for a better future

KEP

KEPITAL
Thermal propreties

KOREA ENGINEERING PLASTICS CO.,LTD.

Thermal properties are important elements for establishing the processing conditions of a plastic material and service temperature of finished part.
It is important to preview all possible thermal properties; melting point, heat deflection temperature, coefficient of linear thermal expansion, thermal conductivity and long-term heat ageing resistance prior to design.

1. Melting point (Melting temperature, T_m)

Thermoplastic materials are classified into amorphous and semi-crystalline polymers.
The latter has both a crystalline region and an amorphous region in the final product.
The melting point is the temperature at which the crystalline region melts with significant volume expansion.
At the temperature of a melting point or higher, the plastic becomes molten and starts the flow process.
The melting point (ISO 3146) is useful information to set up processing temperatures and also determine the temperature at which it exists in a solid state.

KEPITAL has excellent strength and modulus due to its relatively high crystallinity (65 %) in the final product.
(cf. the crystallinity depends on process conditions)

Type	T_m (°C)
PP	165
POM copolymer	165
POM homopolymer	175
PA6	220

Table 1. Melting points of thermoplastics

2. Specific heat

Specific heat refers to the calories required to raise the temperature of a unit mass of material by one degree.
For KEPITAL, it increases gradually from an ambient temperature up to 150°C, and then drastically increases at its melting point.
At temperatures exceeding the melting point, the specific heat in a molten state is exhibited.
The specific heat of KEPITAL is 0.35 kcal/kg · K in the solid state at an ambient temperature and 0.63 kcal/kg · K in the molten phase.

3. Heat deflection temperature

The heat deflection temperature (ISO 75) is the temperature at which specimen exhibits flexural deflection of 0.25 mm under a prescribed load and is used for evaluating relative heat resistance for a service temperature.

4. Coefficient of linear thermal expansion(CLTE)

A plastic expands when temperature increases.
If a material is used in a broad range of temperatures or if both plastic and metal parts are either assembled or molded together, the CLTE is very important in determining tolerance, interference, dimensional changes and in forecasting part failure.

The changes in the flow direction for KEPITAL F20-03 and FG2025 are shown in Figure 1. The CLTE of F20-03 is higher than that of FG2025 since the glass fiber in FG2025 is aligned to the flow direction while injection processed, the CLTE in the parallel to flow direction is lower than that in the perpendicular to flow direction.

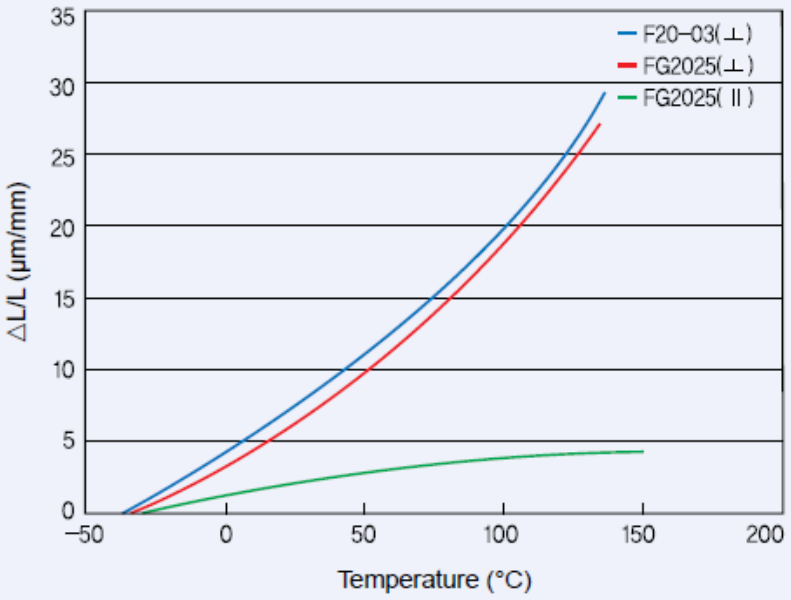

Figure 1. Length changes of KEPITAL F20-03 and FG2025

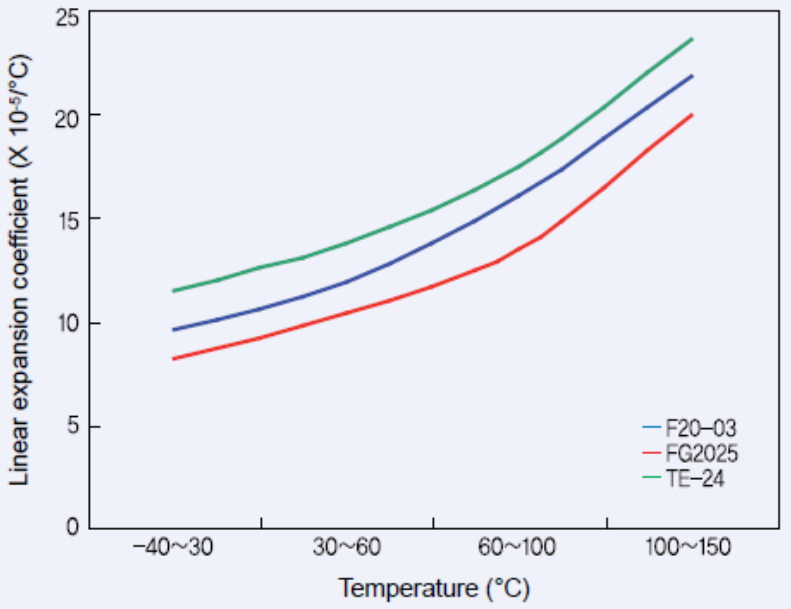

Figure 2. Linear expansion coefficients of KEPITAL
(perpendicular to flow direction)

The linear expansion coefficients of KEPITAL in temperature range are shown in Figure 2.

CLTE of F10 to F30 in standard unfilled grades are very close, so influence of molecular weight is not expected to be considerable.

5. Thermal conductivity

Unlike metals, most thermoplastic materials are insulators with a low thermal conductivity. The thermal conductivity of KEPITAL standard unfilled grades is 0.31 W/m · K in its solid state.

6. Heat aging

The heat resistance of a plastic may be obtained from measurement of melting point, heat deflection temperature and linear expansion coefficient.
The service temperature of plastics should be determined from long-term heat aging experiments.
When a plastic is continuously exposed to evaluated temperature, the mechanical properties gradually deteriorate.
Since the degree of property deterioration depends upon environmental factors such as temperature, stress, and time, it is necessary to select a KEPITAL grade upon the designated environmental condition.

Figure 3 shows retention rates of tensile strength of KEPITAL F20-03 compared with its initial tensile strength in the air for a long period time.
The long-term thermal property of F20-03 is stable up to 100°C.

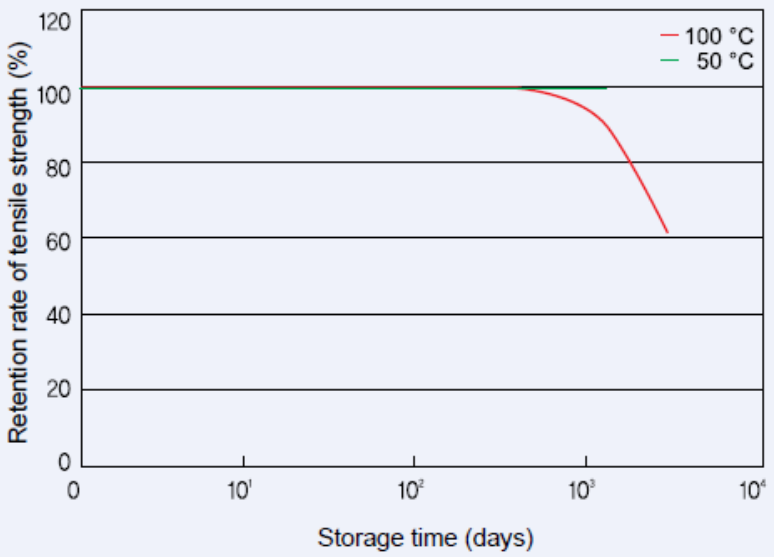

Figure 3. Heat aging resistance of KEPITAL F20-03

Another method for determining the long-term heat resistance of a plastic is RTI (Relative Temperature Index) of the UL 746B Standard.
The value shown on a UL card indicates the temperature at which at least 50 % of initial property values are maintained after 100,000 continuous hours.

Table 2 lists RTI for the electrical properties, impact strength and mechanical strength of KEPITAL F20-03 and FG2025.

Grade	Electrical	With impact strength	Without impact mechanical strength
F20-03	110 °C	95 °C	100 °C
FG2025	105 °C	90 °C	95 °C

Table 2. RTI of KEPITAL F20-03 and FG2025

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