PC/ABS 복합재 기반 카오디오 샤시의 사출 조건에 관한 연구

Analysis of injection moliding conditions of car audio mold chassis using PC/ABS based composites

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1. Introduction

Automobile industry now is trying to improve efficiency as a warning for future environmental regulations such as a 2005 Kyoto Protocol [1]. The main way of improving efficiency is reduction of weight. Especially, the materials of car components are gradually being replaced by engineering plastics and aluminum which are lighter than steel. In this study, as one of this research, reduction of car audio weight was analyzed. In particular, the optimized injection molding conditions of car audio mold chassis was conducted. As a material of mold chassis, PC/ABS composite was used because PC/ABS has excellent mechanical properties [2] and moldability [3]. In addition, metal fiber and glass fiber were mixed with PC/ABS to improve mechanical properties and EMI shielding effectiveness. In other words, the even distribution of metal fibers and glass fibers are very important because it determine the quality of mechanical properties and EMI shielding effectiveness of mold chassis. Therefore, the conditions of injection molding will be assessed by the distribution of metal fibers and glass fibers.

In this study, injection molding was done by different types of catapults and different temperature conditions. Two types of catapults were used. One type is hydraulic catapult and other type is high speed injection catapult. Besides, injection molding of high speed injection catapult will be done according to three different temperatures. Among these conditions, the proper injection molding conditions were evaluated by the distribution of metal fibers and glass gibers.

2. The design of car audio

Fig. 1 shows the basic design of car audio. Car audio is mainly divided into two main part and front part, and chassis is included in the main part.

3. Injection molding of mold chassis

Table 1 indicates injection molding conditions. As shown in Table 1, injection pressure of hydraulic injection is higher than high speed injection. However, injection speed of high speed injection is faster than hydraulic injection, molding time of high speed injection is shorter than hydraulic injection. Especially, in the case of high speed injection, injection molding was done at three temperatures 265°C, 280 °C and 300 °C. In addition, Fig. 2 shows the product of car audio mold chassis manufactured in above conditions [4].

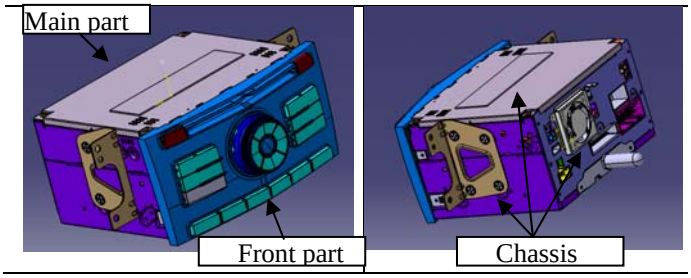

Fig.1 Basic design of car audio

Table 1 Conditions of injection molding

Condition	Hydraulic injection	High speed injection		
Injection pressure(Kg/Cm^2)	125	50 - 80		
Injection speed	75	100 – 200		
Cycle time(s)	56.7	30		
Injection temperature(°C)	255	265	280	300

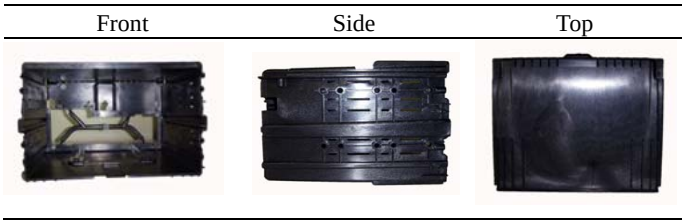

Fig.2 The product of car audio mold chassis

4. Analysis of flow lines of mold chassis

Fig. 3 shows flow lines of top surfaces of mold chassis. In the hydraulic injection, flow lines were gathered in a center point. This phenomenon is called ‘Flow Mark’. It is mainly because the injection speed is relatively low. Conversely, in the high speed injection, flow lines do not converge in center like hydraulic injection. They show traces like an earthworm’s wriggle. It is called ‘Jetting’. This is mainly caused by high injection speed. These ‘Flow Mark’ and ‘Jetting’ can be solved by the regulation of injection speed or the control of nozzle and mold temperature.

5. Morphology analysis

To analyze the qualities of injection molding conditions, morphology analysis(distribution of fillers) was done. Morphology

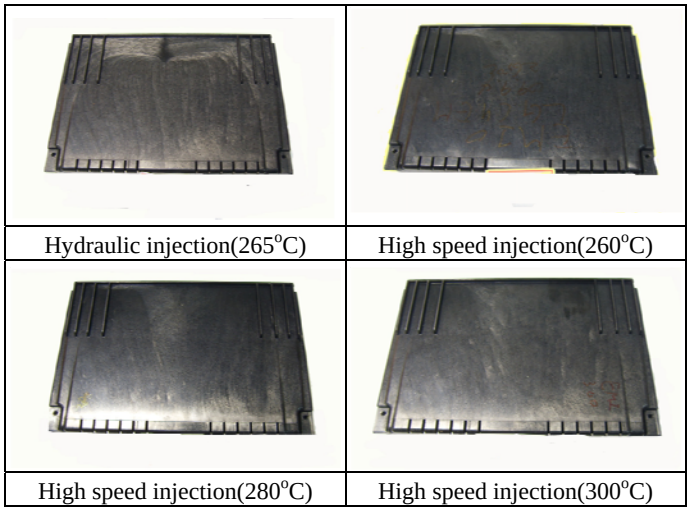

Fig.3 Flow lines of top surfaces of mold chassises at different injection molding conditions

analysis was conducted by counting the number of metal fibers and glass fibers of specimens at top surface of mold chassis. Then, average and standard deviation of right, center and left side of top surfaces were calculated. Finally, through the overall comparison of average and standard deviations of the number of metal fibers and glass fibers at each injection molding conditions, the proper injection molding conditions were evaluated. Specimens were obtained along the flow lines at Fig. 4.

Fig. 5 and 6 show the average number and standard deviation of glass fibers. In addition, Fig.7 and 8 represent the average number and standard deviation of metal fibers.

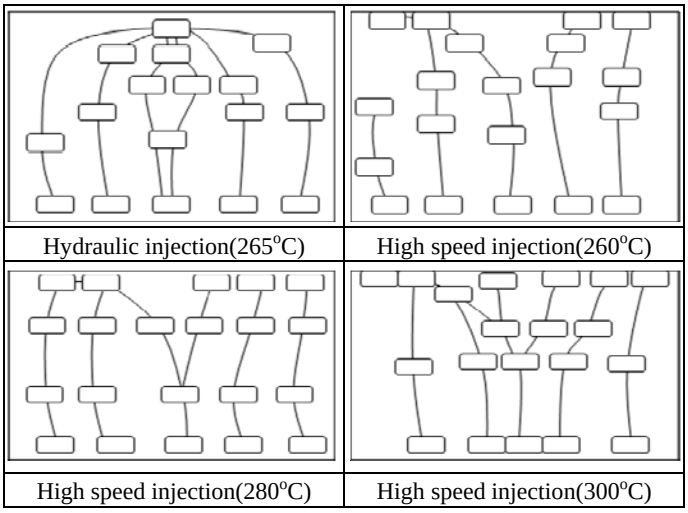

Fig.4 Morphology specimens of top surfaces of car audio mold chassis at each injection molding conditions

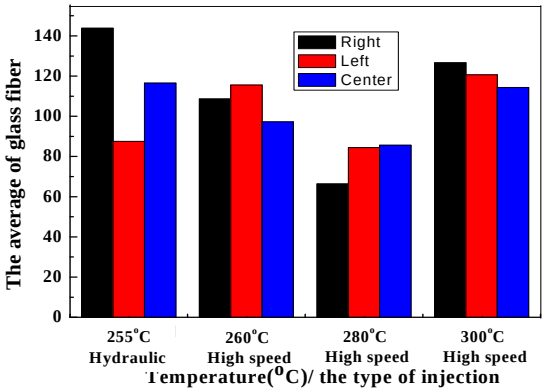

Fig. 5 Average number of glass fiber at each injection molding conditions

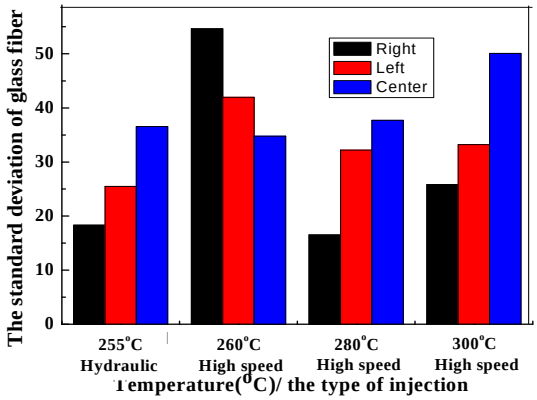

Fig. 6 Standard of deviation of glass fiber at each injection molding conditions

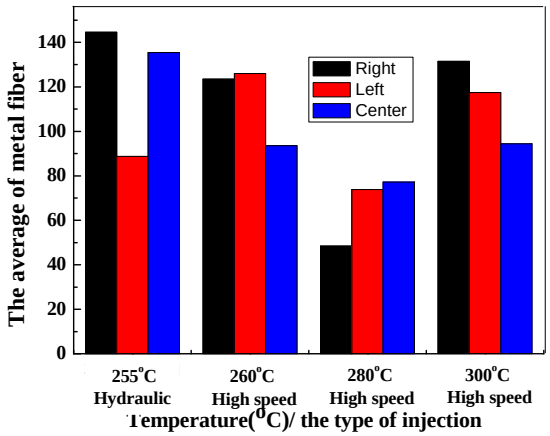

Fig. 7 Average number of metal fiber at each injection molding conditions

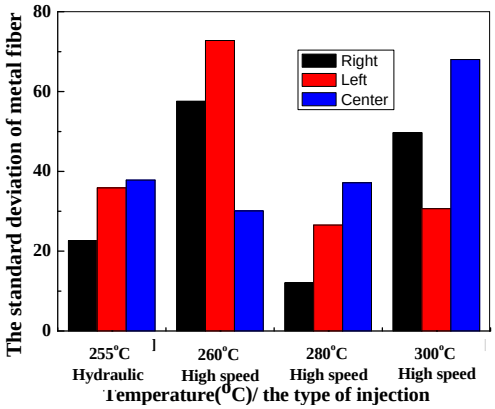

Fig. 8 Standard of deviation of metal fiber at each injection molding conditions

As shown in Fig.5 – 8, average number and standard deviations of glass fibers and metal fibers in hydraulic injection are relatively higher than high speed injection. It means that the distribution of fillers is done well in low injection speed. In addition, in the case of high speed injection, as temperature increase, the average and standard deviations of fillers comparatively increase. Therefore, elevating temperature is also good for even distribution of fillers

6. Conclusion

In this study, as the trend of 'green car' research, the injection molding conditions of car audio mold chassis was researched by morphology analysis. As a result, relative low injection speed and high temperature are the way of improving the qualities of car audio mold chassis which are mechanical properties and EMI shielding effectiveness.

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