CHAPTER 17

SUMMARY AND CONCLUSIONS

17.1 SUMMARY

A great deal of work on the structure properties of air-jet yarns has been carried out in the past by many research workers. Attempts were made to use air-jet nozzle in ring frame for the purpose of reducing hairiness of cotton yarns, and after getting some encouraging results, the nozzle was fitted in cone winding.

A survey of literature such as that presented in Chapter 2 has shown a complete absence of work on the structure and properties of air-jet ring yarns produced with a nozzle in ring frame. This work considers this aspect in depth, and new data for the first time have been generated.

As an extension of work, an attempt has been made to reduce the hairiness of cotton yarns in cone winding by installing an air-jet nozzle in it. The hairiness of cotton yarns wound on the cones was examined.

Another area, which has been investigated for the first time, is the installation of air-jet nozzle in rotor spinning machine, and its effect on the yarn characteristics.

The use of air-jet nozzle in controlling the hairiness of jute yarns, and the process optimization of the air-jet nozzle have been explored.

While each author, who has carried out work on the air-jet nozzle in ring frame, has focussed his attention only on yarn hairiness, this work addresses the yarn structural parameters such as packing coefficient, fibre
migration and also the low stress mechanical properties such as bending rigidity, compression, friction, abrasion resistance, and twist liveliness so as to have a better understanding of the yarns.

Also, the effect of the air-jet nozzle position in between the roller nip and the thread guide on the fibre migration and yarn characteristic has been studied for the first time.

It was, during 1987 - 1989 that comprehensive research work on air-jet spinning was carried out by many workers. In 1997, Wang, Miao and How(190) installed air-jet in ring frame and studied its effect on yarn hairiness. Also, data obtained from a series of experiments were provided by them; they further carried out work on the hairiness of yarns wound onto cones. Many factors, which affect the yarn characteristics such as air pressure, nozzle inclination angle and nozzle position were not considered by them.

Furthermore, the important effects that these yarns have on spirality of weft-knitted fabrics have been studied. It may appear to be incongruous that this was not considered by the previous workers - who did research on air-jet ring spun yarns.

Another significant change that has been made in the characterisation of migration of fibres in the air-jet ring spun yarn is the use of migration factor; this new parameter has been found to represent the migration of fibres in a much better way compared to the ubiquitous parameters. It has been demonstrated that by taking the data provided on migration of fibres by several research workers that this parameter characterises the fibre migration quite clearly.

Using the computational fluid dynamics technique, the torque which acts on the yarn inside the air nozzle, has been computed.

Online twist measurement using high speed photography has been done to examine the effect of air-jet nozzle on twist distribution.
The major conclusions reached in the present study are presented in the following section.

17.2 CONCLUSIONS

There is a noticeable reduction in yarn hairiness of the yarn spun with the air-jet nozzle with cotton.

The nozzle, which is similar to the first nozzle in air-jet spinning machine, has led to a significant reduction in yarn hairiness when it has been installed in cone winding machine.

Air-jet spun ring yarns are characterised by higher packing factor, higher compression, higher abrasion resistance and lower twist liveliness.

The coefficient of friction of air-jet ring spun yarns in comparison with the regular yarns shows that the values are similar.

Fibre migration of air-jet ring spun yarns as exemplified by migration factor shows an increase as compared to the parent yarn.

Fibre migration has been found to be maximum when the air-jet nozzle is positioned very close to the front roller nip.

Air pressure has a profound influence on the yarn characteristics in that higher air pressures are found to be detrimental to yarn characteristics.

The introduction of air-jet nozzle in rotor spinning has led to a higher packing coefficient of all the yarns. In some cases, an increase in tenacity has been obtained. The appearance of the yarn has been found to be better. These findings per se demonstrate the use of air-jet nozzle in rotor spinning for producing compact yarns.
17.3  **SUGGESTIONS FOR FURTHER RESEARCH**

1. Use of twin air-jet nozzles in ring frame, cone winder and rotor spinning on the yarn hairiness can be explored.

2. A study on fabric handle by using air-jet ring spun yarn can be carried out.

3. The effect of fibre properties on the properties of air-jet spun ring yarns not only with cotton fibres but also with the synthetics can be explored.

4. Aspects such as twist flow, in the air-jet ring spun yarn, migration in rotor yarns, effects of spindle speed, twist and air pressure on fibre migration are areas where further work is necessary.