Size Viscosity

Reprint 100

Why you should worry about size viscosity

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Viscosity is a measure of size pickup, since other factors in pickup are constant. Laboratory checks on viscosity are inadequate, mills are finding, and a viscometer on the slasher is being used more and more. This story tells why.

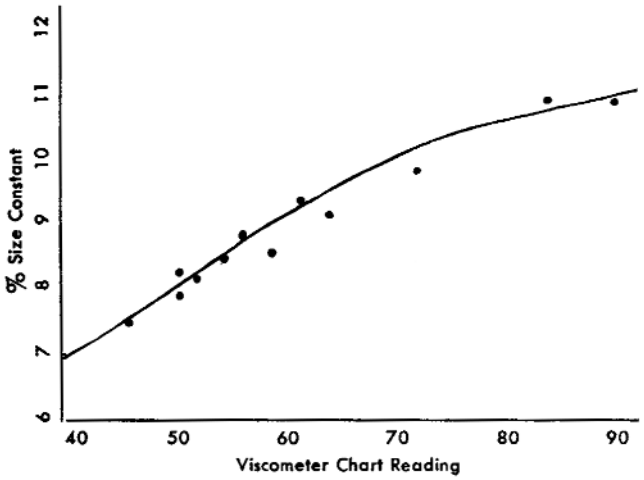
The size content or pickup of a warp is a function of (a) properties of the sizing solution, which can be measured by viscosity, (b) character of the material sized, (c) time of applications, and (d) the effect of the squeezing process. Because items b, c, and d are normally constant, viscosity is also a measure of the size pickup in the warp, and can be used in finding the best size formula for particular warps.

Properties of the Size Solution

The properties of the sizing solution depend upon the type and quantity of size used, how it is prepared, and the operating temperature. Viscosity is a measure of each of these factors because viscosity changes with different types of size. If the quantity of size used is increased, viscosity normally increases. If the operating temperature is increased, viscosity normally decreases. If the size is prepared by cooking, viscosity is low in the early part of the cooking process. The viscosity increases to very high values during the paste state, and then gradually decreases to the correct value when the process is terminated. If the size is under-cooked, the viscosity will be high. If it is overcooked, it will be too low.

Viscosity is also an important factor when starches are mechanically converted by homogenization, and the pressures applied during the homogenization can be adjusted to obtain the desired viscosity. Size held in the storage kettle at high temperature decreases in viscosity. Furthermore, condensation from the steam used to maintain the proper temperature in the size box dilutes the solution and lowers the viscosity. Mechanical agitation of the size in the box further breaks down the starch and also lowers the viscosity. Viscosity of the sizing solution as it is used is therefore an overall measurement of all of factors affecting the properties of the solution, and the viscosity will remain constant if all of these factors are not permitted to vary.

The properties of the textile material being sized and its previous treatment will of course influence size pickup to some extent, but normal variations in the character of the material do not appreciably affect pickup.



The viscosity value that provides the desired pickup for a warp is found by means of laboratory checks on size pickup at various viscosities.

Time of Application and Squeezing

The time of application of the size depends upon the depth of the immersion roll, level of the liquid in the box, and speed of the slasher. The immersion roll can readily be adjusted to the desired depth. The level of the liquid is normally automatically held constant, and the speed of the slasher for any particular type of warp usually varies over a comparatively small range. If the slasher is equipped with an automatic moisture-content control, and if the speed varies over a wide range, the drying is probably non-uniform; and the trouble should be investigated and corrected.

The squeezing process is very important, and the results obtained depend upon the type of roll covering and the pressures applied. Pressure regulators are available for applying uniform pressures to the warps, and normal variations in the roll covering will not appreciably affect the size content.

The importance of maintaining the correct viscosity in sizing solutions has long been recognized in the industry. Many mills in the past have endeavored to control their sizing by periodically removing samples for laboratory tests. This procedure is inadequate because laboratory viscosity measurements are subject to error because of time delay and changing conditions of temperature, agitation,

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and other factors influencing particular solutions. Furthermore, laboratory measurements are applicable only to the sample taken; and by the time the results are available, the viscosity of the solution in the actual sizing process may have further changed, too late to make effective corrections.

What Viscometer Does

Viscometers have been perfected for use on slashers for process control. Such instruments automatically measure the viscosity of the solutions in the actual process where they are used, and eliminate the necessity of removing samples for laboratory tests. As a result, accurate control of viscosity can be maintained under actual operating conditions.

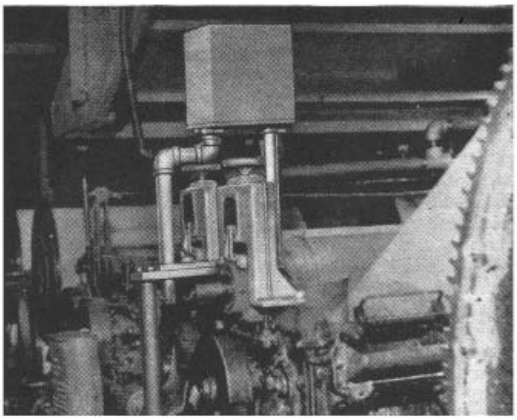
The measuring element of one type of viscometer that is in use in the industry is shown in the accompanying photograph as applied to a cotton slasher. In this particular type, a plunger or piston is raised by a motorcam mechanism and then allowed to drop by gravity. A sample of the solution whose viscosity is to be measured is drawn in through orifices as the piston is raised, and expelled when the piston is dropped. The time required for the piston to drop is a measure of the viscosity. This measurement is transmitted to a recorder through a suitable multi-conductor cable. Measurements are then converted into chart readings by means of motors, relays, and other associated parts. The recorder can be set to sound an alarm if high and low limits of viscosity are reached.

The viscometer records viscosity in convenient arbitrary units from 0 to 100. For such applications, it is not necessary to have the instrument calibrated into absolute viscosity units, because it is not feasible to compute the optimum value of viscosity to be used for any particular warp.

Selecting the Best Formula

The procedure normally used is to install the viscometer and make a few laboratory determinations of size pickup, noting the viscometer reading. Then determine the value of viscosity that will provide the desired pickup for the particular warp. The accompanying chart shows a relationship between size content and viscosity for a typical cotton mill. Points used in plotting this curve were obtained from making laboratory determinations of the size content, and plotting them against the corresponding viscometer readings as the viscosity changed because of the effect of condensate and normal agitation in the size box. For this application, a size content of from 8 to 9% was found to produce the best results, so that 55 was considered the optimum value of viscosity in this case.

The selection of the most suitable size formula depends upon the particular application, and should be left to technicians having experience and highly specialized knowledge of the process. A viscometer installed to measure continuously the viscosity of the warp size furnishes an automatic check on the preparation of the size and on variations in the chemical composition or moisture content of the raw materials used in the size formula. If, for example, a mistake is made in the quantities of the ingredients used in preparing the size, or if the cooking, level, and temperature controls are not all functioning properly, the viscometer reading will deviate from the desired value. The deviation indicates to the operator that a mistake has been made so that the troubles can be corrected before warps are improperly sized. The viscometer will likewise deviate from the desired value, giving an alarm, if the chemical composition or moisture content of the composition or moisture content of the raw materials are not uniform, as may be the case with different shipments.



Viscometers installed at the slasher provide an almost continuous check on viscosity at the size box, can record measurements, and sound an alarm if viscosity varies beyond pre-set limits.

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