Analysis of Temperature Distribution according to Cooling Condition of Edge sealed Glass

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1. Introduction

If glass with improved insulation performance is vacuum glass by joining two glass edges and keeping the inside in a vacuum state, the study of vacuum glass was conducted on each core process. A variety of studies have been conducted on tempered glass according to its various application areas, but in the case of vacuum glass, there is a lack of research on tempered glass. Thermo-hardened glass refers to glass whose intensity has been increased by the difference in residual stresses outside and inside the glass by heating the glass to a glass pre-heating temperature and then rapidly cooling it. In this paper, experiments and basic analyses were carried out for thermal hardening of vacuum glass with edges bonded. Glass transfer temperature of glass was set to initial temperature and the temperature characteristics of glass were analyzed according to cooling conditions. Based on the analysis results, cooling conditions for thermal hardening were reflected and applied to thermal hardening of corner junction glass.

2. Properties and parameters

The actual strength of glass is between 35 and 70 MPa, which is 1% of the theoretical strength, and the glass is reinforced and used in various ways, including thermal hardening, ionization, coating, etc., to compensate for the shortcomings of this glass. Strengthened glass has three to five times the bending strength, three to eight times the shock resistance, and is of superior heat resistance compared to ordinary glass. Among the various hardening methods, thermally reinforced glass is glass that is heated to between 500 and 700°C close to the softening temperature of the glass and cooled rapidly, causing compression stress on the glass surface and tensile stress inside, which increases its strength due to residual stress differences inside and outside the surface.

In this paper, the temperature distribution of glass according to the nozzle design variables in the design of reinforced glass was analyzed through analysis for thermal hardening of corner junction glass. The diameter of the nozzle, the clearance between nozzle and glass, and the clearance between nozzle are set as design variables.

3. Finite element analysis

The analytical model is reinforced to spray air through nozzles after placement of rollers and mating glass inside. The analytical conditions were set to 600°C for the initial temperature of the glass considering the conduction and convection of the glass, and the air with a temperature of 25°C for the top and bottom of the glass was set to an ideal gas state and set to a pressure of 500Pa through the inlet. The pressure inside the bonding glass is set at 1 torr level assuming a low vacuum condition.
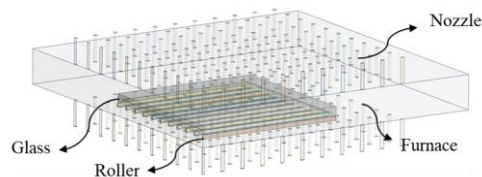

Fig.1 Schematic diagram of tempering system

4. Conclusion

The experiment was conducted in the order in which the rollers inside the reinforcement furnace were rotated and raised in the heating zone, and the cooling fan was moved to the heating zone where it was operating when the temperature reached 600°C, cooled down, and discharged.

Acknowledgment

References

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