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A ROAD TOWARDS A SUSTAINABLE THERMO-HYGRO-MECHANICAL WOOD DENSIFICATION PROCESS

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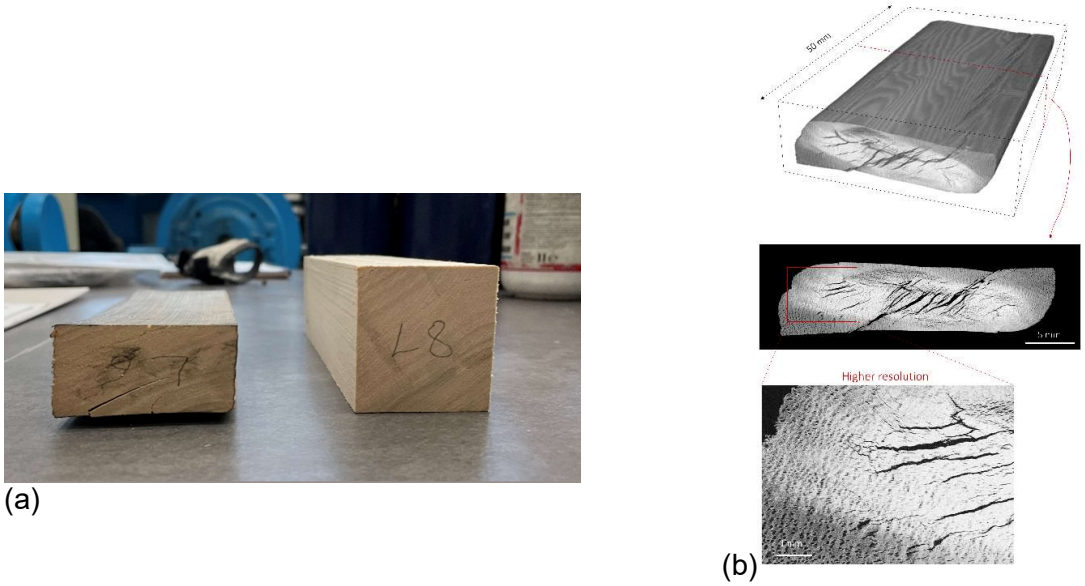
ABSTRACT

Due to climate change, the Belgian forests are under pressure and their health is becoming a major concern. For the moment, the forest parcels contain mostly a unique wood species presenting high density suitable for structural applications. However, it has been proven that the presence of a multitude of wood species, including fast growing species with lower density will strengthen forests health and ensure their sustainable exploitation. In this context, the wood industry is searching a way to add value to such low density wood, that is most often not exploited. One possible approach is to densify the wood using thermo-hygro-mechanical processes, Fig 1.



(a) (b)

Figure 1 - Thermo-hygro-mechanically densified wood: (a) after densification process, (b) analysis of damage inside the specimen by X-ray tomography.

In this research, design of experiment has been used to identify the most promising densification parameters for poplar wood by uniaxial compression. The relationship between the densification process and the mechanical properties, including Young's modulus, hardness, and fracture toughness, of densified wood is investigated through quasi-static mechanical tests, microhardness mapping, microstructural characterization and X-ray tomography. The optimization of the densification process is studied in combination with continuum constitutive models to understand the effects of gradients during the process and their implication on the visco-elasto-plastic behaviour of wood.