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MICROSCOPIC METHODS ADAPTED FOR STUDIES OF NONWOVEN PRODUCTS

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Recent strong advances of nonwoven products into the textile market, and even more recent incorporation of cotton fibers into traditionally synthetic nonwoven products require development of methods for studying these structures to determine relationships of fiber types to each other, and for better understanding of processes of fabric formation. Fibers in traditional fabrics are generally paralleled, and twisted into yarns that are then woven or knitted into fabrics. However, fiber orientation in nonwovens is generally random. For many years microscopic procedures have been applied to studying textile fibers, as well as woven and knitted fabrics processed from the fibers. Many of these procedures can be applied in studying nonwovens. However, because of differences in structural aspects between woven and nonwoven materials, it is sometimes necessary to adapt these procedures, or even develop new ones. Applications of microscopy to studying nonwovens will be shown, and these compared with use of the techniques for woven textiles.

For light microscopy, stains can be applied that distinguish cotton from other textile fibers, or show locations of applied chemicals to the fabric. These tests can easily be applied to nonwovens where the structure is stable enough to withstand heating in water and water washing. Use of dyes can thus show locations and distribution of cotton within a synthetic matrix, and finishes that change the surface chemical character of the fibers..

Wide-field light microscopy is used to view whole samples at low magnifications for studying fabrication patterns. These low magnifications are also often useful for studying dynamic reactions such as water sorption where the fabric may need to be free to move during the test.

Scanning electron microscopy (SEM) provides higher magnifications and greater depth of field than light microscopy for more detailed observations of fiber-to-fiber relations within the fabric structures. These advantages pemit SEM studies of mechanisms of bonding within the samples. Differences in entanglement from needle-punching and hydro-entanglement processes, melt-bonding from thermal set processes, and chemical bonding using materials such as latexes can be shown. SEM also provides a means to study applications of surface chemicals for improving properties of the materials. Locations and amounts of chemicals on fiber surfaces can be shown, and durability to laundering, where applicable, can be compared.

Environmental concerns related to dumping of short-term-use textiles or of textile waste materials provide an opportunity to use cotton in these products because of its bio-deterioration character. Microscopic techniques have been used to show differences in disintegration rates of various fibers used in disposable products when submitted to fungal attack similar to that produced on disposal. Mechanisms by which cotton contributes to bio-disintegration of disposed products was shown using microscopic procedures.