

The Role of Secondary Heater in deciding Yarn characteristics in Texturising Machinery



*By:
B. Basu*

The Role of Secondary Heater in deciding Yarn characteristics in Texturising Machinery

By: B. Basu

Abstract

The role of secondary heater is very often a disputed matter. The temperature is kept by the PTY manufacturers depending upon their end use. The experimental works were carried out with latest POY with latest texturising machine reveals the fact that there is marginal difference found the denier, tenacity and elongation. The main area is HCC % which is known to all. There is as such no difference in fabric width was found nor any dye uptake although the same is very often doubted by the end users. The bulk variation starts only at the difference of 20 degree centigrade between the primary and secondary heater. There is no remarkable difference in dye uptake was also found. The X-Ray and intrinsic Viscosity (IV) also do not show any difference as there is no change in molecular structure.

Key words: Heaters, tension, yarn properties, machine parameters,

Introduction

In Industrial practice the difference between Primary and secondary heater is maintained about 20 °C depending on end use. Higher the difference, higher is the bulk observed. The temperature is being kept in most cases with assumption basis and with practical experience. As such no supporting data is available in this area. For the different end use different temperature (2nd) is being maintained. Hence vigorous studies are being conducted between the °C of secondary heater vs. all yarn properties.

The role of primary heater is to mobilize the molecules and gives the desired yarn properties with the help of Draw ratio and D: Y. But the secondary heater makes the texturised yarn stable and taken for further process. It is also studied whether any structural changes take place with the variation of secondary heater.

1) Material and Method:

It was a latest Himson mc. of model AX4N, close heater with latest amenities. The parameters: Speed > 900 MPM, PH temp-200 °C., SH temperature varying at a difference of 5 °C from 140 °C to 170 °C i.e. at 7 stages. D: R-1.70, D/Y - 1.65, SOF - 4.5% (fixed), CPM - 450 +/-2.5%, oil roll rpm- 4. Take up value was changed as per the SH to maintain uniform package hardness. (3.65 to 4.35) POY - Den > 132.4 , Breaking strength (gms) 285.26 , Elongation at break (%) 126.08 , Tenacity of the yarn – 2.15 , U% = 1.67 , D/F on dynafil -M, Mean 41.76, Min - 36.47, Max- 51.65 , spin finish % 0.44.

2) During texturising process tension values were taken.

T1 CN	T2 CN	T3 CN	T2/T1
32-34	22-24	10-11	0.647-0.75

There was consistency in tension values. No variation in tension was found which proved the Excellent POY properties and yarn path in the Machine.

3) The physical inspection of PTY spools

No fault such as b.f., loops, hardness variation, cross winding was found. No bulk variation was found up to the tempt difference of 15 deg.

The table no 02 has shown how the bulk variation occurred gradually as the difference in heater temperature was widened.

Table no 02

Standard Package	Comparison Package	Bulk diff	Standard Package	Comparison Package	Bulk diff
140 °C	145 °C	No	150 °C	155 °C	No
	150 °C	No		160 °C	No
	155 °C	V.slight		165 °C	No
	160 °C	slight		170 °C	slight
	165 °C	slight	155 °C	160 °C	No
	170 °C	found		165 °C	No
145 °C	150 °C	No		170 °C	No
	155 °C	No			
	160 °C	V.slight			
	165 °C	slight			
	170 °C	slight			

From the table it is very clear that within a difference of 15 °C in 2nd heater temperature, there is almost “no” to very slight difference in bulk. For the difference in 20 to 25 deg the bulk variation starts. For the difference in 30 °C the good difference in bulk is found. It is because of the fact that higher the 2nd Heater higher will be the set yarn and hence less bulk.

4) The physical properties of PTY Spools.

The details are given at table no 04.

Table no 04

2nd Heater tempt	Den with oil	Den without oil	Breaking strength (gm)	Elongation at break (%)	tenacity of the yarn (g/d)	HCC%	Oil content (%)
140 °C	76.6	76.37	292.9	20.74	3.8	39.6	0.31
145 °C	76.6	76.02	303.31	22.24	3.9	36.1	0.76
150 °C	76.9	76.45	305.4	22.67	3.9	35.9	0.58
155 °C	77	76.65	307.5	21.58	3.9	34.7	0.45
160 °C	77	76.63	316.67	22.77	4.1	32.4	0.48
165 °C	76.7	76.29	306.46	21.06	3.9	37.2	0.53
170 °C	76.7	76.33	299.99	21.42	3.9	32.9	0.48

The properties were checked at MANTRA lab as per ASTM standard. It is found that there is hardly any difference in denier and tenacity values. Because all these properties were decided at the stage between input and intermediate roller where simultaneously draw was done in high temperature followed by cooling and formation of bulk. The HCC value is decreasing with the increasing of secondary heater temperature as the thermoplastic yarn gets more relaxations with less temperature and gets more stable with higher temperature.

5) Boiling water shrinkage

The boiling water shrinkage was taken at a tempt of 100 °C for the common duration for all and the findings are given below at table no 05

Table no 05

Sample no	2 nd heater Tempt	Boiling water Sh%	IV Value	X-Ray order factor	Orientation angle at peak 25.5	No of snarls per mtr.	
1	140 °C	11.2	0.591	0.41	15.6	sample 01	sample 02
2	145 °C	6	0.592	0.37	18.9	69	68
3	150 °C	5.6	0.592	0.39	16.4	63	64
4	155 °C	6	0.591	0.41	15.98	63	64
5	160 °C	6	0.591	0.38	17.2	65	63
6	165 °C	3.6	0.593	0.37	17.2	63	57
7	170 °C	2	0.592	0.4	16.4	58	60
						57	58

Sh% value reduces as the 2nd heater tempts increases. But at each point of tempt the value does not decrease. There is no significance deference in X-Ray and IV value which shows no diffraction in molecular orientation.

The snarl per meter also showing decreasing trend as and when 2nd heater tempts increases as it gets more set.

6) *TKD Value (* Tube knitting dyeing)

TKD was done at serial order as well as in match with each other. Very slight difference found between 140 deg and 165 deg. Slight differences found between 140 deg and 170deg.

7) The yarn sample Vs. Fabric width

The cloth was woven on ord. loom and the pirns were wound at single position keeping everything at identical condition. The fabric was woven at single loom and at a sequence where the comparison was made with each 2nd heater temperature.

The width variation within the sample i.e. say sample no 1, 2 etc are found within 0.5 inch and no significant difference was found between sample numbers 01 to 07.

Fabric Dyeing report:

The whole fabric was dyed and no difference in Dye uptake was found. However between samples no 1-7 and that of 1-6, a wrinkle was found. It was found that lesser the 2nd heater better was the cloth feeling for the obvious reason of softness at lesser tempt with higher bulk.

Conclusion

There is no significant impact on denier and tenacity with the variation of secondary heater temperature. The HCC and boiling water shrinkage value decrease as the secondary heater tempt increases. The dimensional stability improves with increase of secondary heater tempt. Such is in the case of snarl value. In IV and X-Ray value no difference was found and it can be said that there is no change in structural value within this experiment. There is as such no significant width variation found in grey and finished fabrics with the total difference of 30 °C even though the bulk variation was observed. The cloth feel is better with lesser 2nd heater temperature. In TKD value, slight darker was found at the temperature difference of 25 °C and above.

Acknowledgements

The author is grateful to Dr. S. V. Agarkar , Principal of Anuradha Engineering College for the continuous support , grateful to Dr. Tapas Bhattacharya (Ex RIL) , Dr. Swadesh Sett (Director) and Dr. S. K. Basu (Director MANTRA) for their technical support and guidance. The author is also highly grateful to Dr. A. B. Talele of Himsom Engineering, Surat to allow in conducting the Project works.

About the Author

The author is retired General Manager from RIL and is presently working as Lecturer in the Department of Textile Engineering Department, Anuradha Engineering College, Chikhli, Maharashtra as a T&P Officer and MR- ISO

This experiment is an ideal guideline for the PTY manufacturers

Image Courtesy:

<http://www.asia.ru>