FAQ:Tensile Testing

8. A yarn gave strength of 250 gram when the time taken to break was 10 sec. Estimate the Tenacity in gram/Tex if the rate of loading was increased to cause the yarn to break in 1 sec. Given yarn count was 50s Ne.

Answer:

$F_1 = F_{10}(1.1 - 0.1 \log 1.0)$

$= 250 (1.1 - 0.1 * 0.0)$

$= 250 * 1.1 = 275$ gram

The breaking load when the yarn breaks in 1 sec is 275 gram

Tenacity in g/tex is = 275 / (590.7 / 50) = 23.27 g/Tex.

9. A 40 Ne 67/33 polyester/cotton blended yarn gave a breaking load of 300g when tested on a CRE tester with 100 mm gauge length and at 100 mm/min traverse rate. What are the expected percentage change in the observed tenacity of the yarn if; i) the traverse rate is increased to 500 mm/min (keeping the gauge length constant), and ii) the gauge length is increased to 500mm (keeping the traverse rate constant). [Assume a constant breaking extension of 25% and single yarn strength CV% of 10% for all the above conditions]

Answer:

i) Breaking Extension 25%

S = 25/100 = 0.25 min

T = 25 / 500 = 0.05 min

$F_T - Fs / Fs = 0.1 \log_{10} S/T = 0.1*\log(0.25/0.05) = 0.0699$

% change = 6.99%

ii) Sl = 300 gm

V = 10% r = 5

$S_{rl}/S_l = 1 - [4.2 (1-r^{-1/5}) v/100]$

$1-S_{rl}/S_l = 4.2\ (1-r^{-1/5})\ 10/100 = 0.1156$

% change = 11.56%

10. The following are the tensile test data of a 30 Ne single yarn while testing on a tensile tester, works on pendulum lever principle with *Standard machine rate of loading* (μ_o) 440 cN/cm.

    Tenacity - 11 cN/tex

    Breaking extension - 7 %

    Gauge length - 20 cm

    Traverse rate - 57 mm/min

    Calculate the time to break.

    Answer:

    Tenacity = (Breaking Load / Count in Tex)

    11 = (Breaking Load / 19.69)

    Breaking Load= 19.69 * 11 = 216.59 cN (221 gram)

    Time to break = [{(221/448.8) + 20 * 0.07}/ 5.7] * 60

    = 20 sec.

11. Define Work of rupture? Also briefly write about the instrument used for measuring 'work of rupture'.

    Answer:

    This is a measure of 'toughness' of the material. It is the energy or work required to break the specimen. The area under the load-elongation curve represents the work done in stretching the specimen to breaking point and therefore the unit of work of rupture will be in unit of work, e.g. gram-centimeters.

    The work of rupture will be proportional to the cross section of the specimen and to its length.

    Instrument measuring work of rupture

    Refer: Tensile Testing→ Principle of Tensile testing→ f) ballistic or impact tester

12. What are all factors influenced by fabric tensile test? During Tensile Testing of fabric which fabric will give higher strength plain or satin, why?

Answer:

Fabric tensile strength depends on following factors,

- Raw material.
- Yarn strength (twist: more twist for more strength)
- Fabric construction
- Finish applied (resin finish improves weave slippage).
- Adverse of “finishing” process.

Satin weave is having more floating point than plain weave so in the plain weave the transverse thread assistance will be more than satin weave on longitudinal weave. So plain weave has more tensile strength.

13. State the advantage of Uster Tensorapid and explain test principle using in the same?

Answer:

The following are the advantages of Uster Tensorapid

- For tensile testing of single and ply yarn.
- Testing of slivers, leas and fabrics is also possible.
- Force measurements up to 1000 N without exchanging the force transducer.
- The *clamping force*, the yarn tensioners and the suction-off of the yarn can be programmed.
- All numerical and graphical results are displayed on a video screen. (Histogram, L-E curve, tables etc.)
- Package creel for the automatic measurement up to 20 packages.
- Calling-up of test parameters of frequently tested yarn types from the memory (up to 40).

- *Pneumatically-actuated yarn clamps*; the clamp pressure is programmable. Electronic elongation measurement. Test speed – Continuously adjustable between 50 and 5000 mm/min.

Test Principle used in the Uster Tensorapid is CRE.

CRE: Rate of increase of specimen length is uniform with time (the load measuring mechanism moves a negligible distance).