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ECL용 유리기판의 레이저 저온 실링처리

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The Low Temperature Laser Treatment of Sealing Glass Substrate for ECL

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Abstract - In this paper, we reported fabrication of sealing the glass substrate using laser treatment at low temperature for electrochemical luminescence (ECL) cell. The laser treatment at temperature is using laser diode. The glass substrate sealing by laser treatment tested at 1-5 W, 1-5 mm/s for builted and tested. The sealing laser treatment method will allow associate coordination between the two glass substrate was enclosed. The effect of laser treatment to sealing the glass substrate was found to have cracks and air gap at best thickness of about 845-780 μm for condition 5 W, 1-5 mm/s. The surface of sealing was roughness which was not influent to electrodes So, it is more effective viscosity between two glasses substrate.

1. Introduction

The electrochemical luminescence (ECL) cells are known in phenomena light emitting device by oxidized and reduced reaction in organic molecules [1]. The ECL cell is composed of a transparent conductive oxide (TCO) glass and Ru (II) Complex electrolyte. Generally, the enclosed area of ECL cell by epoxy sealing, which more thickness of distance between electrodes about 60 μm. However, the sealing method of ECL cell has techniques such as epoxy sealing, plastic sealing and so on. From, these problems can be improved by laser treatment method which less than thickness at distance about 600 nm and have not crack, not air gap, not leakage solution of material, high resistance for distance electrode and can endure heat. The used laser diode for sealing can be helped smooth on surface due to low temperature while sealing on glass substrate and no damage to the workpiece.

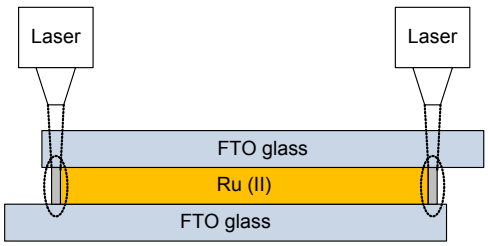
The light amplification by the stimulated emission of radiation (LASER) diode is modern lasers which formed by the p-n junction of a semiconductor similar to that found in light-emitting diodes [2-3]. The laser diode is formed by injection into electricity. The laser diode can be widely used for application in the industry such as optically pumped laser diodes, laser diode for welding seal and other. The output optical of laser diodes will be light emitted power (pump) beam, which often encourages occur by laser diodes.

In the study, we are fabricated laser treatment at temperature for sealing the glass substrate on ECL cell. The welding seal between distance electrode glass substrate at low temperature using laser diode was investigated thickness, crack and tightness on surface. The surface of the weld is expected cracks or air gap decreasing.

2. Experimental Setup

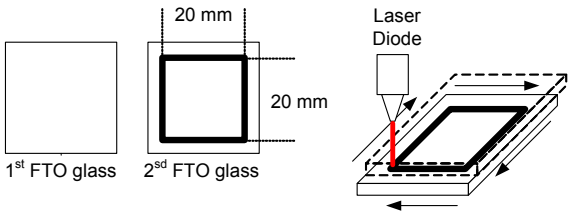
The laser treatment at low temperature for ECL cell can be shown structure in figure 1. The ECL cell consists of fluoride tin oxide (FTO) glass/ Ru (II) Complex/ FTO glass [3]. And, the seal used by laser diode welding at 20 x 20 mm^2. The laser treatment at low temperature for ECL cell used laser diode method in the composition is a semiconductor laser diode which is Nd:YAG laser (output: 80W, wavelength: 800 ±3nm) with optical was employed at wavelength 800 nm and spot size 2.0 mm. The laser diode beam was injected on FTO glass at 400 nm of thickness.

The temperature of laser treatment for ECL cell was 150°C on surface glass substrate sealing. The condition of sealing by laser treatment at low temperature can be helped to leakage of electrons and chemical solution to outside. The glass substrate of FTO glass not influence to conductive on glass.



<Fig. 1> Laser sealing glass substrate for ECL device.

The production of sealing the glasses substrate using laser treatment at low temperature for electrochemical luminescence (ECL) cell were fabricated glass substrate cleaned by ultrasonic cleaner and micro-UV treatment, dried at 120°C 45 minutes [4]. The second FTO glass injected by laser diode welding, was square enclose 20 x 20 mm^2 at 1-5 W, 1-5 mm/s for built and test. After that, the laser diode was sealing overlapping the printed FTO glass substrate and the lower plate glass. The glass substrate was molted by irradiating the laser from the top of the substrate due to gravity of junction off the bottom plate glass, show in figure 2.

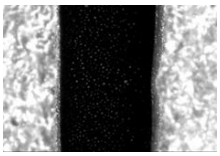


<Fig. 2> The production of sealing by laser diode.

3. Experimental Result

Figure 2(a) are show photographs results after weld sealing by laser diode at 3 W, 3 mm/s. The sealing on FTO glass has spot 2.0 mm and length enclosed 20 x 20 mm. The weld making the thermal expansion coefficient is similar to the glass substrate which glass substrate deformation due to thermal expansion coefficient difference prevention. Our glass substrate using laser welding pre-test (condition 5 W, 3 mm/s) is melting phenomenon was observed. The scanning electron microscope (SEM) of sealing the glass substrate using laser treatment at low temperature, it is seen that on surface has not crack, not broken and 800 nm of thickness, in show figure 3(b). The sealing of glass substrate has surface particle roughness which is caused by the welding speed.

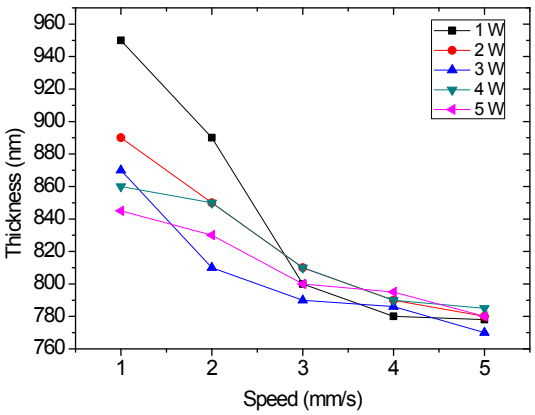
(a)



(b)

<Fig. 3> (a) Photographs of sealing glass substrate (b) SEM of laser diode sealing.

The thickness of sealing by laser treatment at low temperature was prepared glasses substrate 1-5 W of power beam and at condition 1-5 mm/s of speed for built and test. It can be summarized results following: thickness of 1 W was 950-780 nm, thickness of 2 W was 890-790 nm, thickness of 3 W was 870-770 nm, thickness of 4 W was 880-790 nm and thickness of 5 W was 845-780 nm. The optimum of power beams was 5 W due to it has in thickness of sealing less than another power beams.



<Fig. 4> The relationship speed-power beam of laser welding.

4. Conclusion

The application of laser diodes is in the sealing between the electrode glass substrate at low temperatures for ECL cell. The speed control and power beam of laser welding is increased; the thickness and spot of line glass substrate is decreased. The optimum of power beams was 5 W (condition 1-5mm/s) which has thickness at 845-780 nm. It can reduce the cracks, crevices and air gaps as well, improves the performance viscosity in butter bus bar electrodes.

Acknowledgments

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[References]

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