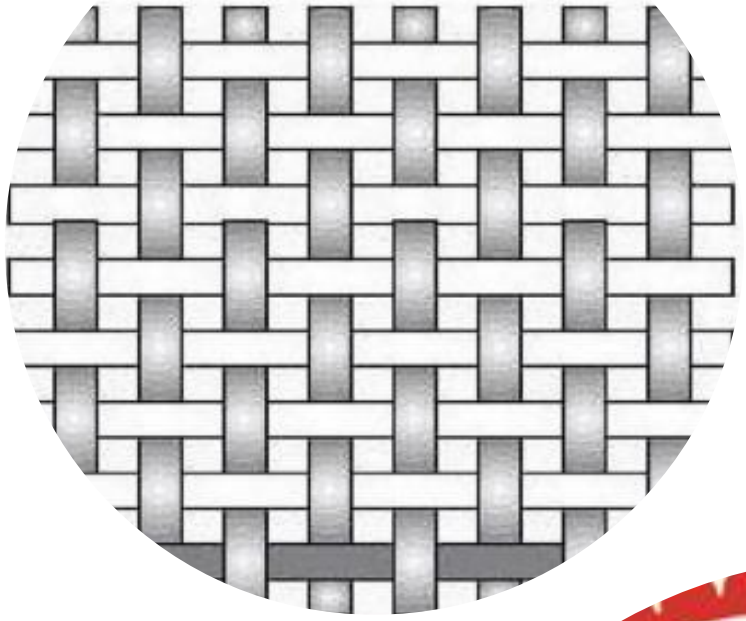
Fabric Manufacturing I (TXL231)



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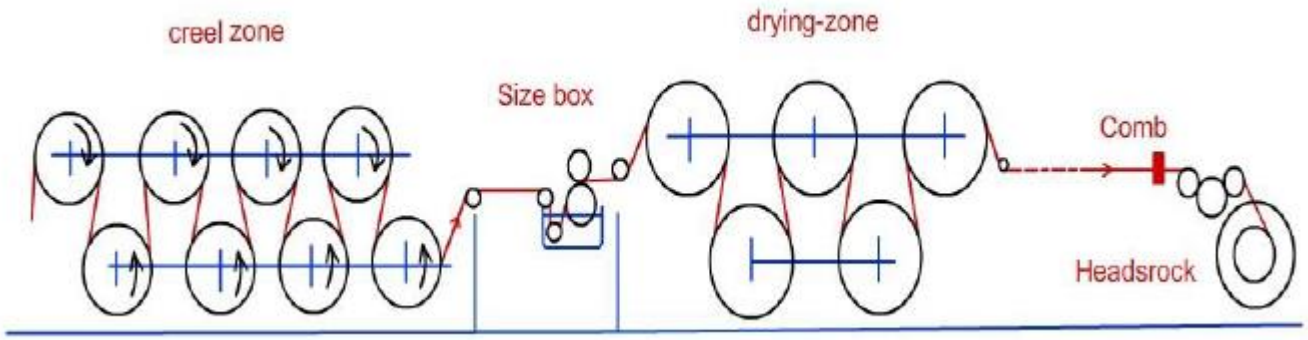
Sizing: Sizing machine

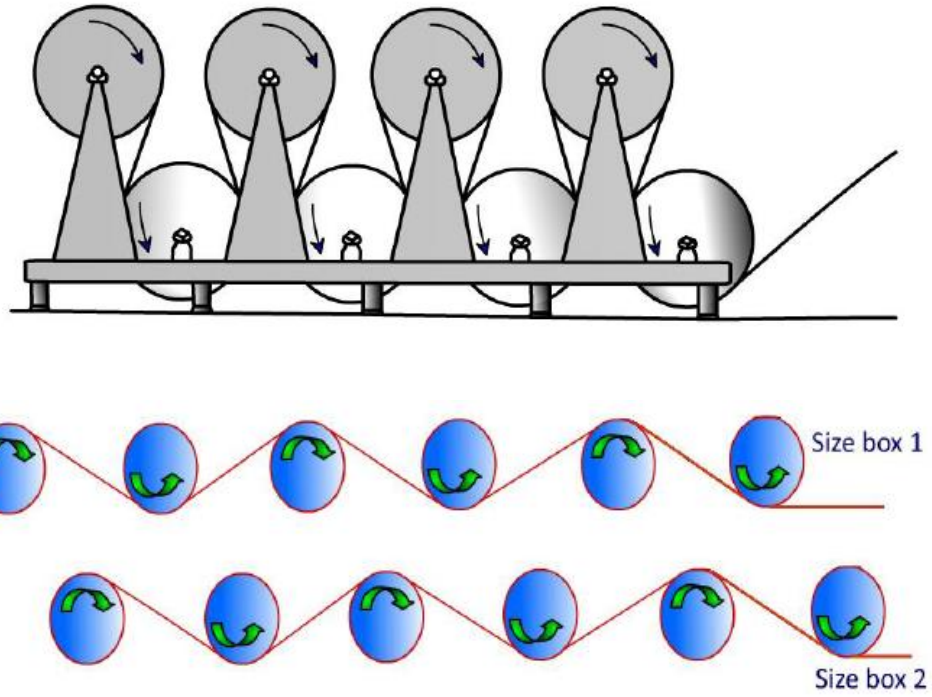


The creel zone contains large number of warper's beam which can be arranged in different fashion depending on the design of the creel. Individual warp sheet emerging from warper's beam are merged together to form the final warp sheet which passes through the size box. During the passage through the size box, the warp sheet picks up size paste and holds a part of the paste after squeezing. Then the wet warp sheet passes through the drying zone and wound on the weavers beam

Sizing: Creel Zone

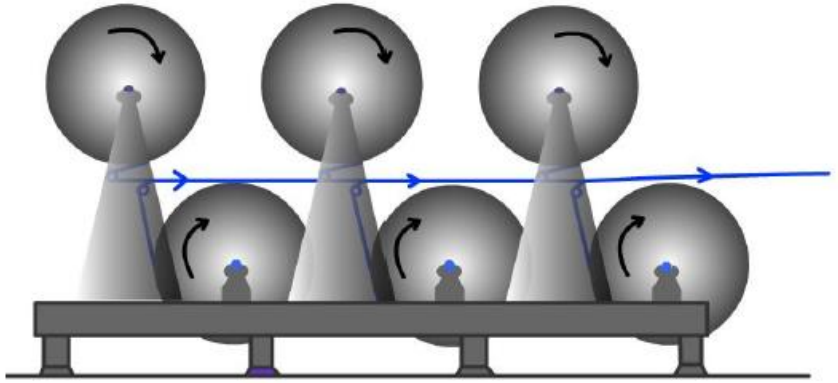
1. An easy withdrawal of warp sheet from each beam
2. Proper assembly of each sheet into the final form in which sizing of the assembled yarn sheet would take place
3. Easy access of the operator to each element of the creel

Over and under creel



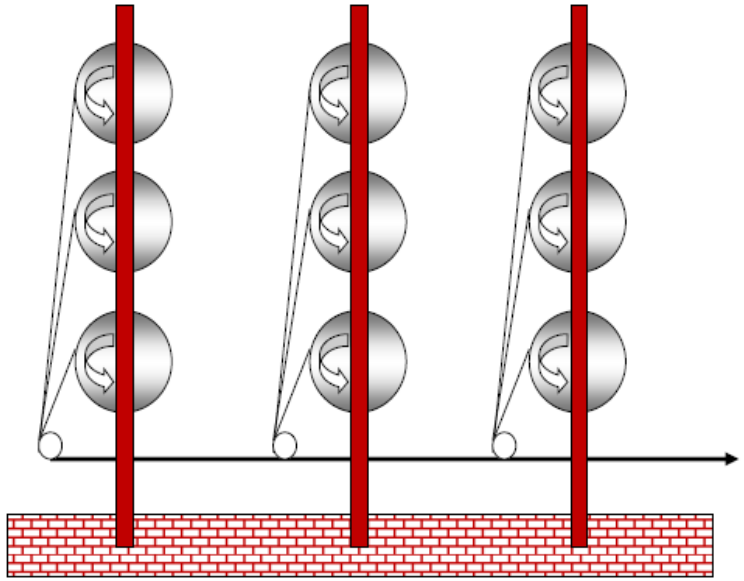
The warp sheet coming from the rearmost beam experiences more tension and stretch than the warp sheet coming from the beam located nearest to the size box

Equi-tension creel



The warp sheets are subjected to equal tension and stretch irrespective of the position of the warper's beam

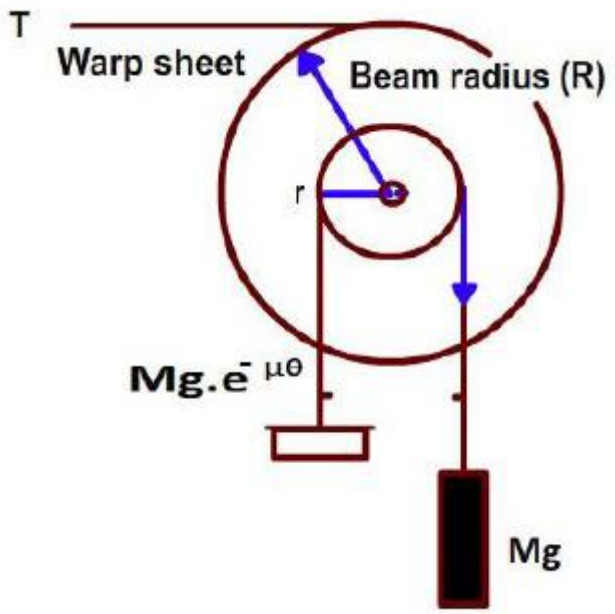
Vertical creel



The beams are stacked vertically to reduce floor space

Sizing: Warp tension

As the sizing process continues, the radius of the warper's beam reduces. Therefore, it is required to adjust the warp tension by adjusting either the dead weight suspended with the rope passing over the ruffles of the warper's beam or by controlling the pneumatic pressure applied on the bearing region of warper's beam



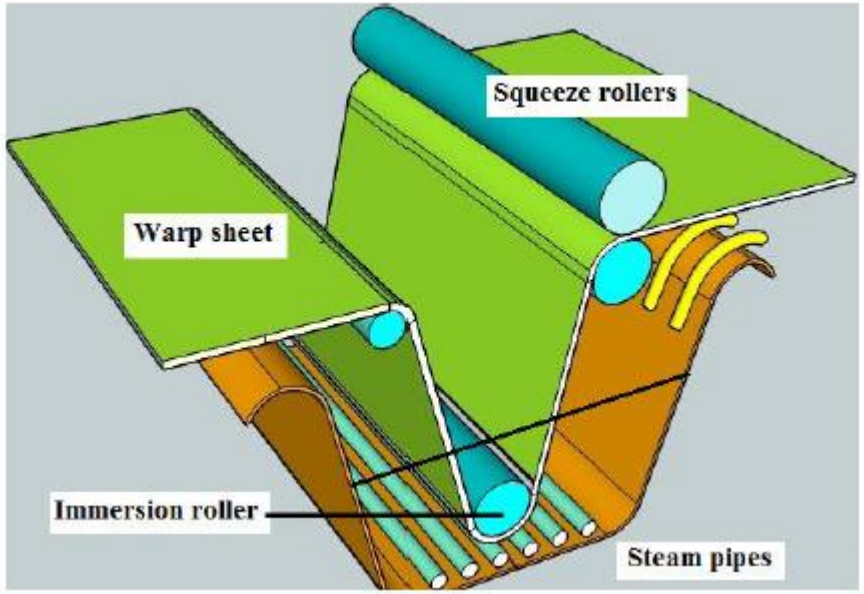
T is the warp tension, R is the radius of warper's beam, r is the ruffle radius, μ is the coefficient of friction between the rope and the ruffle, θ is the angle of wrap (in radian) of the rope over the ruffle, M is the mass of suspended element and g is acceleration due to gravity.

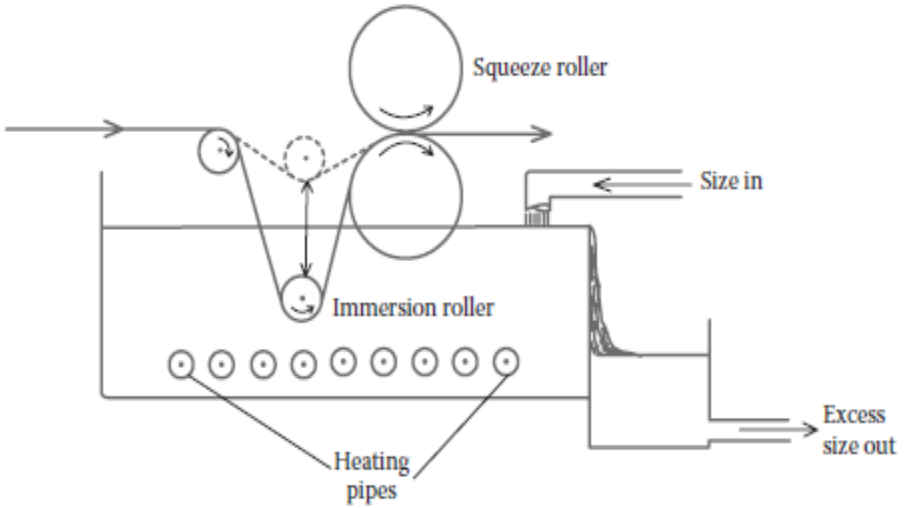
$$T.R = 2.Mg.r.(1-e^{-\mu\theta})$$

In sizing process, the allowable stretch is 1-1.5% for cotton and polyester yarns. The stretch can be higher (3-5%) for viscose and acrylic yarns

Sizing: Size Box Zone

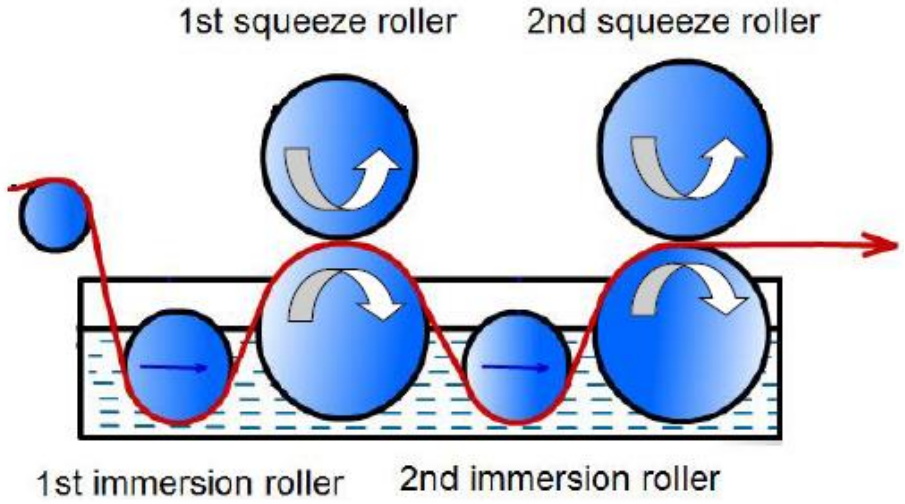
The process of immersion is called ‘dip’ and the process of squeezing by means of a pair of squeezing rollers is called ‘nip’



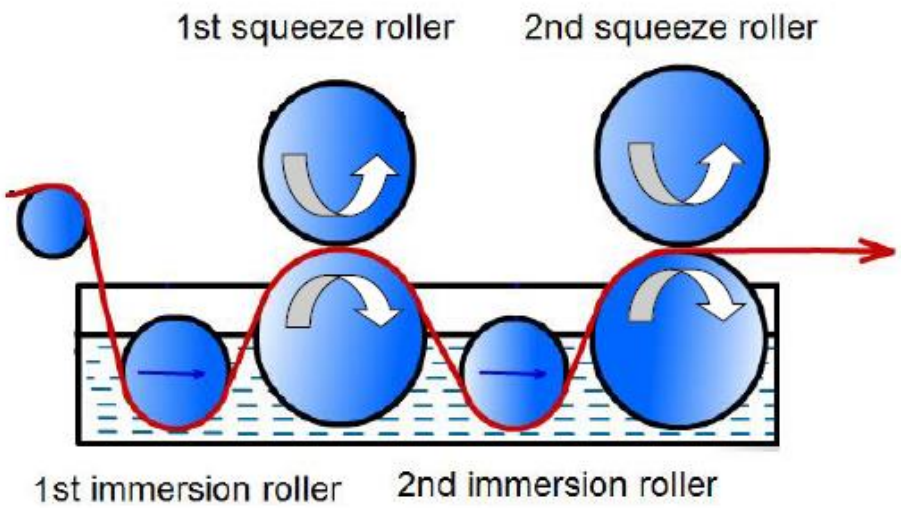


One dip one nip size box

Two dip and two nip process allows grater time for immersion of yarns within the size paste and thus this process forms more uniform coating of size film



Sizing: Size Box Zone



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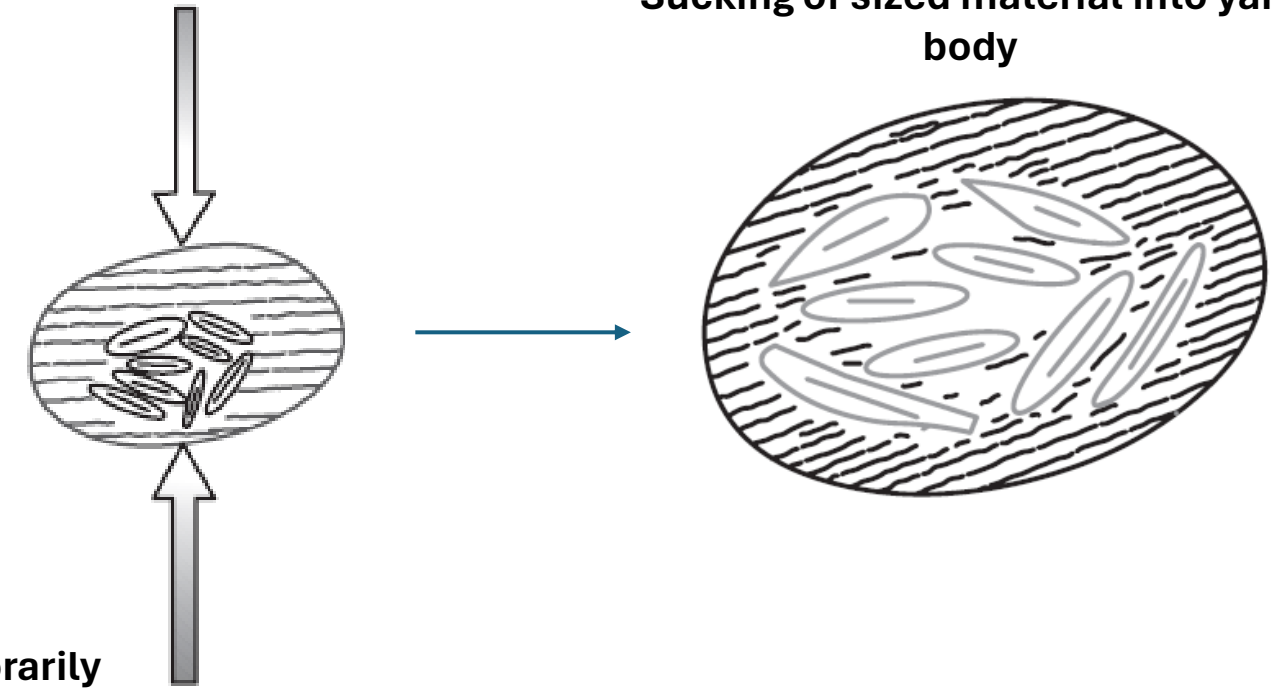
Sucking of sized material into yarn body



Squeezing pressure temporarily flattening sized yarn

Sizing: Size pick up dependence

Viscosity of Size Paste

The wet pick-up generally increases with the increase in viscosity. Viscosity also determines the penetration of size paste within the yarn structure. If more penetration is desired then viscosity should be lowered and vise versa.

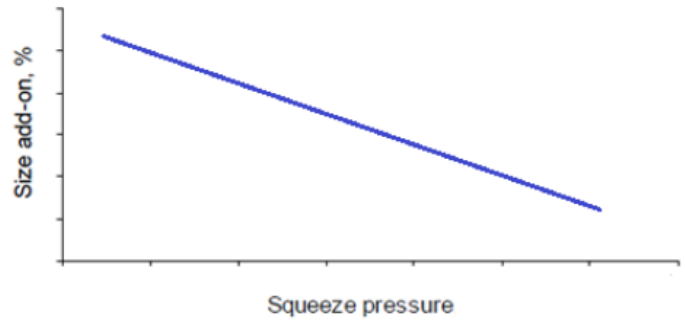
Squeeze Pressure

The squeeze pressure forces out the excess paste picked up by the warp sheet. Besides, the pressure distributes the paste uniformly over the yarn surface and causes size penetration within the yarn structure

Pressure	Size coating (film thickness)	Size penetration
High	Low	High
Low	High	Low

Hardness of Top Squeeze Roll

If the hardness of the top roller is low, then there will be flattening of the roller. Thus, the contact area increases which effectively reduces the pressure acting at the nip zone. Therefore, the size pick-up increases



Sizing: Size pick up dependence

Thickness of Synthetic Rubber on the Top Roller

If the thickness of synthetic rubber cover on the top roller is greater, then the extent of flattening is more. This will reduce the nip pressure and thus the wet pick-up will increase

Position of Immersion Roller

If the height of immersion roller is lowered, then the residence time of the warp sheet within the size paste increases. This will lead to the increase in wet pick-up if other factors are constant.

Speed of Sizing

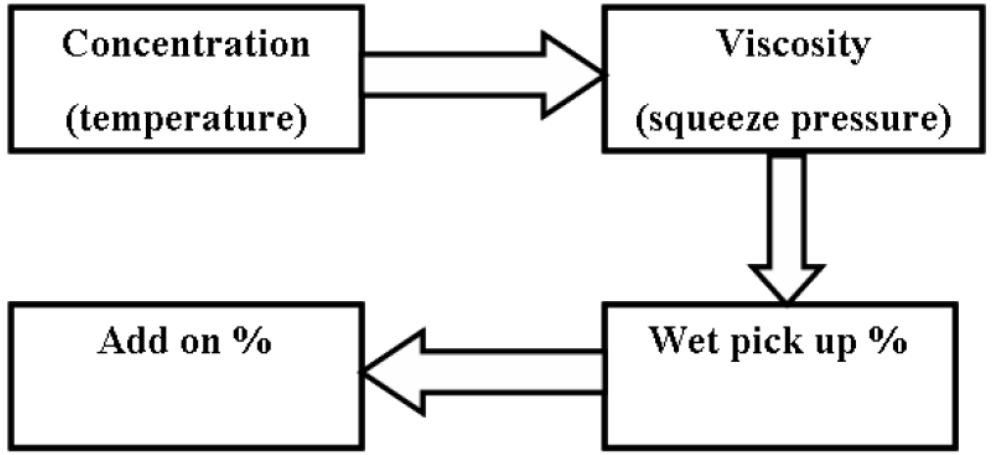
- Higher speed reduces the residence time of the yarn within the paste which should reduce the wet pick-up.
- Higher speed increases the drag force between the warp sheet and size paste which should induce more flow of paste with the warp sheet.
- Higher speed reduces the time of squeezing which should increase the wet pick-up

In modern sizing machine, the practical speed can be around 100 m/min

Sizing: Size pick up

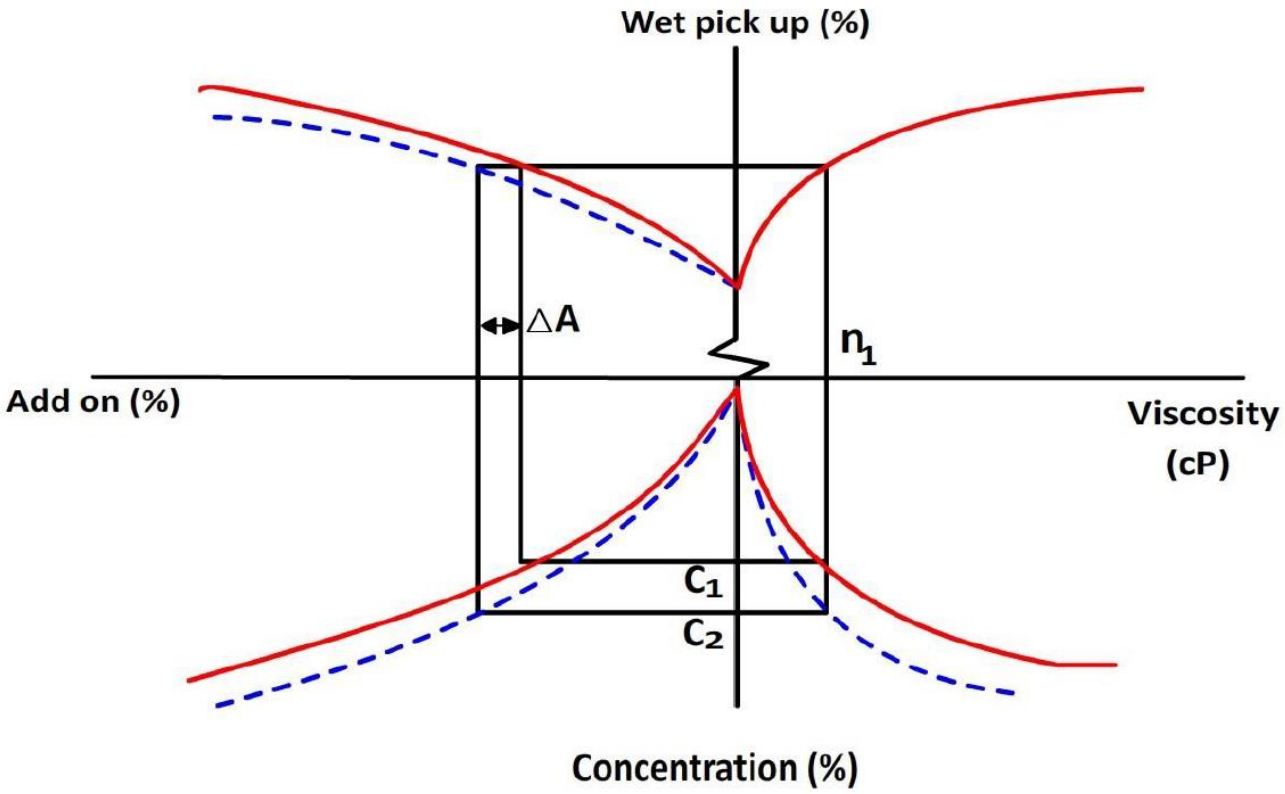
The balance between viscosity and add on

- At a given temperature, concentration of size paste determines the viscosity.
- For a given yarn, squeeze pressure and sizing speed, viscosity of size paste determines the wet pick-up.
- Wet pick-up determines the add-on.
- For a given concentration of size paste, higher wet pick-up leads to higher add-on and vice versa.



Sizing: Size pick up

The balance between viscosity and add on



Pressure		
High	High pressure Low conc.	High pressure High conc.
Low	Low pressure Low conc.	Low pressure High conc.
	Low	High

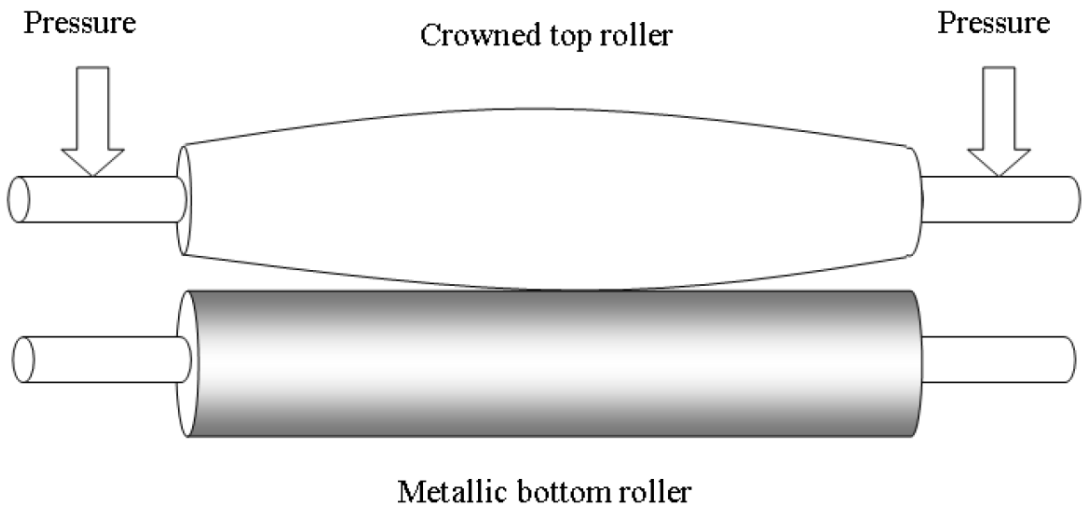
Concentration

The broken line representing the thin boiling starch is positioned below the solid line representing normal starch

Sizing: Some other important factors

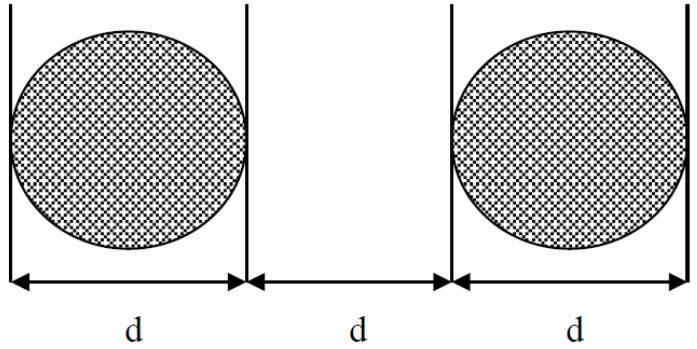
Crowning of Top Roller

To avoid uneven pressure along the nip line



Percent Occupation and Equivalent Yarn Diameter

The relative closeness of the yarns inside the size box is expressed by percentage occupation and equivalent yarn diameter. Equivalent yarn diameter indicates the space between the two yarns in terms of yarn diameter



Yarn arrangement for 50% occupation

$$\text{Percent occupation} = \frac{\text{Actual number of yarns in the warp sheet}}{\text{Number of yarns in the warp sheet with 100\% occupation}}$$

$$\text{Percent occupation} = \frac{100}{1 + \text{Equivalent yarn diameter}}$$

If the percent occupation is very high, then the yarn may not be uniformly coated by the size film.