Sizing and Desizing Technology

Lecture 11
Sizing Agents

The traditional sizing agent is starch; however, in recent years the trend has been towards synthetic sizes for upgraded size performance. Brief description of the function of the various sizes used is given below.

Starch

Starch granules consists of alpha and beta- amylose; the former is insoluble in water whereas the latter is soluble. The beta-amylose is contained within a membrane of the alpha-amylose. On heating water permeates through the outer membrane causing the betaamylose to dissolve and swell. The granules become expanded and the viscosity increases. Excessive temperature or agitation causes the alpha-amylose membrane to be ruptured leading to a decrease in viscosity.
Many starches form an irreversible gel on cooling. Reheating the gel with strong agitation causes redispersion, however small pieces of gelled particles tend to remain. By substituting acetyl or hydroxy-ethyl group for hydrogen or hydroxide groups on the starch molecule, modified starches are formed. These have lower and more stable viscosity characteristics. Modified starch adheres more strongly to synthetic fibres than does native starch. Even the modified starch films are not very water soluble and in order to remove the size from the fabric, enzymes are used to degrade the starch into soluble sugars.
Carboxymethyl Cellulose

Carboxymethyl cellulose (CMC) is formed by treating cellulose with sodium hydroxide and monochloroacetic acid. The two properties which can be varied are degree of substitution and molecular weight. Solutions of CMC maintain their viscosity for up to 24 hours.

Sodium and potassium salts do not affect the viscosity but calcium, iron and aluminium salts form gel-like precipitates. Warps sized with CMC can be woven at lower humidities than starches. The CMC film readily dissolves in water and desizing can be accomplished by a hot water wash.
Polyacrylates

Polyacrylate sizes (PAA) are based on salts of polyacrylic acid. The two most commonly used are sodium and ammonium salts. Acrylate sizes have higher adhesion than starch, CMC or polyvinyl alcohol. They are suitable particularly for nylon and polyester.

The humidity in the weaving shed must be controlled as these sizes become sticky and lose film strength at high humidities. They are very soluble in water and can be removed from the fabric with ease.
Polyvinyl Alcohol

Polyvinyl alcohol (PVA) is produced by acid or alkaline hydrolysis of polyvinyl acetate. The two chemical properties that can be manipulated during the manufacturing process are:

(i) degree of polymerization or molecular weight
(ii) degree of hydrolysis or the fraction of sites that have OH groups attached to them.
Desizing Process

The complete removal of size is a necessary prerequisite for successful finishing. The chemicals and methods used for desizing depend on the type of size used. Starch and modified starches must be padded with an enzyme and detergent and allowed a dwell time of up to 8 hours.

The action of the detergent is to allow the enzyme solution to penetrate into the fabric so as to degrade the starch into its constituent sugar units.
Removal

Complete degradation is seldom achieved and the removal of the starch is by reducing the viscosity and solubilizing the fragment portions. Acrylic sizes when used on their own are very water soluble and a high removal rate can be achieved by the use of cold water. Heating the rinse water allows more complete removal to be achieved at a lower water consumption.

Polyvinyl alcohol size can be removed from the fabric by washing at the boil. When PAA or PVA sizes are used padding and hatching are necessary, although it will promote gelling of the size and assist removal.