

카오디오 샤시 적용을 위한 PC/ABS 복합체의 물성 및 사출 특성 평가

Characterization and injection molding analysis of PC/ABS/NF composite for car audio chassis

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1. Introduction

Polycarbonate / Acrylonitrile – butadiene -styrene (PC/ABS) has been applied and researched in automobile engineering as the substitute of stainless steel. It is due to more stable moldability and mechanical strength of PC/ABS than any other engineering plastics. In this study, PC/ABS was applied into car audio as the material of chassis to reduce overall weight and improve fuel efficiency. Before this study, PC/ABS with metal fiber (MF) and glass fiber (GF) was developed [1], however, it failed to be pelletized, so it did not ensure the even distribution of fillers.

Therefore, nickel-coated carbon fiber(NCF) was added instead of metal fiber and glass fiber. As known, carbon fiber has been used in the form of carbon fiber reinforced plastics (CFRP) due to high strength-to-weight and stiffness-to-weight ratios, high damping and good corrosive resistance properties [2]. In addition, nickel was expected to increase electro - magnetic interference shielding effectiveness (EMI SE) because EMI SE is highly regulated when car audio is commercialized.

As explained above, PC/ABS with NCF was developed and its characterization was studied through comparison with prior material; PC/ABS with metal fiber and glass fiber. In addition, dispersion of NEC in mold chassis was analyzed to find the optimum injection molding condition.

2. Composite material

2 cases of material were prepared according to the NCF contents 10% and 12% because small amount of fillers did not show higher EMI SE; PC/ABS with 3wt% metal fiber did not have EMI SE higher than 40dB [1]. In this study, PC/ABS/NCF 10wt% and PC/ABS/NCF 12wt% were named “A” and “B”, respectively.

3. Characterization of material

Table 1 shows the mechanical (tensile, impact and flexural) and electrical properties (EMI SE) of PC/ABS/NCF. In addition, it indicates the improvement of PC/ABS composite by comparison with PC/ABS/MF. Most importantly, EMI SE of material B is above 40dB. It is very critical notification because EMI SE of car audio should be higher than 40dB. Hence, material B is more suitable material of car audio chassis than material A.

Table 1 Properties of PC/ABS/NCF

	A(NCF10%)	B(NCF12%)	PC/ABS/MF
Impact test(J/m)	500	500	140
Flexural Strength (kg/cm ²)	1,100	1,200	1,010
Young's Modulus (GPa)	2.40	2.84	1.66
EMI SE 2t(dB)	32.5	47.3	45

**4. Injection molding analysis
(Investigation of NCF distribution)**

As described before, carbon fiber can be pelletized with PC/ABS. Therefore, it is expected to give regular fillers' distribution which facilitates the superior mechanical strength and EMI SE. In addition, the degree of fillers' distribution is used as the criterion of selecting optimum injection molding condition. In this study, 4 cases of injection molding were done according to the variation of molding conditions (reference, upping injection speed, upping tool temperature and upping injection temperature). In addition, injection molding conditions of material B were primarily inspected.

Distribution of fillers was done by counting fillers in left, center and right areas of car audio chassis. In addition, scanning electron microscopy (SEM) was employed to obtain photos of cross section of mold chassis. Figs 1 and 2 display results of NCF's distribution by matrix contour drawing (Fig.1) and average number with standard deviation according to areas (Fig.2). Fig. 1 exhibits that increasing injection speed (case 2) and tool temperature (case 3) is the effective way for the high dense of fillers. This fact can be supported by Fig. 2. In Fig. 3, case 2 and case 3 presents higher number of fillers and relative smaller standard deviation than other 2 cases.

5. Conclusion

In this study, PC/ABS with nickel coated carbon fiber (NCF) was developed and its injection molding condition was studied for its application into car audio chassis. PC/ABS/NCF had upgraded mechanical and electrical properties when it compared with PC/ABS/MF; previous PC/ABS composite. Besides, the research of fillers' dispersion shows that injection speed and tool temperature were key factors for highly dense of NCF in car audio mold chassis.

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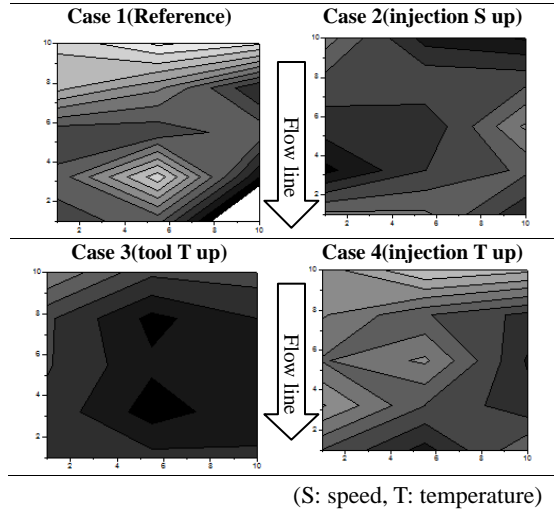


Fig. 1 NCF distribution of material B (NCF 12wt%)

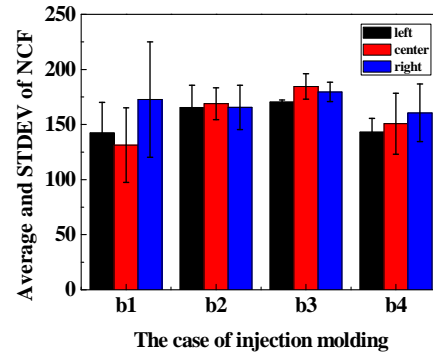


Fig. 2 Average and standard deviation of fillers in material B

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Reference

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