



**INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS**

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SHORT ABSTRACT

Magnesium alloys have low density, high specific strength, high stiffness, superior damping capacity, high thermal conductivity and good electromagnetic shielding characteristics. These properties make them suitable for a wide range of industrial applications. In present work, experimental and numerical studies were carried out to assess the feasibility, productivity and product quality during laser based bending of magnesium alloys. The experimental studies revealed that magnesium alloys can be bent with laser bending process without catching fire and significant deterioration in mechanical properties. Numerical model was developed by considering temperature and strain rate dependent material properties and the effect of melting. A model based on standard beam propagation equations was used to obtain beam diameter from stand-off distance. The straight line, curvilinear and multi-scan laser bending of magnesium alloy M1A sheets were investigated by using the developed numerical model. The effects of process parameters, viz. laser power, scan speed, beam diameter, scanning path curvature and number of scans on performance parameters such as temperature and stress-strain distribution, bend angle, edge displacement and edge effect were studied. It was observed that laser bending process parameters have a complex interactive non-linear effect on performance parameters. In curvilinear laser bending, it was observed that bending does not occur along the scanning path unlike in straight line laser bending. The results showed that bending was offset outside the scanning path. Laser bending does not generate large bend angles in a single scan and hence multi scan laser bending was studied. Large bend angles as high as 18° could be achieved in ten scans. The changes in bending mechanism, bend angle and edge effect with number of scans were explored during multi-scan laser bending process. A novel integrated, simple and efficient technique of laser assisted bending with moving pre-displacement load was proposed for bending of large sheets. The experimental setup was designed and developed to achieve the defined objectives. It was observed that the proposed technique was able to generate large bend angle in a single scan. The numerical model was developed and validated for the proposed technique. The validated model was used to investigate the effects of laser power, scan speed, beam diameter and pre-displacement on the bending mechanism, edge displacement, residual stresses, bend angle, edge effect and spring-back effect during laser assisted bending with moving pre-displacement. The present work contributed systematic and extensive numerical as well as experimental studies on laser bending of magnesium alloy M1A.