Chapter 3
Modern Testing of Wood-Based Panels, Process Control, and Modeling

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ABSTRACT

The fast development of the wood-based panels industry during the last decades resulted in a substantially increased production capacity of manufacturing lines. The utilization of advanced manufacturing systems created a large output of different panel types with a production of more than 1,000 m³ per day on at least 300 days within a year. Therefore, it is important to take into account the new requirements for an on-line control of the manufacturing process. Only on-line Non-Destructive Testing (NDT) technologies are able to survey, detect, and forecast the quality of the raw materials, level of production parameters, and development of the panel properties. Main parameters like moisture content, resination level, mat area weight, thickness, and density profile influence the final properties of the panels. For over a decade there has been no other choice to control these and other process parameters than NDT methods using microwave (water content), IR (moisture and color), X-ray (mat and board area weight and density profile), ultrasound (blisters or density variation), etc. The determination of the effective resin content on the wood particle...
or the density, temperature, and moisture development during the hot pressing are further requirements for the future production units. The on-line measurement of free formaldehyde remaining after resin curing and other volatile substances from wood and resin seems to be a further subject of major interest. The intelligent implementation and integration, use, and understanding of on-line NDT methods in wood panel manufacturing is a big challenge that includes a better understanding of the overall process and its limits, an updated state of the art of knowledge, as well as an open and continuous dialog between the equipment producers, board manufactures, and users that could be another important key for the development of an environmentally friendly modern wood-based panel industry in the world.

NON-DESTRUCTIVE TESTING OF WOOD-BASED PANELS USING IN-LINE CONTROL TECHNIQUES

Introduction

The fast development of the wood-based panel industry during the last decades resulted in a substantially increased production capacity. Production speed of continuous press lines up to 120 m/min combined with an increasing demand on quality and cost efficiency as well as the large variety of panel types require an advanced in-line control. The aim of this study is to give an overview about the state of the art of nowadays inline control technology, ongoing research and developments as well as a preview on future trends within this field of expertise.

The most important measuring parameters for further process steps and the quality of wood-based panels are moisture content, weight per area unit, board density, cross-and lengthwise density distribution and density profile, thickness, weight of the board. Moreover, other factors such as surface quality, particle geometry, internal defects (e.g. blisters and foreign bodies) as well as trending and forecast of the board’s quality are well-established and taken into consideration by inline measuring systems today. All these parameters influence strongly the final mechanical properties of the product, e.g. internal bond (IB) and modulus of rupture (MoR), modulus of elasticity (MoE), surface soundness (SS) but also physical characteristics like thickness swelling (TS) after 24h, free formaldehyde emission, surface color, coating capability etc. (Hasener & Barbu, 2009; Hasener, 2009).

The standardized quality control in the wood-based panel industry is usually based upon results obtained from time consuming destructive tests in the laboratory. For a comprehensive and continuous process- and board quality inspection, modern inline-techniques and process control systems were developed and fitted to the wood processing and available since two decades.
Fabrication of Orthotic Calipers With Epoxy-Based Green Composite
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