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NUMERICAL ANALYSIS OF THE DISPERSING GLASS FIBER BUNCH FOR THE POLYMER COMPOUND PROCESS BY THE TWIN-SCREW EXTRUDER

K. Hirata[a,b]*, H. Ishida[a], M. Hiragohri[a], Y. Nakayama[a] T. Kajiwara[b]

[a] *Compound Technology Group, Process Innovation Center, POLYPLASTICS CO., LTD., Japan and* [b] *Faculty of engineering, Kyusyu University, Fukuoka, Japan.*

**Corresponding author: kunihiro.hirata@polyplastics.com*

In this report the dispersion techniques of the glass fiber bunch in the polymer compounding process by the twin-screw extruder are discussed. Recently the demand of compound plastics is increasing rapidly and the improvement of plastics productivity are being demanded more and more. In polymer compound, the glass fiber reinforced plastics (FRP) is the most famous. The dispersion techniques of the glass fiber bunch in FRP are very important especially on high throughput rate and the inadequately kneaded pellet including the fiber bunch causes a lot of problems such as molding defects, bad appearance, and degradation of the mechanical property. However, it is very difficult to find the pellets including the non-dispersed glass fiber bunch by the process check, because the probability of occurrence is very low. Therefore, we investigated and quantified the probability of occurrence of the non-dispersed pellets experimentally, and the polymer behavior in the twin-screw extruder was analyzed by three-dimensional simulation. In the experiments, we changed the producing conditions such as throughput rate and screw elements and counted the number of non-dispersed pellets per five kilogram at each condition. Then we simulated the kneading region in the extruder by transient analysis and particle trace analysis. We found the correlation between the probability of occurrence of the non-dispersed glass fiber bunch and the minimum value of time-integrated shear stress. And the number of the non-dispersed pellets was predicted by introducing the term of throughput rate and screw rotation into the correlation equation. In addition, the maximum producing conditions were suggested more practically by the introduction of the deteriorating polymer temperature.