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Advanced in mould assembling technologies for high precision polymer based optical components

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ABSTRACT

Today the major goal of any company is to produce faster and cheaper. Was base on this daily object that this project will be implemented, through the integration of different processes in the same production cycle time. For this, will be combined a laser, a robot and a mould with rotative plaques on the same process. With the application of the laser will be necessary make spectroscopy tests for analyse the light transmittance through of the parts for understanding if is possible weld the two plastic parts and how many laser power is necessary. Nowadays is also important take in consideration the environment, for that reason will be use conductive polymers and LEDs. These two solutions will help reduce the number of production process and the amount of disposal in the final of the life cycle. Is important take in consideration that LEDs need less energy to illuminate the same area as the common light. This integration will be study in an existent motorcycle tail light.

INTRODUCTION

Along of these last years, welding laser technology is being improve and growing in a very competitive market, where is possible finding innumerous solutions, since glue to complex processes as ultrasonic welding process. This market increment is achieved by the versatility that is type technology is capable, mainly because the linkage between the laser head and the robot. With this its possible weld almost whole plastic parts, that exist on the market, the exception is welding different materials with a melting temperature difference of 50ºC.

In this technology is possible finding two possible processes, the direct and by transmission. The first process is use mainly in plastic films. In this case the two material are in parallel and connected by a surface and both absorbs a the same time the beam energy. The second process is the most used, mainly because the major part of plastic are transparent to the laser beam (600 to 1180 nm). To overcome this difficulty is common use additives as black carbon or lumogen or clearweld, for improving the absorption. The weld by transmission is very simple process, two materials one transparent to the laser and other with the capability of absorbing the laser, are united by pression where laser pass making the seam.

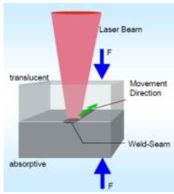

figure 1 welding by transmission

beside the laser technology, this project has also the objective of applying LEDs (light-emitting diode) and conductive polymers to the motorcycle tail light. The application of these two will help diminished the electric consumption of the lamp and also improve the flexability of the design. This flexability is acchived by the capacity of injecting the conductive polymers.

DEVELOPMENTS

Like was describe before this study will be applyed to a commercial part, in this case a motorcycle tail light. This light is built from three parts a black part named housing made in PC, an incandescent light bulb, and a lens made in PMMA having the colour red.

figure 2 actual tail light

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One of the main achievements of this project is the application of laser technology inside of a mould. To achieve this, will be initial assumed that housing has the capability of absorbing, and the lens transparent to the laser. For confirming this initial assumption and understand the influence of the red additive in the beam transmission through the part, was made a spectrocospy. This analysis was made in a Shimadzu UV/VIS spectroscope between 600 nm to 900 nm. Where analysed three samples, one without red additive, another with 0,05%wt of red additive and third one with 0,1%wt of red additive. With this was possible confirm the assumption and see that PMMA is transparent enough for making a good seam. The additive didn't show any influence on the light transmission through de part.

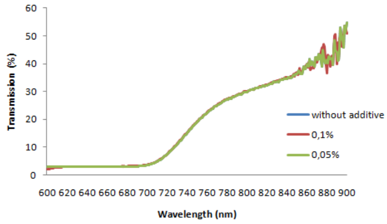

Figure 3 PMMA spectroscopy

The next step was applying the LED technology and conductive materials to the tail light in study. For making this, was choose the HPWT-MD00-F4000 LED of Lumileds Lighting U.S. and the conductive material EMI 333 G FR Polycarbonate (PC) of the rtp company. The main reason for choosing this LED was his high luminous flux output, in the case of conductive material was his low resistivity in this case <1 ohm.cm.

For the development of this new tail light has taken in consideration the legislation of UNECE Vehicle Regulations - 1958 Agreement; Regulation No. 50 - Rev.2 - Position lamps, stop lamps, direction indicators for motor cycles. According with this law the tail light need to be visible at the distance of 100 m and need to have luminous intensity of 4 to 12 candela to the rear position light and 40 to 185 candela to the stop light.

During the development of the rear light, was realized that LED light distribution doesn't accomplish the angle requirements. For that reason was necessary apply some notions of lighting propagation, as the secondary optics (pillow lens and reflector cavities). Applying the conductive materials and secondary optics was achieved the following design.

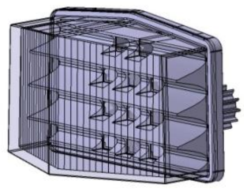

figure 4 the new tail light

Is important state that the all process will be made inside of the same mould. For achieve this, was decided to use rotative plates, like is shown in the following figure.

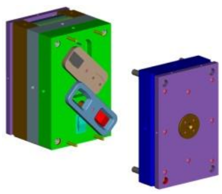

figure 5 mould concept

CONCLUSIONS

Until now was possible concluded that the combination of laser welding and in mould assembling is faster and saves more material and tasks that the common processes.

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UNECE Vehicle Regulations - 1958 Agreement; ***Regulation*** No. 50 - Rev.2 - Position lamps, stop lamps, direction indicators for motor cycles

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