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I-PAN

INNOVATIVE POPLAR LOW DENSITY STRUCTURAL PANEL

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Document information

Abstract

The IPAN project is drawing to a successful conclusion in technical, environmental and economical terms. The techniques applied and those still in the testing stages [optical control system of the strands] will enable the partners to open new lines of business and to improve existing plants in terms of efficiency and environmental impact.
The introduction of a new type of sustainable board produced with "greener" and more environmental friendly techniques will enable the partners to take part in the 'go green' conversion of current wood based panel manufacturing processes.

Keywords

Nozzles, distribution, blender, optic system, forming, LSB

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* Abbreviations of editor/contributor name

TABLE OF CONTENTS

LIST OF ABBREVIATIONS AND DEFINITIONS

DM	Deliverables Manager
DoW	Description of Work
EC	European Commission
PM	Project Manager
PMQP	Project Management and Quality Plan
PMB	Project Management Board
PR	Peer reviewer
TMB	Technical Management Board
QM	Quality Manager
WP	Work Package
OSB	Oriented strand board

INTRODUCTION

IBL is an industrial facility for the manufacture of OSB panels where it has been possible for the partners to experiment innovative solutions to make improvements to the OSB panel production process due to the fact that IBL is a partner in the IPAN project.

Parts of equipment and machinery have been implemented within the existing plant to verify correct operation in terms of efficiency, affordability and environmental impact.

Some parts have been designed from scratch without adding the relative cost to the project, whereas some other parts were studied for further adapation.

The combination of the OSB production plant and the modifications effected, and the choices made in terms of the resins used and the control software/hardware, have all enabled the IPAN project group to make their own choices and propose innovative OSB/LSB lines.

A lot of areas have been improved on in the existing line to obtain economic advantages on the market and to give the IPAN project partners the possibility of having a real plant that possesses some industrial research options aimed at motivating potential sales in the near future.

The techniques applied and the solutions adopted will be optimised to achieve an economical ad flexible system and which, above all, is environmental friendly.

The introduction of specific solutions within the project, for example the correct angle of the strander blades or the algorithms used for processing the images of the strands as they travel through the process, and others, are the strong points of the project which, after a couple of service visits to the IBL line, have led us to believe that the prototype line will be converted into a real production line in the very near future.

1 THE PILOT LINE

IBL has designed its own production line specifically for the production of OSB panels. Innovative solutions have been experimented on this OSB panel production line by IMAL, IBL, UNIMI, ECSC, IDP, CHIMAR and CIAOTECH each in relation to its own field of business, to improve the process and to produce a board from poplar wood only, utilizing the top part of the poplar tree as well which was previously destined for other uses.

The following modifications have been made and installed with respect to a standard OSB board production line:

Partner	Activities	Notes
Imal	Modification to the flaker knives to adapt them to flaking poplar wood	Activity reported in the costs Items not purchased as these were made available by IBL
	Design and construction of innovative forming equipment	Cost not listed in the project
	Introduction of high-pressure resination technology – HPRS project-life2013-000307- [1]	Cost not listed in the project
	Design of a hardware system that is able to implement the software designed by UNIMI and ECSC for the analysis	Cost listed in the project due to the experimental nature of the activity
	Analysis of the plant, of the requirements and of the preparation of the parts to be implemented within the line as the pilot line	Activity cost listed
	Insertion of a rotary chute	Item cost listed
CHIMAR	Preparation of natural resins to verify board quality with the application of green resins	Activity cost listed
STELA	Introduced a belt dryer, adapted to the project	Cost not listed in the project
IDP	Technical support for the conveyors and fine layer forming station	Activity cost listed

partner	Activities	Notes
UNIMI	Design of the software with cameras for controlling strand orientation and dimensions	Items cost listed by IMAL, part of the pilot line Activity cost listed
ECSC	Support with the development of the control software with cameras for strand dimensions and orientation	Activity cost listed
IBL	Support with the definition of the layouts and locations for the parts of the pilot line. Preparation of the supporting structures of the parts inserted and support with the LCA analysis. Research on poplar I.214 clone	Activity cost listed
CIAOTECH	Dissemination and LCA	Activity cost listed

1.1 THE PROJECT

Generally the value of the equipment alone for an OSB production plant is over 20 M€ and hence it is difficult to reproduce it to conduct research to improve the work process unless a panel manufacturer is actually involved in the project. The IPAN project stems from the idea to innovate some aspects of the OSB panel production process within a freshly constructed productive reality – IBL – and launch a new, more ecological panel on the market [using both the trunk and the top part of the poplar tree, a part which is generally used for other purposes or burnt, and applying resins with low formaldehyde content] and introduce some novelties into the process:

Improve the strand cutting process

Reduce the environmental impact of the dryer and ensure that the strands do not break during the drying process or as they go through the work process in general

Introduce innovative logic to form a layer of wood dust on the mat to produce a new type of board [LSB]

Introduce specific algorithms to monitor/control strand dimensions, flaker knife wear and deviation with respect to ideal flake orientation when producing the mat

1.2 PROTOTYPE PARAMETERS

The parameters for the production process are always defined on field, starting from a range of standard values in relation to the work process [raw material at infeed, type of board required, technology applied [continuous or single-opening press,…]. In the case of the IPAN project, some technical solutions have been implemented within the actual IBL plant and equipment which have been configured with their own work process parameters.

The parameters for line speed, temperature, moisture content, pressure,… throughout the various steps of the process have been measured on field and agreed on and shared with IBL for a better understanding of their impact on the end product.

1.3 METHODS

As in nearly all the plants where the customers are involved with the definition of their own production parameters, a series of tests and trials has also been implemented in conjunction with IBL on their OSB production line from poplar wood to configure the process parameters step by step.

1.4 FINE-TUNING AND WORK PROCESS TECHNIQUES

With the remote assistance link up application, [the production process is monitored step by step from Modena] and since IBL is highly skilled in the process, the fine tuning process for the parameters, which is still ongoing, has been carried out and implemented by IBL through the assistance of an IMAL technician linked up remotely.

The development of the on line technology has greatly reduced the need for technicians to travel to fine-tune the process parameters, which have nevertheless been processed as they are required for the subsequent process of industrialization.

2 INTEROPERABILITY BETWEEN THE NEW AND EXISTING EQUIPMENT

The control software implemented with new solutions inserted on the IBL line has been adapted to the requirements of the existing line and likewise, the new optical systems have been connected in a safe manner to the existing ones.

2.1 FORMING THE LSB BOARD

As highlighted in Deliverable 7.3, the mat forming process has been adapted to produce the LSB board and modifications have been made upstream as well to achieve, through innovative technical solutions, a blending process which will not ruin the strands in any way

2.2 STRAND CONTROL SOFTWARE

The software controlling strand breakage, dimensions and orientation as it goes into operation, should ensure a continuous feedback on the process to save natural and technical resources within the production process - Deliverables 6.2 – 6-3 -

The vision-system performs real-time monitoring to analyse the blending effects on the strands. Both two-dimensional and three-dimensional setups are employed to study and prevent possible strand damage, which, in turn, can result in a better use of the resources and raw materials and to obtain a lighter and less expensive panel.

The main goal of the system designed is to study the granulometry, i.e., the particle size distribution, of the wood strands employed in the production of OSB panels. This study is important since the size of the strand is directly related to the quantity of resin necessary to produce the final panel.

It is necessary to estimate the dimensions of the strands before they enter the blending process and after they have been sprayed with resin. During the development of the project, the two dimensions that emerged as more important were length and width. Hence, the systems have been optimized accordingly to achieve a good performance. In addition, some techniques based on 3D-reconstruction have been applied to provide an estimation of the variation trend in strand thickness.

We have introduced two acquisition setups and developed three methods to perform a real-time monitoring that controls the blending effects on the strands and helps estimate the optimal amount of resin.

The first acquisition method is based on a two-view acquisition setup that obtains 3-D images from free-falling strands. This setup is designed to be used before the wood strands start the blending process. In addition, a method that analyses the 3-D images and performs a granulometric analysis of the strands is proposed.

The second acquisition setup obtains the images from a top view of the conveyor belt. This setup has been designed to be used after the wood strands have gone through the blending process. Two methods have been developed to analyse the images produced using this setup. The first one uses an optimized segmentation method to perform a granulometric analysis of the strands present on the surface of the mat. The second one performs a qualitative analysis of the strands, by studying the Fourier transform of the image.

It is possible to monitor the process continually with these systems and, it is believed after approximately 10 installations, this could complete the case studies of the problems.

2.3 ANALYSIS OF THE COMPLIANCY OF THE SOLUTIONS ADOPTED WITH NATIONAL AND EUROPEAN STANDARDS AND DIRECTIVES

The following standards/directives have been observed for both the engineering of the pilot line as well as for its construction, and for the product trials and tests that have been run:

ISO 12460-1	Determination of formaldehyde release
BS EN 335-3	Durability.
BS EN 13986:2002	Wood-based panels for use in construction - Characteristics, evaluation of conformity and marking.
BS EN300	OSB: size tolerances, edge straightness, squareness, moisture content, mean density and formaldehyde class
DLG. 81/2008	Italian standard on safety in the working environment.
DIRECTIVE 2006/42/CE	European standard on safety in the working environment. IMAL Srl has compiled the relative technical documentation in accordance with the provisions given in Annex VII B of Directive 2006/42/EC and in response to a reasoned request by the National authorities, shall transmit the relative information on the partly completed machinery.
EN 13986	Characteristics, evaluation of conformity and marking the formaldehyde release from wood-based panels used in internal applications.
ISO 14040, ISO 14044, ISO1406	Life Cycle Assessments, definitions and methodologies
UNI CEN 13354 2003	in conformity with gluing quality.
Directive 2004/108/CE	Directive of 15th December 2004 and subsequent amendments, on the approximation of the laws of the Member States of the European Union (EU) relating to electromagnetic compatibility;

UNI EN 789 2008	testing methodologies and mechanical properties of the panels.
UNI EN 319 1994,	on the determination of the resistance to traction normal to the panel surface.
UNI EN 311 2003	on the resistance to the detachment of external panel layers.
Directive 94/9/CE	Directive of 23rd March 1994 and subsequent amendments, on the approximation of the laws of the Member States of the European Union (EU) relating to equipment and protective systems intended for use in potentially explosive atmospheres, the partly completed machinery is to be installed in areas which are not subject to risk of explosion (unclassified zone according to Directive 99/92/CE).

Furthermore, the pilot line and its components have been designed on the basis of the IMAL quality system guidelines - ISO 9001-2008 - system certified by TUV Italia Srl – valid until April 2018.

The pilot line has been constructed taking the subsequent industrialization process into account and consequently, some of the hours have been used to optimize the future industrialization process.

3 THE INDUSTRIALIZATION PROCESS

As illustrated in earlier sections, some processes derive from solutions applied on field thus enabling each partner, even at this early stage, to proceed with the relative industrialization, in relation to its field of business.

IMAL has already received requests for a quotation for the optical monitoring system [an American customer has made a request to install the system] and for the high pressure resination system, we have already received new orders and we are proceeding with the industrialization of this type of technical solution.

The industrialization process in the wood based panels industry is closely linked to the references; hence as soon as the project is complete, we believe that we will have many opportunities to industrialize all the solutions introduced by the IPAN project partners.

4 CONCLUSIONS

The IPAN project is drawing to a close, we only need to test the optical imaging system and so we can say that the project targets have been reached.

The techniques and solutions applied have been shared with the partners and in some cases are already in the industrialization stage.

The IPAN project has led to an innovation of the forming station equipment and new techniques for controlling the OSB process, which will be applied in future by the partners in various plants around the world.

5 REFERENCES

Ref	Authors	Descriptions
[1]	University of Modena &Reggio Emilia	High pressure injector analysis

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