

Long-lasting stress relaxation behaviour prediction at various straining level

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Abstract

The main problem in investigation and prediction of stress relaxation is a long time periods (not in seconds or minutes but in days or even months) of measurements for each kind of textiles, especially in the cases when users need to know behaviour of textile in prolonged time usage. It was found that the rate of relaxation in log scale can be described by two straight lines and the values of relaxation in long time can be predicted by the rate of relaxation of second linear dependency. The investigations of 29.4 tex multifilament polyester (48 filaments, twisted 100 m⁻¹) yarns relaxation behaviour at different levels of elongation, i.e. at 3%, 5%, 7% and 10%. Investigations show that the place of break-point of relaxation depends on the level of elongation – by increasing the level of elongation the time decreases till break-point. This phenomenon is very well visible at higher levels of elongation, while at low levels (3% and 5%) the difference is quite small. Using data, it is possible to predict long-lasting relaxation without long-lasting experiments, only shorter than 1000 seconds tests are needful.

Behaviour of multifilament polyester yarns relaxation at the different levels of elongation is not the same and the rate of relative stress relaxation is higher in the case of lower value of elongation. The rate of relative stress relaxation at the time of relaxation is not the same and after some time changes. The time when this break-point is reached depends on the level of deformation and this time decreases at the higher values of elongation, while at lower values of elongation become constant. In all cases, description of relative stress relaxation process by using the method of two straight lines with the break-point gives higher correlation with the empirical data than the linear dependence. Determination of the place of break-point allows the prediction of long-lasting relaxation behaviour of investigated polyester yarns without long time experimental investigations - for relaxation prediction till 500000 seconds only tests till 1000 seconds are needful.

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