Influencing Experimental Factors on the Tensile Properties of Keratin Fibres

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Deformation along the longitudinal axis of keratin fibres such as hair or wool is the most common way to assess the fibre mechanical properties. Quasi-static tensile testing instruments can be used to measure mechanical parameters as a result of fibre extension but also to study fibre hysteresis and stress-relaxation. The first part of this presentation will focus on how experimental parameters such as strain rate or fibre length influence the mechanical properties of the fibres.

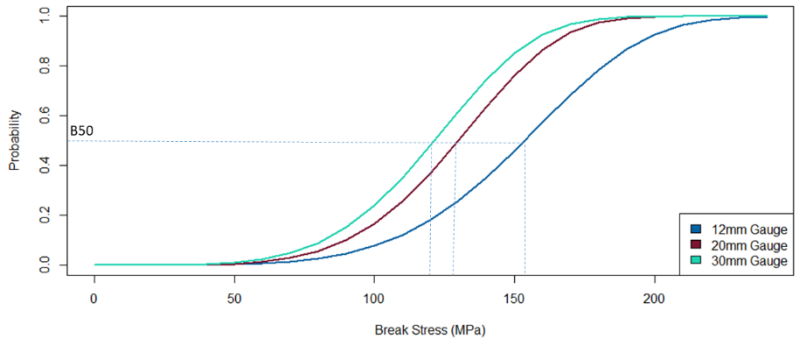


Figure 1: Weibull CDF showing the influence of gauge length on the break stress of single wool fibres

When straight keratin fibres are stretched, they typically show three distinct regions in the load-extension curve namely the 'elastic', yield and post yield regions. However, for curly or crimped fibres, there is an additional region or 'toe in' feature which is attributed to the removal of the fibre crimp. When curly or crimped fibres are initially extended, the inherent crimp within the fibre is removed followed by the actual fibre stretching from a straight configuration. This mechanical crimp removal is a relatively unstudied aspect within the hair are industry. Traditional quasi-static tensile testing instrument based on load cells are unable to accurately measure the extremely small loads which occur during the crimp removal in single fibres. To address this, Dia-Stron has developed the fibra.lex.decrimp which is an ultra-low force extensometer system to enable the high resolution force/displacement measurement of this initial region of the load extension curve attributed to crimp removal (figure 2). The second part of this presentation will introduce these low load measurements.

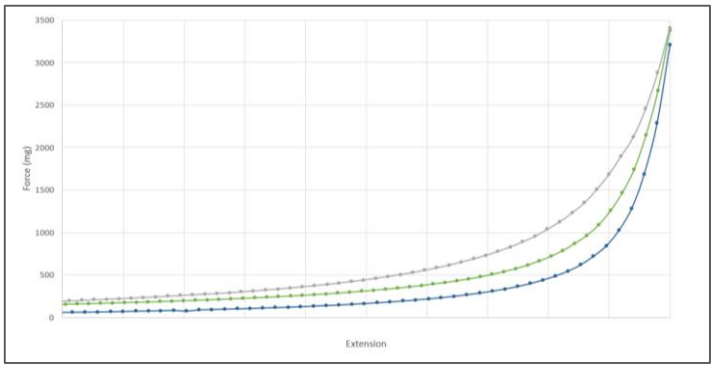


Figure 2: Load extension curve within the initial decrimping region of fibre with different degrees of curl