

Material properties and nondestructive evaluation of laminated veneer lumber (LVL) made from *Pinus oocarpa* and *P. kesiya*

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Abstract This study aimed at evaluating the mechanical, physical and biological properties of laminated veneer lumber (LVL) made from *Pinus oocarpa* Schiede ex Schltdl (PO) and *Pinus kesiya* Royle ex Gordon (PK) and at providing a nondestructive characterization thereof. Four PO and four PK LVL boards from 22 randomly selected 2-mm thickness veneers were produced according to the following characteristics: phenol-formaldehyde (190 g/m²), hot-pressing at 150°C for 45 min and 2.8 N/mm² of specific pressure. After board production, nondestructive evaluation was conducted, and stress wave velocity (v_0) and dynamic modulus of elasticity (E_{MR}) were determined. The following mechanical and physical properties were then evaluated: static bending modulus of elasticity (E_M), modulus of rupture (f_M), compression strength parallel to grain ($f_{c,0}$), shear strength parallel to glue-line ($f_{c,0}$), shear strength perpendicular to glue-line ($f_{c,90}$), thickness swelling (TS), water absorption (WA), and permanent thickness swelling (PTS) for 2, 24, and 96-hour of water immersion. Biological property was also evaluated by measuring the weight loss by *Trimetes versicolor* (Linnaeus ex Fries) Pilát (white-rot) and *Gloeophyllum trabeum* (Persoon ex Fries.) Merrill (brown-rot).

After hot-pressing, no bubbles, delamination nor warping were observed for both species. In general, PK boards presented higher mechanical properties: E_M , E_{MR} , f_M , $f_{c,0}$ whereas PO boards were dimensionally more stable, with lower values of WA, TS and PTS in the 2, 24, and 96-hour immersion periods. Board density, $f_{c,0}$, $f_{c,90}$ and rot weight loss were statistically equal for PO and PK LVL. The prediction of flexural properties of consolidated LVL by the non-destructive method used was not very efficient, and the fitted models presented lower predictability.

Material Eigenschaften von Furnierschichtholz aus *Pinus oocarpa* und *Pinus kesiya* und deren zerstörungsfreie Prüfung

Zusammenfassung Ziel dieser Studie war die Bestimmung der mechanischen, physikalischen und biologischen Eigenschaften von Furnierschichtholz (LVL) aus *Pinus oocarpa* Schiede ex Schltdl (PO) und *Pinus kesiya* Royle ex Gordon (PK) sowie deren zerstörungsfreie Prüfung. Vier PO und vier PK Platten aus 22 zufällig ausgewählten 2 mm dicken Furnieren wurden wie folgt hergestellt: Phenolformaldehydharz (190 g/m²), Pressetemperatur 150 °C, Pressdauer 45 Minuten, Pressdruck 2,8 N/mm². Nach der Herstellung der Platten wurde diese zerstörungsfrei geprüft und die Spannungswellengeschwindigkeit (v_0) sowie der dynamische E-Modul (E_{MR}) wurden bestimmt. Anschließend wurden die folgenden mechanischen und physikalischen Eigenschaften bestimmt: statischer Biege-E-Modul (E_M), Biegefestigkeit (f_M), Druckfestigkeit in Faserrichtung ($f_{c,0}$), Scherfestigkeit in Richtung der Klebstoffuge ($f_{c,0}$), Scherfestigkeit rechtwinklig zur Klebstoffuge ($f_{c,90}$), Dickenquellung (TS), Wasseraufnahme (WA) und permanente Dickenquellung (PTS) bei 2-, 24- und 96-stündiger Wasserlagerung. Daneben wurde die natürliche

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Nondestructive Evaluation And Material Properties Ii

Peter K. Liaw



Nondestructive Evaluation And Material Properties Ii:

Nondestructive Evaluation and Material Properties II Peter K. Liaw, 1994-01-01 This collection of papers is from Materials Week 93 held in Pittsburgh Pennsylvania October 17 21 1993 The book intends to develop a fundamental understanding of relating non destructive evaluation NDE techniques to microstructures and material properties of metals polymers ceramics and advanced composite and intermetallic materials

Nondestructive Evaluation and Material Properties II Minerals, Metals and Materials Society Staff, **Advanced Nondestructive Evaluation II - Proceedings of the International Conference on Ande 2007** Seung-Seok Lee, 2008 This volume comprises papers presented at the 2nd International Conference on Advanced Nondestructive Evaluation ANDE 2007 held in Busan Korea on October 17 19 2007 Many of the excellent papers included in this book show the current state of nondestructive technologies which are experiencing rapid progress with the integration of emerging technologies in various fields As such this volume provides an avenue for both specialists and scholars to share their ideas and the results of their findings in the field of nondestructive evaluation

Electromagnetic Nondestructive Evaluation (X) Seiki Takahashi, Hiroaki Kikuchi, 2007 Since the first Electromagnetic Nondestructive Evaluation ENDE workshop was held in London 1995 the workshops have contributed to the technical advance in ECT through competition and collaboration This title focuses on Eddy Current Testing ECT to identify cracks in metals and alloys

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Advanced Nondestructive Evaluation Ii (In 2 Volumes, With Cd-rom) - Proceedings Of The International Conference On Ande 2007 - Volume 2 Seung-seok Lee, Joon Hyun Lee, Ik-keun Park, Sung-jin Song, 2008-08-04 This volume comprises papers presented at the 2nd International Conference on Advanced Nondestructive Evaluation ANDE 2007 held in Busan Korea on October 17 19 2007 Many of the excellent papers included in this book show the current state of nondestructive technologies which are experiencing rapid progress with the integration of emerging technologies in various fields As such this volume provides an avenue for both specialists and scholars to share their ideas and the results of their findings in the field of nondestructive evaluation

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integration of emerging technologies in various fields As such this volume provides an avenue for both specialists and scholars to share their ideas and the results of their findings in the field of nondestructive evaluation

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Nondestructive Evaluation Don E. Bray, Roderick K. Stanley, 2018-10-03 Nondestructive evaluation NDE inspection schemes are important in design manufacturing and maintenance By correctly applying techniques of NDE we can reduce machine and system failures and increase reliability of operating systems over an extended lifetime Nondestructive Evaluation A Tool in Design Manufacturing and Service introduces and discusses primary techniques used in the field including ultrasonics acoustic emission magnetics radiography penetrants and eddy currents Examples of each of these techniques are included demonstrating typical applications

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Review of Progress in Quantitative Nondestructive Evaluation Donald O. Thompson, Dale E. Chimenti, 2012-12-06 The objective of this study was to increase the understanding of damage in composite materials with through the thickness reinforcements As a first step it was necessary to develop new ultrasonic imaging technology to better assess internal damage of the composite A useful ultrasonic imaging technique has been successfully developed to assess the internal damage of composite panels The ultrasonic technique accurately determines the size of the internal damage It was found that the ultrasonic imaging technique was better able to assess the damage in a composite panel with through the thickness reinforcements than by destructively sectioning the specimen and visual inspection under a microscope Microscopic determination of crack location and lengths in a composite panel with through the thickness reinforcements was almost impossible Five composite compression after impact panels were tested The compression after impact strength of the panels with the through the

thickness reinforcements was almost twice that of the comparable panel without through the thickness reinforcement

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Electromagnetic Nondestructive Evaluation (XIII) Jeremy Knopp, 2010 The 14th International Workshop on Electromagnetic Nondestructive Evaluation ENDE was held at the Crowne Plaza Hotel in Dayton Ohio USA in July 2009 where the ENDE activities in the Dayton area reflect the local aerospace industry With 80 participants from over ten countries worldwide this workshop provided an important opportunity for an international exchange of information and ideas This book contains the proceedings of that workshop From the 59 oral and poster presentations 39 were submitted for publication Of these 37 peer reviewed papers appear in this volume These papers pr **Review of Progress in Quantitative Nondestructive Evaluation** Donald Thompson, 2012-12-06 This Proceedings contains the edited papers presented at the annual Review of Progress in Quantitative NDE held at the University of California Santa Cruz Aug 7 12 1983 In it papers have been arranged topically by chapters and subsections rather than by order of presentation at the Review The editors believe that this format is preferable as a reference volume Thus the Proceedings contains nine chapters and subsections which provide broad coverage of topics of current interest in NDE research and development The Review was sponsored by the Center for Advanced NDE Ames Laboratory of the U S Department of Energy in cooperation with the Office of Basic Energy Sciences USDOE the Defense Advanced Research Projects Agency the Materials Laboratory of the Air Force Wright Aeronautical Laboratories and the Naval Sea Systems Command Approximately 275 attendees representing various government agencies industry and academia participated in the technical presentations poster sessions and discussions This Review possibly the most comprehensive annual symposium in NDE emphasizes both basic research and early engineering applications it provides a valuable forum for the transfer of technical information Para graphs given below provide a brief summary of the contents of the Proceedings Chapter 1 consists of four papers that discuss elements of NDE Reliability and contains the keynote paper given by Dr J M Coffey of the NDT Applications Centre Central Electricity Generating Board Manchester England In his paper Dr *Computational Nondestructive Evaluation Handbook* Sourav Banerjee, Cara A.C. Leckey, 2020-06-01 Introducing computational wave propagation methods developed over 40 years of research this comprehensive book offers a computational approach to NDE of isotropic anisotropic and functionally graded materials It discusses recent methods to enable enhanced computational efficiency for anisotropic materials It offers an

overview of the need for and uses of NDE simulation The content provides a basic understanding of ultrasonic wave propagation through continuum mechanics and detailed discussions on the mathematical techniques of six computational methods to simulate NDE experiments In this book the pros and cons of each individual method are discussed and guidelines for selecting specific simulation methods for specific NDE scenarios are offered Covers ultrasonic CNDE fundamentals to provide understanding of NDE simulation methods Offers a catalog of effective CNDE methods to evaluate and compare Provides exercises on real life NDE problems with mathematical steps Discusses CNDE for common material types including isotropic anisotropic and functionally graded materials Presents readers with practical knowledge on ultrasonic CNDE methods This work is an invaluable resource for researchers advanced students and industry professionals across materials mechanical civil and aerospace engineering and anyone seeking to enhance their understanding of computational approaches for advanced material evaluation methods

Electromagnetic Nondestructive Evaluation (XVI) J.M.A. Rebello,F. Kojima,T. Chady,2013-12-18 Electromagnetic Nondestructive Evaluation ENDE is the process of inducing electric currents magnetic fields or both within a test object to assess its condition by observing the electromagnetic response An important tool in fields as diverse as engineering medicine and art it does not permanently alter the object being tested thus proving invaluable for product evaluation troubleshooting and research This book presents the proceedings of the 17th International Workshop on Electromagnetic Nondestructive Evaluation ENDE held in Rio de Janeiro Brazil in July 2012 ENDE workshop is an important event for all scientists with interests in non destructive testing The first workshop took place in 1995 in London UK and has been followed by workshops held in various parts of the world but this is the first time this workshop series has come to a Latin American country The workshops bring together scientists and engineers active in research development and industrial applications of ENDE The book is divided into five sections advanced sensors analytical and numerical modeling systems and techniques for electromagnetic NDE characterization of materials and NDE of cracks and new developments and others Each section includes papers on a variety of subjects From the papers submitted for publication thirty six peer reviewed articles have been accepted six of which emanate from Latin American authors The book will be of interest to all those wishing to keep abreast of developments in the field or who rely on the advanced techniques based on electromagnetic principles applied to nondestructive evaluation in their work

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United States. National Bureau of Standards,1986 *Publications of the National Institute of Standards and Technology ... Catalog* National Institute of Standards and Technology (U.S.),1977

Handbook of Nondestructive Evaluation 4.0

Norbert Meyendorf,Nathan Ida,Ripudaman (Ripi) Singh,Johannes Vrana,2025-06-29 This handbook now as second edition continues to comprehensively cover the cutting edge trends and techniques essential for the integration of nondestructive evaluation NDE into the changing face of the modern industrial landscape In particular it delves into the marriage of NDE with new techniques in e g data mining and management cloud computing autonomous operation AI for data analysis and

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