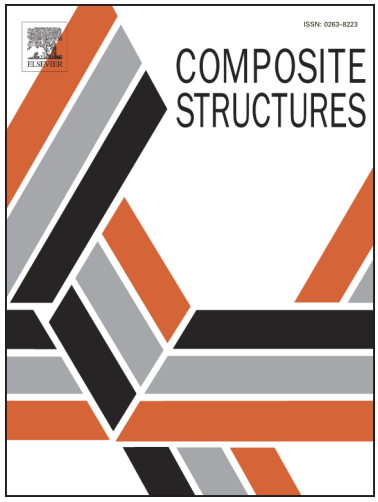

Bendability characteristics of wood lamellae in plastic region

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Bendability characteristics of wood lamellae in plastic region

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ABSTRACT

This article examines the effect of different factors (material thickness, degree of densification and number of loading cycles) on the selected bending characteristics of European beech (*Fagus sylvatica* L.) and European aspen (*Populus tremula* L.). The bending characteristics, including bending strength, plasticity potential and modulus of plasticity, were measured using three-point bending. Results of the four-factor analysis demonstrate that each bending characteristic is affected differently by the given factors. The bending strength, which was higher in beech wood than in aspen wood, increased along with the degree of densification. Cyclic loading had no significant effect on the bending strength. Although material thickness had some statistical significance, its effect was not unequivocal. The modulus of plasticity was significantly affected only by the wood species and material thickness. Higher modulus of plasticity values were achieved in beech wood than in aspen wood. The modulus of plasticity gradually decreased with an increase in material thickness. Again, the cyclic loading had no significant effect. The degree of densification also proved to be insignificant, especially in aspen wood. In beech wood a somewhat greater difference between various degrees of densification was found.

Keywords: bending strength; modulus of plasticity; plasticity potential; cyclic loading; European beech; European aspen

INTRODUCTION

Wood is one of the most frequently used materials, especially for its specific properties. Its high strength, good workability and durability predispose it for conventional utility products, as well as furniture or supporting structures in buildings. However, not all wood properties are always satisfactory, which is why there are many modifications that can improve the targeted properties or eliminate those that are undesirable.

One of the most commonly used treatments of wood is densification. Methods of densification increase the mechanical properties of wood and also improve certain physical characteristics (Higashihara *et al*. 2000; Kamke 2006; Boonstra and Blomberg 2007; Gabrielli and Kamke 2008). These methods of densification use compression of the entire volume of the wood or some of its layers with or without the use of heat, steam or humidification (Welzbacher *et al*. 2008). Densification utilizes the principle of increasing the density of wood, because most of the mechanical properties are closely dependent on the density and its profile (Kutnar *et al*. 2009; Belt *et al*. 2013; Pařil *et al*. 2014). The density profile varies depending on the degree of densification and determines the bending characteristics of the wood (Pařil *et al*. 2014).

The bending strength of wood, as well as other mechanical properties, is strongly dependent on the nature of the stress. Although wood has relatively high strength during regular loading, cyclic loading significantly reduces this strength (Imayama 1994). Cyclic