STRUCTURE AND PROPERTIES RELATIONSHIPS OF DENSIFIED WOOD

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Thesis submitted to the Faculty of the

Virginia Polytechnic Institute and State University

in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

in

Wood Science and Forest Products

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August 30, 1999
Blacksburg, Virginia

Keywords: Densified Wood, Tensile Strength, Stiffness

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ABSTRACT

The objective of this research was to investigate the effect of applied compressive strain in various environments, on the strength and stiffness of compressed wood samples. It is believed that transverse compression of wood at specific conditions of temperature and moisture will result in improved mechanical properties, which can be attributed to increased density and perhaps other physical or chemical changes.

Specimens of both mature and juvenile southern pine *(Pinus taeda)* and yellow-poplar *(Liriodendron tulipifera)* were compressed radially at three different temperature, and moisture content conditions relevant to the glass transition of wood.

Ultimate tensile stress and longitudinal modulus of elasticity were obtained by testing compressed, uncompressed and control samples in tension parallel-to-grain. Strain measurements were performed using laboratory-built clip-on strain gauge transducers. Results of the tensile tests have shown an increase in the ultimate tensile stress and modulus of elasticity after all densification treatments.

Scanning electron microscopy was employed for observing changes in cellular structure of densified wood. Existence of the cell wall fractures was evaluated using image processing and analysis software. Changes in cellular structure were correlated with the results of the tensile test.

Chemical composition of wood samples before and after desorption experiments was determined by acid hydrolysis followed by high performance liquid chromatography (HPLC). The results of the chemical analysis of the wood specimens did not reveal significant changes in chemical composition of wood when subjected to 160 °C, pure steam for up to 8 hours.

The results of this research will provide information about modifications that occur during wood compression and will result in better understanding of material behavior during the

manufacture of wood-based composites. In the long run, modification of wood with inadequate mechanical properties can have a significant effect on the wood products industry. Low density and juvenile wood can be used in new high-performance wood-based composite materials instead of old-growth timber.

ACKNOWLEDGEMENTS

I would like to express my sincere appreciation to my advisor Dr. Frederick A. Kamke for his excellent technical guidance, never-ending support, encouragement, and patience throughout my graduate education. One can not wish for a better advisor and teacher.

I am also grateful to the other members of my committee, Dr. Chip Frazier and Dr. Audrey Zink-Sharp who served as my teachers and guides during my study at Virginia Tech. Their helpful suggestions and assistance during the course of this project are greatly appreciated.

I also would like to acknowledge the support of the USDA National Research Initiative Competitive Grants Program.

Special thanks to Dr. George Stern, Dr. Joseph Loferski, Dr. Geza Ifju and others who provided me with the opportunity to study in the United States.

This project would not have been possible without extensive assistance of the staff and students of the Department of Wood Science and Forest Products. Many thanks to Harrison Sizemore (Butch), Carlile Price, Jody Jervis, Angie Riegel, Sharon Daley and the members of the Wood Composites Group, Chris Lenth, Mansur Ahmad, and Balazs Zombori. I also would like to thank Andrew Kuti and Mike Lockhart for help with preparing samples for this research.

My friends and fellow grad students at Virginia Tech have also been a source of encouragement. I would like to acknowledge the support and friendship of Nicole Robitaille, Marie Laborie, Balazs Zombori, Chris Heine, Alex Salenikovich, Victor Makarov, Vladimir Kochkin, and Olga Stepanova.

Special thanks to the friends from International Bible Study Group for their sincere prayer and true friendship in Christ.

Finally, but most importantly, I would like to thank my mother, Galina, father, Vasilii, and brother, Alexander, for their love, encouragement and continued support throughout the course of my studies. All my achievements would not be possible without them.

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