STRUCTURE AND PROPERTIES OF PP-BASED SANDWICH INJECTION MOLDINGS

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ABSTRACT: Structure and mechanical properties of sandwich injection moldings are investigated as well as flow behavior of materials in the process in order to obtain well controlled sandwich injection moldings. It has been found that there are four processes of flow behavior in sandwich injection molding as shown in Figure 1: (1) primary injection process, (2) core material injection process, (3) core material expansion process, and (4) core material break-through process. In the “primary injection process”, only skin material is injected into cavity, and it is followed by core material injection into skin material in the “core material injection process”. In the “core material expansion process”, core material growths with skin material at the flow front, and the core material break through skin material at the flow front in the “core material break-through process”. It has been found that the break-through behavior of core material is dependent on injection conditions such as injection speed and injection pressure, however the primary parameter to the break-through behavior is melt tension of skin material. The occurrence of the core material break-through can be minimized when high melt tension materials are used as skin material as shown in Figure 2.

Well controlled polypropylene (PP)-based sandwich injection moldings with biodegradable polymers in core are molded based on the above results in order to investigate structure-property relationship of the sandwich injection moldings for automotive applications. Two types of compatibilizers are used to improve interfacial adhesion between skin and core parts. Microstructure of PP in skin and at the interface is investigated. Effects of MFR of PP, compatibilizers, and injection molding conditions on mechanical properties of PP-based sandwich injection moldings are discussed. Special attention is given to skin-core adhesion properties and its effect on mechanical properties of sandwich injection moldings. The skin-core adhesion properties are evaluated by modified peel tests. The final goal of this study is to provide the concept to design sandwich injection moldings for target properties based on material selections of skin, core and compatibilizer, and injection molding conditions.

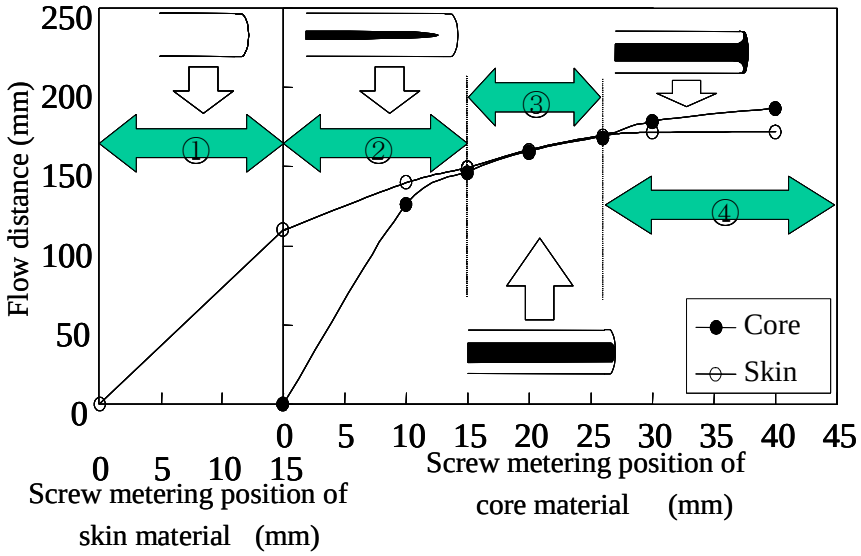

Fig. 1 Four process of flow behavior in sandwich injection molding.

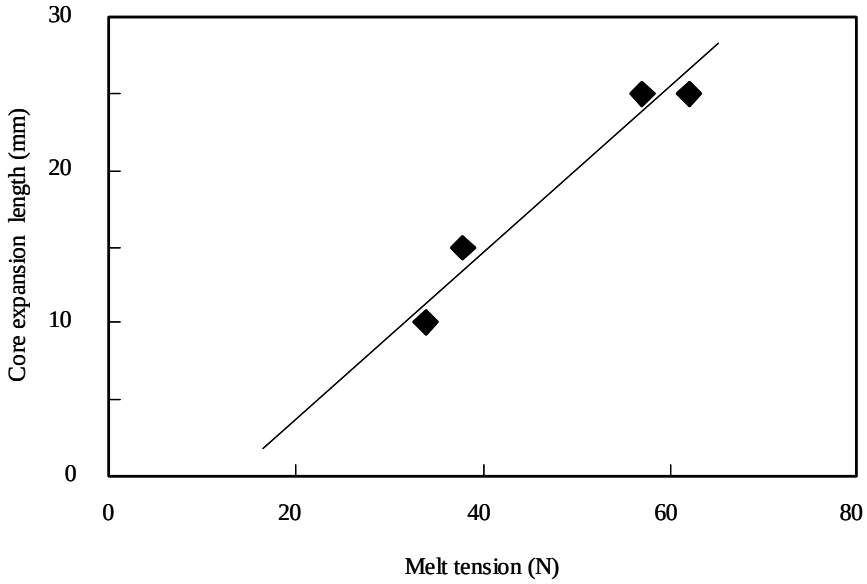

Fig. 2 Relationship between core expansion length and melt tension in sandwich injection moldings.