



Hairiness Reduction of Yarns by Nozzles at Ring Spinning: Airflow Stimulation Approach

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ABSTRACT

In this paper we report on the investigation of hairiness control using nozzles at ring frame. Airflow simulation inside the nozzles gives some insight into the mechanism of hairiness reduction. To solve the three-dimensional airflow field inside the nozzles, a CFD (computational fluid dynamics) model has been developed to simulate the airflow pattern using FLUENT 6.1 software. Swirling effect of the air, caused by the design of the nozzles seems to be main reason behind hairiness reduction. 10, 20 and 30 tex Z-twisted ring spun yarns were produced with and without nozzles and tested for hairiness, tensile and evenness properties. The total number of hairs equal to or exceeding 3 mm (i.e. the S3 values) for yarn spun with nozzles is nearly 38-59% less than that of ring spun yarns, while both the yarn types show little difference in evenness and tensile properties. Nozzle angle (angle of auxiliary inlets) plays a significant role in reducing the S3 values as evident from large reduction of hairs with varying the same. The change in yarn channel diameter plays lesser role in reducing the S3 values than the changes in nozzle angle of auxiliary inlets.

Keywords: Airflow, Hairiness, Nozzle angle, NozzleRing, S3 values, Simulation, Yarn channel diameter.

Introduction

Hairiness inevitably occurring during the spinning process is one of the most serious causes of inefficiency in sizing, weaving and knitting. Higher number of hairs on the surface of fabrics makes the appearance fuzzy and prone to pill formation. Yarn hairiness is a key factor affecting properties and processability of yarn as well as fabrics. Hairiness can be

reduced by conventional techniques such as sizing for short staples and two-folding for long staples. Some new technologies, which have been developed to reduce hairiness of ring spun yarn, are compact spinning [1-5] and using air-nozzle (in other words nozzle) in ring spinning (JetRing spinning) [6-11]. JetRing spinning combines features of ring and air-jet spinning technology. The single nozzle placed below the yarn formation zone, acts in a way similar to the first nozzle