

Polybutylene Terephthalate (PBT)

DURANEX®

SF3300

EF2001/ED3002

Super high flow, HB

POLYPLASTICS CO., LTD.



Introduction

DURANEX® PBT has excellent heat resistance and mechanical and electrical properties. It is used in various applications such as automotive, electrical and electronic, OA equipment, and industrial machine components.

In recent years, the market trend toward high functionality, modularization and integration of components is advancing, especially in the automotive industry and electrical and electronic industry. Accordingly, downsizing and wall thickness reduction of such components are progressing. Therefore, materials with high flowability, strength and stiffness are desired to meet such market requirements.

DURANEX PBT SF Series are specialty grades to meet these market requirements.

DURANEX® PBT SF Series Properties

Compared to conventional PBT materials, flow length has improved by 30% ~ 100%, which may result in the following advantages:

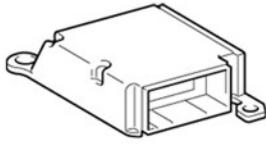
1. Thin, lightweight product design
2. Use of multi-cavity molds with a larger number of cavities
3. Shorter molding cycle due to thin-wall design
4. Wider window of molding process conditions
5. Longer mold life due to a reduction in injection peak pressure

DURANEX® PBT SF Series Grade Line-up

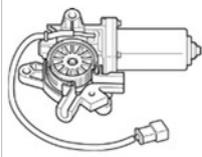
- **SF3300** GF30% reinforced, standard, high-cycle and high flowability
- **SF733LD** GF30% reinforced, low warpage, low specific gravity, high-cycle and high flowability
- **SF755** GF 55% reinforced, high rigidity, good surface appearance, high-cycle and high flowability



Examples of Practical Applications



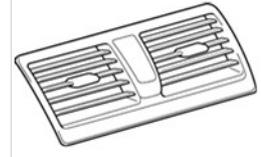
ECUs



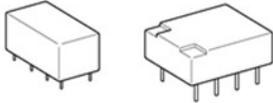
Actuators



Door mirror stays



Ventilators



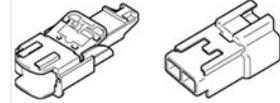
Relays



Bobbins



Smartphone parts



Connectors



1. SF3300 General Properties

Table 1- 1 SF3300 General Properties (ISO)

Item	Unit	Test method	Super High Flow,HB	HB,Standard
			SF3300	3300
			GF30% reinforced,Standard	GF30% reinforced,Standard
Color Number			EF2001/ED3002	EF2001/ED3002
ISO Marking Code		ISO11469 JIS K6999	>PBT-GF30<	>PBT-GF30<
Density	g/cm ³	ISO 1183	1.53	1.53
Tensile strength	MPa	ISO 527-1,2	135	140
Strain at break	%	ISO 527-1,2	1.9	2.2
Flexural strength	MPa	ISO 178	218	220
Flexural modulus	MPa	ISO 178	9340	9030
Charpy impact strength (notched)	kJ/m ²	ISO 179/1eA	10	10.5
Temperature of deflection under load (1.8MPa)	°C	ISO 75-1,2	213	213
Coefficient of linear thermal expansion (23 – 55°C, flow direction)	x10 ⁻⁵ / °C	Our standard	-	2
Coefficient of linear thermal expansion (23 – 55°C, transverse direction)	x10 ⁻⁵ / °C	Our standard	-	9
Dielectric breakdown strength (3mmt)	kV/mm	IEC 60243-1	-	23
Volume resistivity	Ω ·cm	IEC 60093	-	5 x 10 ¹⁶
Tracking resistance (CTI)	V	IEC 60112	-	375
Flammability		UL94	Equivalent HB	HB
UL yellow card file number			-	E213445
Appropriate list number of Ministerial Ordinance for Export Trade Control			Item 16 of Appendix -1	Item 16 of Appendix -1

The above values are representative values obtained by injection molding. They are not minimum values of the material. The data shown here cannot necessarily be applied "as is" to parts that are utilized under different Conditions.



2. High-cycle Properties

2.1 Mold Release Performance

DURANEX® SF3300 greatly reduces molding defects, which enables high-cycle molding.

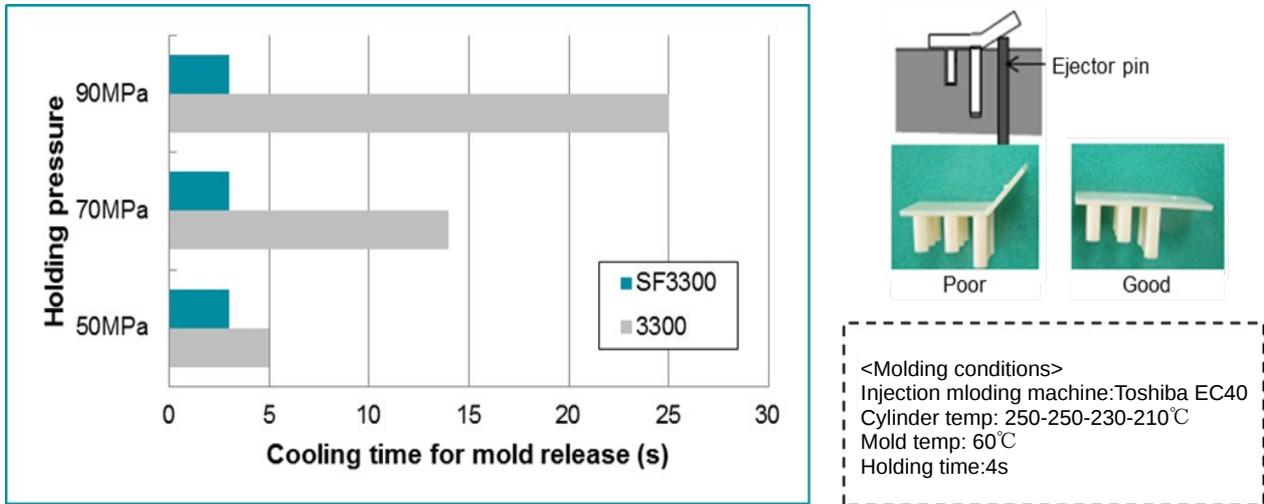


Figure 2-1 Comparison of SF3300 and 3300 Mold Release Performance

Note) Above are simplified comparison data, based on the assumption that molding cycle is solely determined by mold release performance. In reality, the degree of improvement may vary depending on the actual part design and molding conditions.

2.2 Shorter Cycle Time

SF3300, with its high flow properties, enables a reduction in wall thickness. This leads to a shorter solidification time and hence a shorter cycle time. (For more information, please refer to "Streamlining the Molding Process with DURANEX® PBT SF Series" in the Appendix to this document.)

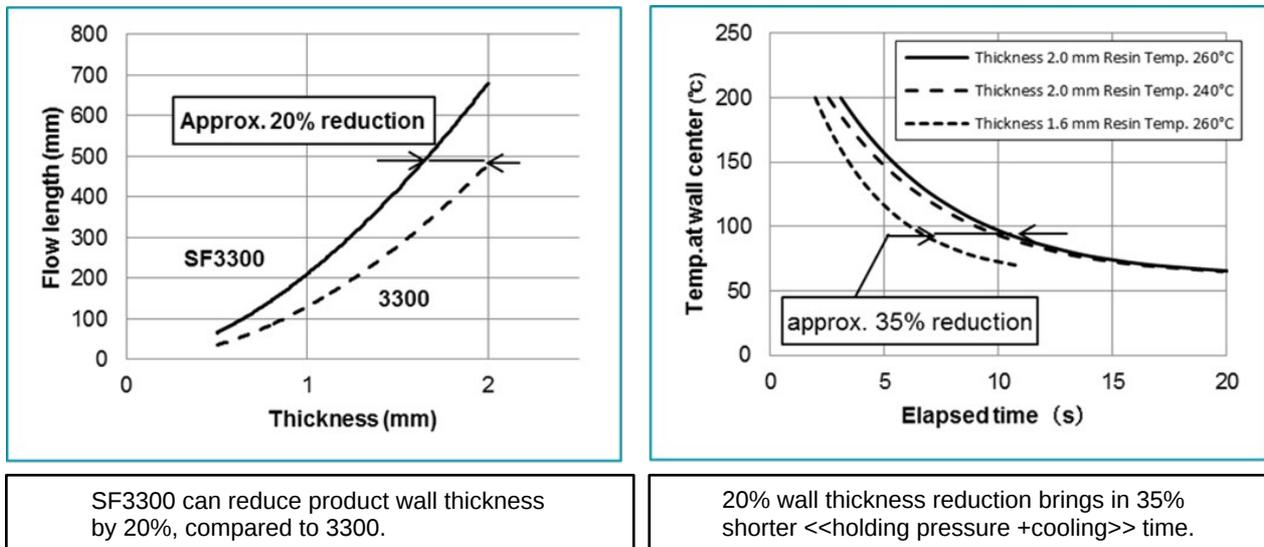


Figure 2-2 Flowability and Thinning

Figure 2-3 Cycle Shortening by Thinning

3. SF3300 Moldability

3.1 Flow Properties

SF3300 shows improved flow properties as compared to conventional grade 3300.

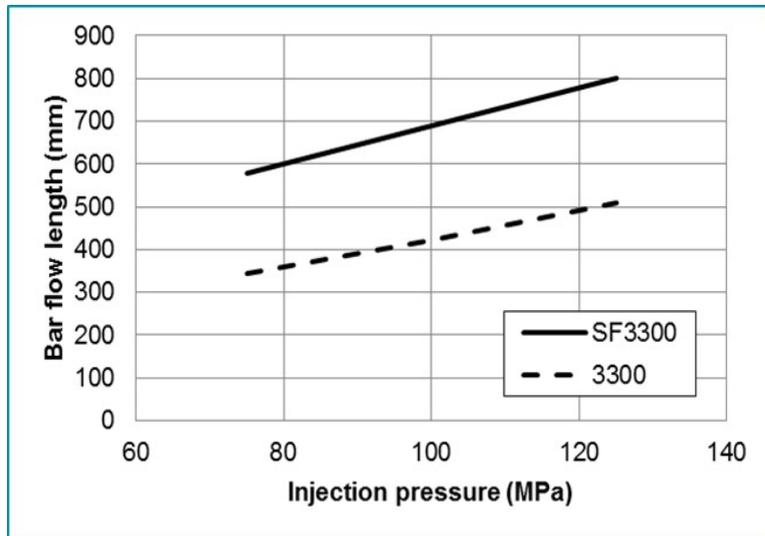


Figure 3- 1 Bar Flow Length (2mmt)

<Molding conditions>

Injection molding machine:

Nissei ES3000

Cylinder temp: 260-260-260-230°C

Mold temp: 65°C

Injection speed:70mm/s

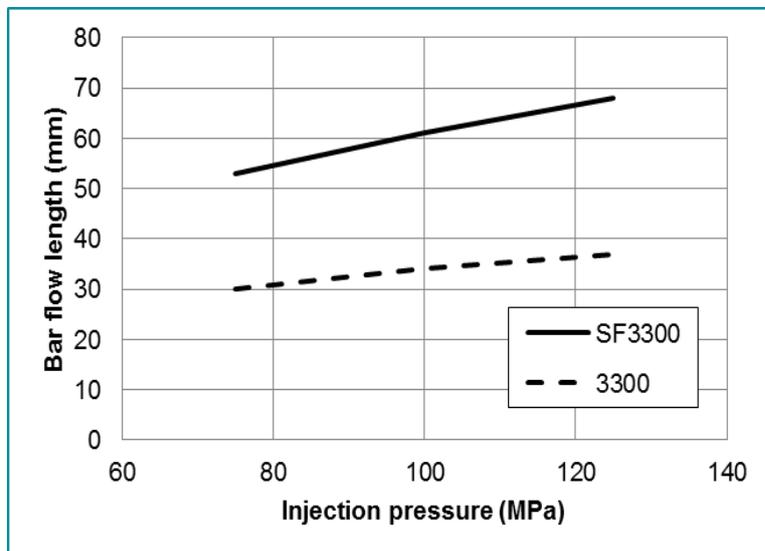


Figure 3-2 Bar Flow Length (0.5mmt)

<Molding conditions>

Injection molding machine:

FANUC 2000i100B

Cylinder temp: 260-260-250-240°C

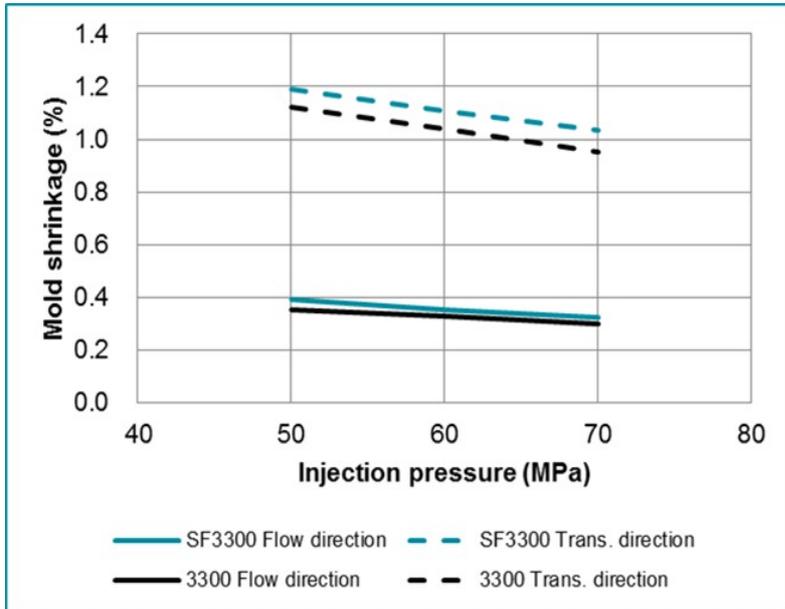
Mold temp: 60°C

Injection speed:70mm/s



3.2 Mold Shrinkage

SF3300 shows almost the same mold shrinkage as conventional grade 3300.



<Molding conditions>

Injection molding machine: Nissei ES3000

Cylinder temp: 260_260_260_260_230°C

Mold temp: 65°C

Injection speed: 70mm/s

Mold: 120×120×2mm flat plate

Side gate, 4w×2t

Figure 3-3 Mold Shrinkage (120×120×2mmt)



Appendix

• Flow properties of DURANEX® PBT SF Series in Thin-wall Molding

In order to mold thin-wall products such as CPU sockets, LCP materials, well-known for its excellent flow properties, are often used. Conventional PBT materials, like many other engineering thermoplastics, do not flow adequately for molding CPU sockets of which thickness is less than 0.20mm.

On the other hand, **DURANEX PBT SF Series** is capable of full cavity filling due to its excellent high flowability.

Figure 4-1 shows a CPU socket (thickness: 0.18mm) molded with LCP, **SF3300**, and **3300**. Despite its forbidding thickness, **SF3300** has succeeded in fully filling the cavity, indicating that the flowability of this grade is beyond the level that conventional PBT materials can ever achieve and close to that of LCP materials.

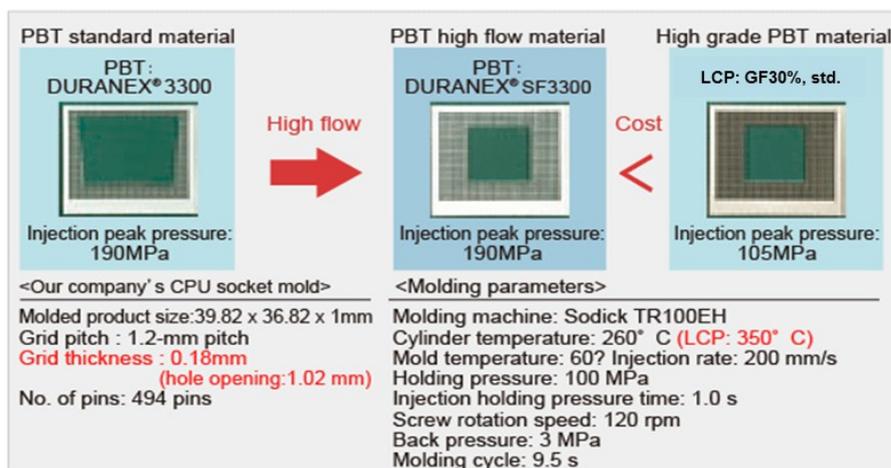


Figure 4- 1 Flowability Improvement - Comparison in CPU Socket Molds

• Streamlining the Molding Process with DURANEX® PBT SF Series

In addition to the advantage in molding extremely-thin products as mentioned above, **DURANEX PBT SF Series** also provides other merits in molding products with ordinary thickness (for example, 1 ~ 3 mm).

One example is that **SF Series** offers a great degree of freedom in product design, providing the possibility of developing thinner or lighter products. Another example is that **SF Series** contributes to streamlining molding processes. More specifically, it provides a wider window of molding process conditions, shorter cycle time due to wall thickness reduction, possibility of gate size reduction, possibility of reduction of the number of gates, and suitability of multi-cavity molding.

Figure 4-2 shows an example of molding streamlining by using **DURANEX PBT SF Series**.

(1) With resin temperature 260°C and 2.0mm wall thickness, solidification time of 3300 is approximately 10 seconds. By using **SF3300**, giving the same flow length, the wall thickness can be reduced to 1.6mm (approx. 20% reduction of wall thickness). This also contributes to weight reduction.



- (2) By reducing the wall thickness down to 1.6mm, it becomes possible to shorten the solidification time from 10 seconds to 6 seconds (approximately 35% reduction).
- (3) Even in product designs where mold modification such as wall thickness reduction is not feasible, **DURANEX PBT SF Series** can help shortening cycle time. Since **SF Series** has excellent flowability, it is possible to lower resin temperature during molding process, which contributes to shorter cooling time and thus shorter cycle time in total. For example, if resin temperature is lowered from 260°C to 240°C, solidification time can be shortened from 10 seconds to 9.5 seconds (5% reduction).

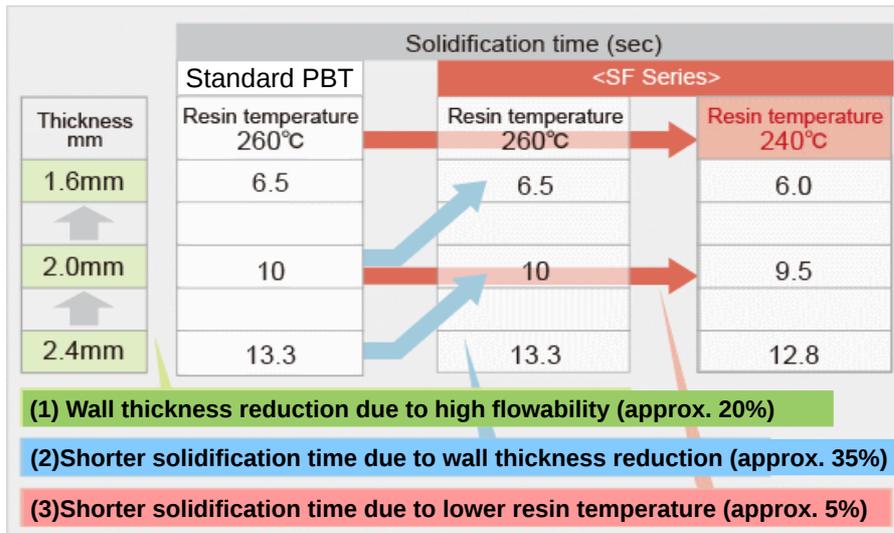


Figure 4-2 Streamlining the Molding Process with DURANEX® PBT SF Series
Solidification Time (second)



NOTES TO USERS

- All property values shown in this brochure are the typical values obtained under conditions prescribed by applicable standards and test methods.
- This brochure has been prepared based on our own experiences and laboratory test data, and therefore all data shown here are not always applicable to parts used under different conditions. We do not guarantee that these data are directly applicable to the application conditions of users and we ask each user to make his own decision on the application.
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