Zawartość zarchiwizowana w dniu 2024-06-16

Knowledge based process control system to optimize needle performance for high added-value needle-punched nonwovens

Sprawozdania

Informacje na temat projektu

NEEDLES

Identyfikator umowy o grant: 18221

Projekt został zamknięty

Data rozpoczęcia
15 Września 2005

Data zakończenia
14 Września 2007

Finansowanie w ramach
Horizontal research activities involving SMEs: Specific activities covering wider field of research under the Focusing and Integrating Community Research programme 2002-2006.

Koszt całkowity
€ 1 518 622,00

Wkład UE
€ 910 261,00

Koordynowany przez
CIM-MES PROJEKT SP. Z O.O.
Poland

Final Report Summary - NEEDLES (Knowledge based process control system to optimize needle performance for high added-value needle-punched nonwovens)

The process technology for the needling of the fibre webs is characterised by needle design, needle density per working width, stroke frequency, feeding and delivery speed. Fineness, design (amount and location of barbs) and strokes of the needles determine the degree of consolidation of the felt. The performance and quality of the felt heavily depend on the number of fibres which are reoriented at each penetration of the needles without damage and on how many penetrations per unit area are made. The wear of needles strongly affect final performance and quality as the barbs wearing causes a much decreased reorientation of the fibres. This issue becomes even more important when processed reclaimed fibres or recycled material are used for different products in the automotive or other industries. The load acting onto every needle is then highly increased by the in-homogeneity of the delivered fibre web of recycled material. Impurities and thickenings lead immediately to massive needle breaks and the production must be terminated. Currently, quality control of non-woven felt is limited to the visual control performed by an operator. Then, according to usual in house procedures, samples of felt are tested in local laboratories, in order to check web strength and permeability.

The main strategic objective of NEEDLES project was to increase the competitiveness of the European non-woven textile sector by providing a cost-effective monitoring system able to optimally control the status and the performances of the needles in the needle-punching machine, during nonwoven textile manufacturing process. The increase in the competitiveness was assumed to be achieved through an improvement of the quality of the produced nonwoven fabric. This is a benefit for the end-users, who are expected to save 40 % of the needle cost, as well as to reduce the production of low quality textile fabric. Besides this, the expected life-cycle needle-bar shell increased by above 15 million cycles, thanks to the more precise time to maintenance periods implementation, while the working hours for needles replacing will be reduced of 30 % and the occurrence of non-woven defects has been evaluated to decrease by estimated 30 %.

These reductions imply a decrease of non-woven webs (mainly man-made fibres) annually land-filled due to unacceptable quality levels (at the moment around 19 millions of tons), with high impact on the environment. From a societal point of view the decrease in waste production (non-usable web and broken needles) will contribute to safety for the environment. Quality of life for the operators involved in needle replacement will also increase as today they are mostly visually identifying broken needles in the carrying bar. To improve above socio-economical preassumptions as well as to study the possible exploitation scenarios, consortium partners released for internal purposes their economic data.

The feasibility study disclose the justified investment into considered monitoring system on the level of EUR 35 000, when 60 % depreciation rate and 10 % needle cost and 10 % man-hour decrease costs are is considered. Main technical objective reached during NEEDLES project was development of an online, production monitoring system which allows to predict and to prevent critical defects in nonwoven production and lost of non-woven quality. The targeted performance in terms of accuracy was elementary needling area 8 x 8 mm2, and in terms of production process parameters - in a range of 1500-2500 strokes per minute and with a production range from 1 to 20 m/min. The considered control and measurement system allows to introduce the new added value to the present state of art in the non-woven machinery through its completeness of acquisition of parameters, which are crucial for the quality of non-woven manufacturing. That is the variations of the needles load, the measure of needles degradation and

needles presence / absence in the needle board, the measure of needle board degradation.

The complex evaluation of considered parameters allow to evaluate the time to failure for needle board module. It is expected that the non-woven machinery equipped with considered control system allow to decrease low quality non-woven production dramatically. That feature is achieved through a multi-sensor approach, which is based on the combination of inductance or optic sensors and on the sophisticated data processing, where patterns of lost needles are identified and stitch density are calculated and prompted onto operator console in the real time.

After 26 months of research and development under NEEDLES project, a new tool for non-woven quality on line monitoring was developed. That application will allow to decrease costs of low quality production thanks to a more exact information on time to maintenance parameter, according to demanded level of production quality. It also allows a strong reduction of cost due to wasting of low quality non-woven product which cannot be used and commercialised. Last but not least, the factor of elaborated solution is lowered requirement for laboratory quality control thus, decreases of laboratory man-hours cost and samples measurements costs. The most innovative functionality developed with Muqups system consists in the online prediction of the governing quality parameters for non-woven, performed during manufacturing process. Innovation of that approach lies on the prediction of non-woven quality loss acquired through direct and indirect evaluations of needles breakages and abrasions. A multisensor technology was introduced and used for needle-board sensing (needle breakage) and consequent evaluation of its performances. That information has been correlated with manufactured nonwoven quality. Two possible measures to predict web quality have been applied: the first one uses a threshold of lost needles to detect lost needles pattern, while the second one uses a threshold to assess stitching density value.

Powiązane dokumenty

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Ostatnia aktualizacja: 14 Kwietnia 2011

Permalink: https://cordis.europa.eu/project/id/18221/reporting/pl

European Union, 2025