STREAKINESS IN CARPET - SOME CAUSES AND DETECTION METHODS

Myriam Vanneste, Valja Everaert, Sandra De Decker, Luc Ruys,
Centexbel, New Material Concepts & Nanotechnology, Technologiepark 7, BE-9052 Zwijnaarde

Streakiness in carpet can have various causes:
- differences in process settings during extrusion as well as during heatsetting;
- differences in tension along the production process (winding, twisting, heatsetting, tufting or weaving);
- problems regarding cutting during tufting or weaving;
- remaining chemicals preventing the carpet pile to open during brushing;
- real colour differences (differences in concentration of pigment or dye stuff);
- filament shape (round versus trilobal, modification ratio for trilobal filaments);
- orientation of the pile;
- ...

and can find expression in:
- dark or pale spots, non-continuous;
- dark or pale streaks, continuous;
- differences in height between the piles;
- differences in distance between the piles;
- ...

The difference in carpet aspect gives often already a clue toward the possible cause of the problem. When a streak changes from dark to pale depending on the observation angle there is every indication that it is caused by a physical difference (orientation of the pile, voluminosity, ...). If the streak retains its colour, independent of the observation angle, a chemical problem causes the streak.

In a number of cases streakiness in carpets can be classified into one of the following, frequently occurring causes: heatset variations or differences in crimp. By means of multi-client research projects, subsidised by the government, CENTEXBEL has built up knowledge and experience towards the detection of causes and has developed a number of methods to trace these causes.

HEATSET VARIATIONS

Differences in heatset parameters such as temperature, residence time, yarn density, ... lead inevitably to differences in aspect in carpets. CENTEXBEL developed several years ago during a 'heatset project' a method that allows to get indications regarding heatset quality of heatsetted yarns as well as carpet. The use of this method for the determination of the thermal history is unique in the world!!

For PP carpets a good indication can be obtained for the used heatset temperature for Suessen as well as for Superba qualities. The same applies for PA6 carpets produced with Suessen heatsetted yarns. For Superba heatsetted PA6 yarns only an index can be given (deviating from the exact heatset temperature) which makes it still possible to compare the streak with the normal zone.

In Figure 1 a carpet is presented in which a pale streak is present. By means of the method developed it could be demonstrated that the heatset temperature within the pale streak was about 8°C lower than in the normal zones (see Figure 2).

Figure 1: pale streak present in a PA6-heatset carpet (photo: Marc Van Hove, Centexbel)
finally the individual filaments. When the yarn corresponding to the streak and the normal zone is available, crimp measurements on yarn can be performed using the TYT (Textured Yarn Tester), a dynamic testing method that was refined and correlated with various process parameters within the project “dynamic yarn characterization”. A PA6 carpet with pale streaks was investigated using microscopy on the various levels (carpet-pile-filament). Since the corresponding yarns of both zones (normal and streak) were also available they were examining with TYT. From Figure 6 it seems that in the pale streak the top of the pile is tilted while in the normal region the piles are all straight. When the top of the pile is tilted, the incident light is reflected more leading to a pale aspect. In the normal zone the light enters the carpet and as a result the light is not reflected and thus leads to a dark aspect.

Images of the side view of the piles clearly show that the carpet piles in the normal zone (being dark in this example) have less volume than the piles in the pale streak. The images of the individual carpet piles also clearly show the difference in volume or bulk (see Figure 7). Examining the individual filaments a difference in crimp is observed (see Figure 8). This difference in crimp can be caused by differences in process parameters as well as with differences in tensions on the yarn.

DIFFERENCES IN CRIMP

Not only differences in crimp between BCF bobbins but also crimp variations within a bobbin can lead to streakiness. In the first case continuous streaks will result, with the high crimp regions appearing as dark zones and the low crimp regions as light streaks. The variation within a bobbin will lead to non-continuous streaks (see Figure 5).

When examining streakiness of an unknown carpet in Centexbel first of all a microscopic investigation or inspection of the carpet is performed. This inspection starts on the carpet (top and side view of the carpet/piles) followed by a much more thorough investigation starting with the crimp of the individual piles to
A higher crimp of the yarn corresponding with the pale streak compared to the yarns of the normal zones that have a lower crimp. This proves that the crimp difference was introduced during extrusion of the BCF yarn.

CONCLUSION
By means of a few concrete examples it was shown that streakiness in carpet due to heatset variations and crimp differences can be detected using various techniques available at CENTEXBEL (see scheme).

Myriam Vanneste
Centexbel - Technologiepark 7 - BE-9052 Zwijnaarde
Tel: 09/243 82 31 - Fax: 09/220 27 34
e-mail: myriam.vanneste@centexbel.be
www.centexbel.be

2 "Beproeven van de fysische karakteristieken van multifilamenten - via dynamische meetmethodes en het oog voor kracht en kwaliteit van textielmaterialen" (Ghent, 2004)