes and cuts made due to the Gaussian nature of a laser beam.