SABIC
Innovative
Plastics™

Tensile stress and strain

Stress/Strain is the most used piece of design data for a plastic material:

- Defines the relationship between applied load and resulting deformation in simple tension.
- Defines the stiffness or modulus in simple tension.
- Defines the maximum load a material can sustain without permanent damage.
- Area under the stress/strain curve is an indication of the energy absorbing capability of the material.
- Defines the ultimate stretch a plastic can attain before failure.
- Only accurate for short term loading.

Stress

Applied load, normalized by the supporting cross sectional area. Stress is reported in pounds per square inch (psi) or Mega Pascals (MPa).

Strain

Deformation or stretch normalized by the original length. Strain is reported in percentage (%), inch per inch (in/in), or mm/mm.

Modulus (tensile)

Stiffness, the ratio of stress/strain. The tensile modulus is reported in psi or Giga Pascals (GPa).

Yield stress

The initial stress at which an increase in strain occurs without an increase in stress.

Ultimate elongation

Maximum possible elongation (usually much larger than the yield strain- the strain at yield stress).

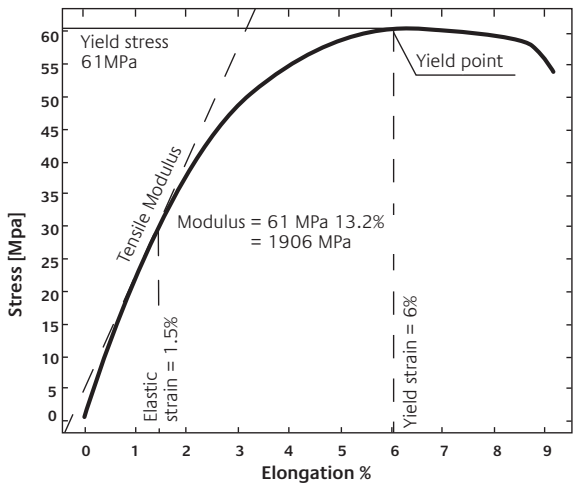

Figure 1
Typical stress/strain diagram

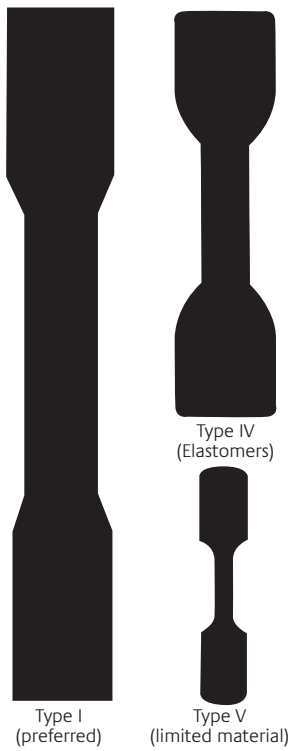

Figure 2
ASTM D638 Tensile specimens

Increasing glass content:

- Increases modulus.
- Increases maximum load capability.
- Decreases elongation.

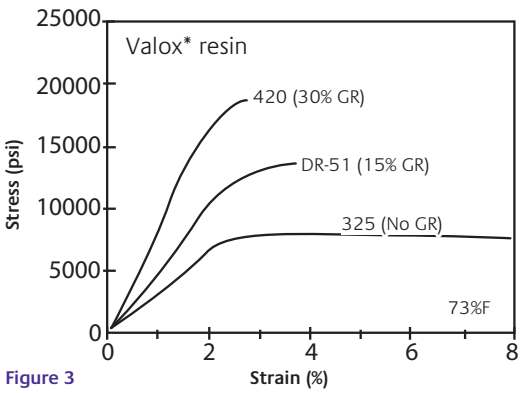

Figure 3

note

Curves shown here may extend beyond 8% elongation.

Increasing rate:
- Increases modulus.
- Decreases elongation.
- Increases yield stress.

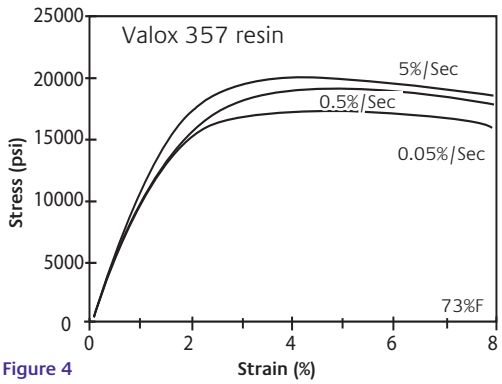

Figure 4

Increasing temperature:
- Decreases modulus.
- Decreases maximum load capability.
- May increase or decrease elongation.

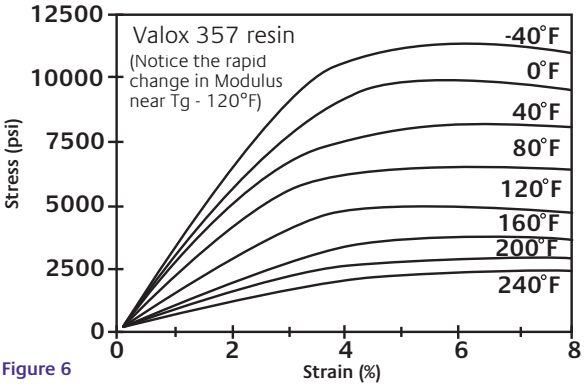

Figure 6

Flow direction:
- Higher modulus.
- Higher yield strength.
- Lower elongation.

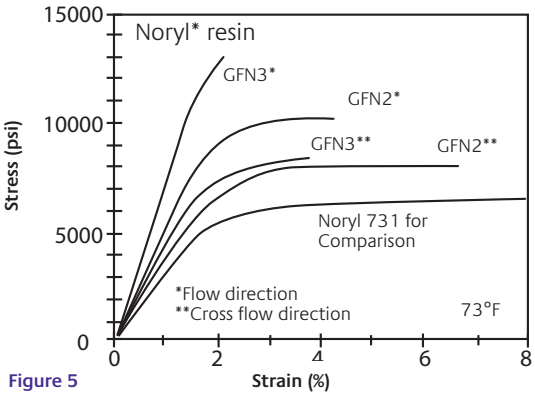

Figure 5

A plot of tensile modulus vs. temperature (fig 7).
This Shows the same transitions measured in Dynamic Mechanical Analysis.

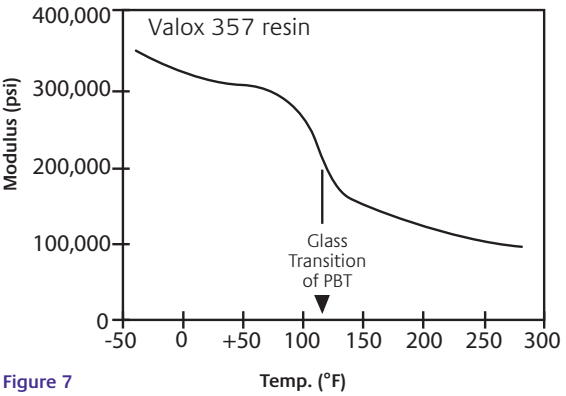

Figure 7

More stress/strain plots for a variety of resins are available through our Multipoint Data tools on-line at sabic-ip.com.