Mechanical Properties

Panlite has stable mechanical characteristics over a wide range of temperatures. Panlite has particularly impressive tensile strength, flexural strength, impact strength and creep characteristics, and as such is a highly regarded engineering plastic material.

Tensile characteristics

Panlite shows stable tensile strength over a wide temperature range. Especially, it will not show any conspicuous change in quality even under high temperatures.
Panlite G is a glass fiber reinforced grade, and its tensile strength increases as the glass fiber content increases. For example, see Fig. 1.

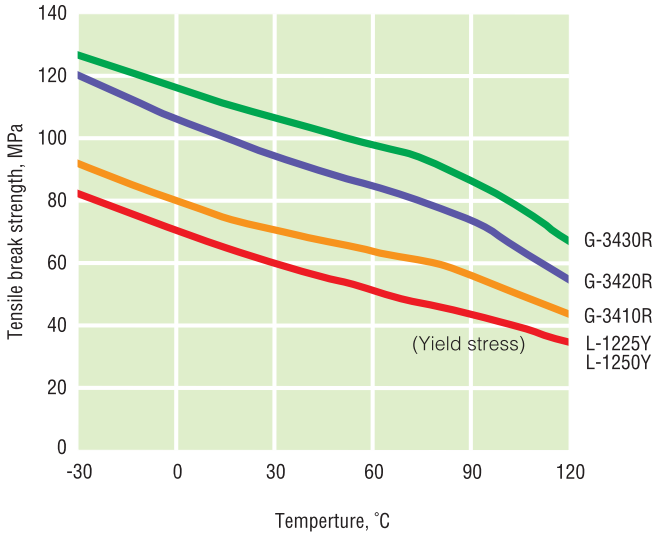

Fig. 1 Tensile break strength of Panlite vs. temperature

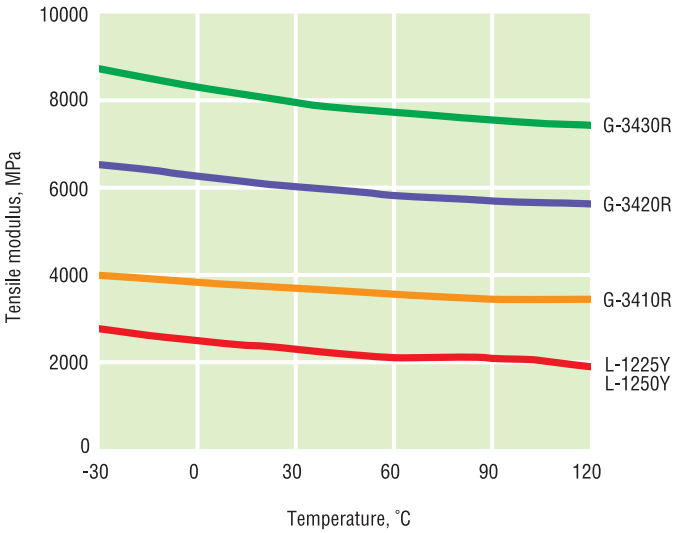

Fig. 2 Tensile modulus of Panlite vs. temperature

Flexural characteristics

Panlite shows stable flexural characteristics over a wide temperature range.
The flexural strength and the flexural modulus of Panlite G increase as the glass fiber content increases.

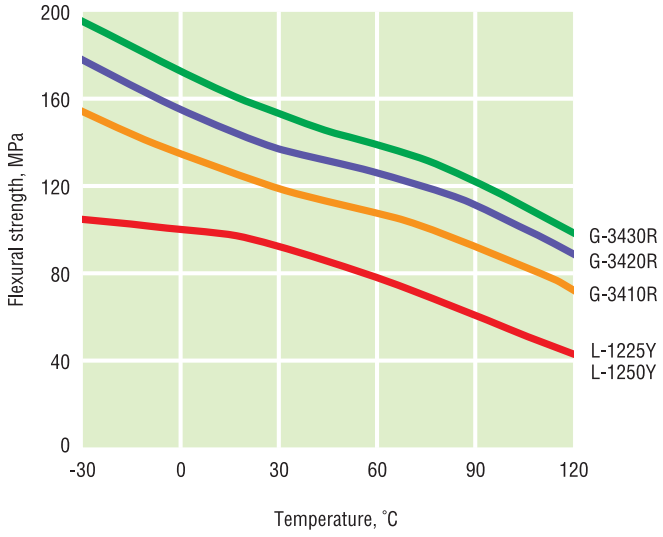

Fig. 3 Flexural strength of Panlite vs. temperature

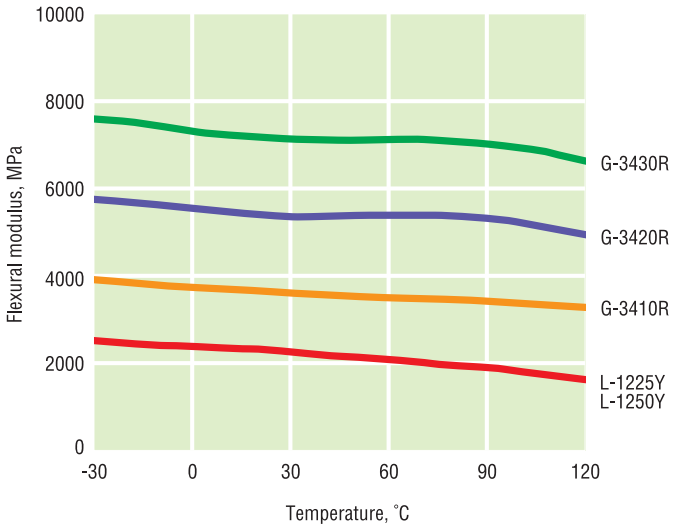

Fig. 4 Flexural modulus of Panlite vs. temperature

Impact characteristics

Panlite has outstanding impact characteristics.
For example, it shows a high Charpy impact value (notched) of 67 KJ/m^2 or more at room temperature.
At temperatures below -20˚C or -30˚C, although ductile fracture characteristics change to brittle fracture, the material shows a high value compared with other plastic materials (Figure 5).
If the designed product is unnotched and without sharp corners, stable impact characteristics are obtained over a wide temperature range, as brittle fracture at low temperature is eliminated.
It should be noted that the impact value is affected by the average molecular weight (Fig. 6).
The impact value of Panlite G increases as the glass fiber content is increased (Fig. 7).

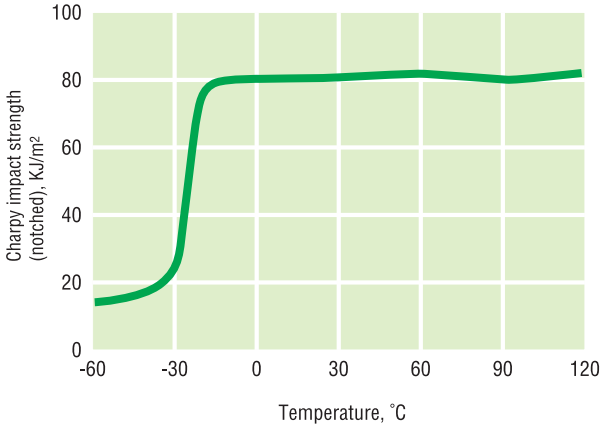

Fig. 5 Impact Strength of Panlite vs. Temperature (General PC)

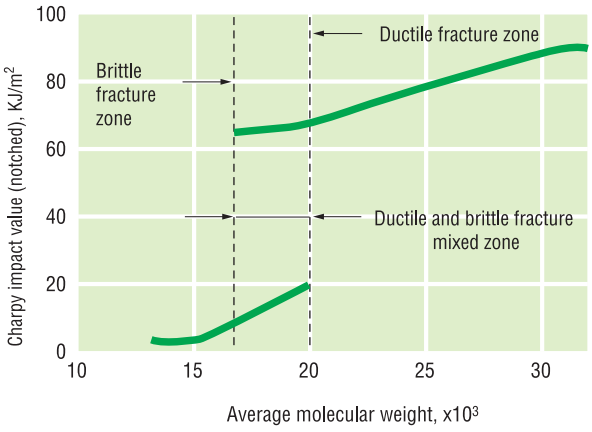

Fig. 6 Molecular Weight vs. Impact Strength of Panlite

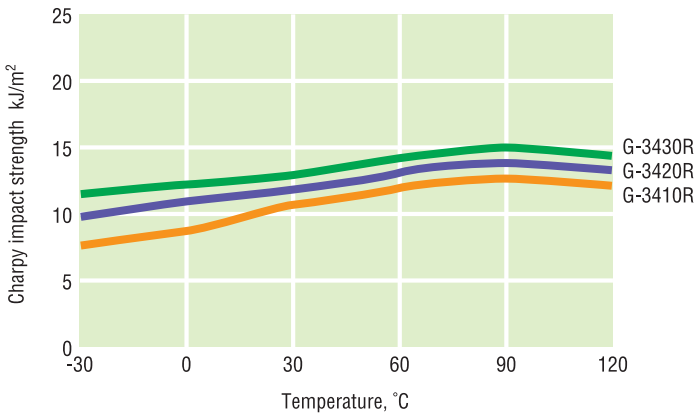

Fig. 7 Impact value of Panlite vs. temperature (PCG)

Creep characteristics

Creep is a phenomenon that is characterized by an increase in the deformation of the material with time when a certain stress is given to the material. Creep is related to both the temperature and the stress.
Panlite has outstanding creep characteristics (Fig. 8).
In the cases of Panlite and Panlite G, the apparent flexural modulus varies respectively due to the creep (Fig. 9).
As for the relationship between creep deformation of Panlite and the designed stress, for example, when the material is subjected to the stress of 12.7 MPa at 20˚C, the deformation after 20 years is 0.7% (Fig. 10).

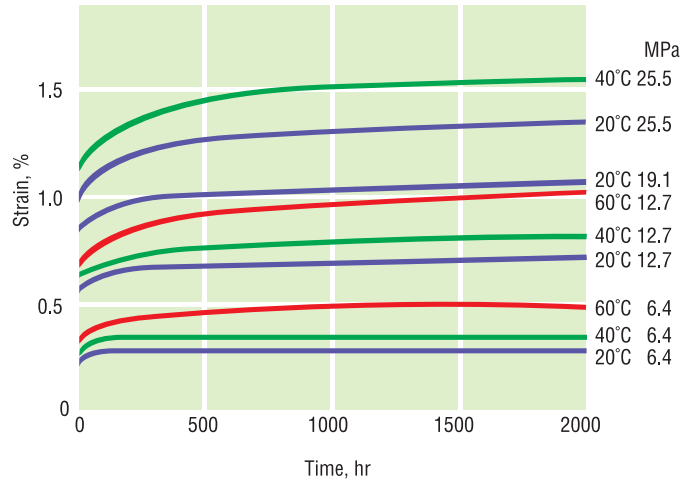

Fig. 8 Creep Characteristics of Panlite

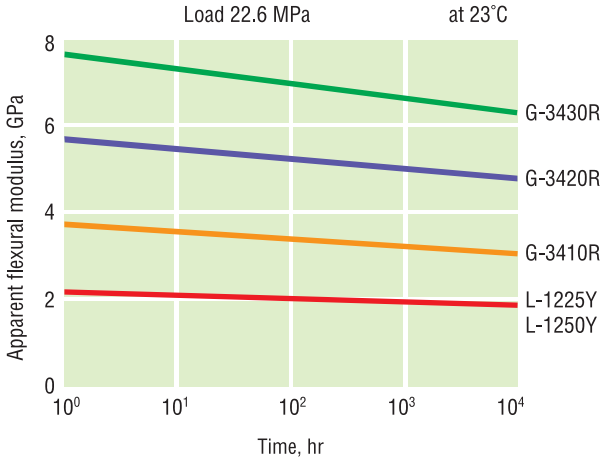

Fig. 9 Creep Characteristics of Panlite (Apparent flexural modulus)

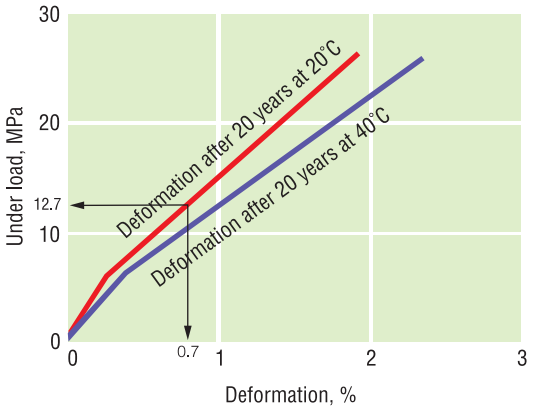

Fig. 10 Creep Deformation vs. Stress of Panlite

Repeated fatigue characteristics

The rupture of material due to repeated fatigue occurs even when the stress is lower than its flexural strength.
The curve drawn by plotting the values of repeated stress and the number of times of repetition of the stress until the rupture occurs is called the S-N curve. The repeated fatigue characteristics of Panlite can be improved largely by increasing the glass fiber content (Fig. 11).

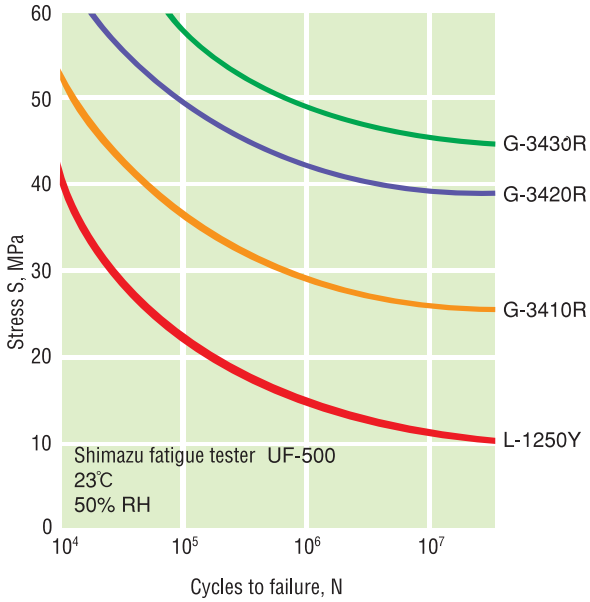

Fig. 11 Repeated Fatigue Characteristics of Panlite

Allowable stress

When a plastic part has been used for a long period of time under stress, crazing or cracking sometimes occurs. The maximum stress at which neither crazing or cracking occurs is called allowable stress, and it varies depending on the operating temperature. The allowable stress is the greatest stress under which a material is believed to be safe in actual use, and may also be called design stress. Allowable stress varies according to the type of stress, but in all cases it has been determined after material testing, by service conditions and experiences (Table 1).
Since allowable stress is a maximum value, a safety allowance must be added when assuming the stress in service conditions.

Table 1 Allowable Stresses of Panlite and Panlite G

Static load: MPa

Grade \ Temp, °C	−20	0	20	50	100
L-1250Y	15.7	14.7	13.7	11.3	2.9
G-3410R	20.6	19.6	18.6	13.7	3.9
G-3420R	27.5	24.5	23.0	17.7	5.9
G-3430R	32.4	29.4	27.5	22.6	8.3