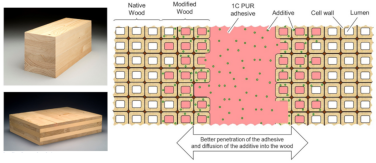
Additives for Adhesives in Wood Construction Products

Due to climate change and wood pests, spruce availability is decreasing, while the demand for construction wood products increases as part of a low-CO_2 economy. Alternative wood species like beech, birch, larch, and Douglas fir are considered. However, the stable and durable bonding of such wood species with one-component polyurethane (1C-PUR) adhesives currently still poses a challenge. The use of additives in the adhesive formulation brings a better penetration of the adhesive into the wood structure, which forms a thicker modified wood layer and a stronger bonding that prevents delamination.



Redistribution of the Shear Forces and Improved Mechanical Stability

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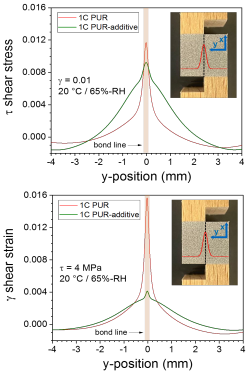
1C-PUR adhesives fail when using other wood species, because the individual boards deform differently than the glue line. Thus, a peak occurs in the joint, producing the failure of the wood product. Using additives in the adhesive formulation allows for a smooth distribution of stresses (upper plot) and a lower concentration of deformations (bottom plot) avoiding delamination.

01 Better penetration of the adhesive into the wood structure

02 Formation of a larger intermediate modified wood layer

03 Smooth and wide distribution of forces, which avoids delamination

04 Adaptable formulation for the different wood species



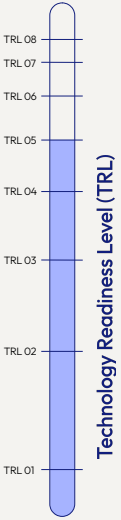
Shear stress (upper plot) and shear strain (bottom plot) distributions in the y-direction perpendicular to the bond line (x-axis).

CHALLENGE

The presence of additives in the 1C-PUR adhesives solves the issues regarding the use of primers or wood surface treatment when gluing different wood species. The technology has been successfully tested on beech wood in particular. While additives work well with the tested wood species, the final composition of the 1C-PUR adhesive has to be adapted and tested for each wood species to be used, and the resulting load-bearing timber construction product approved.

INNOVATION

This invention allows for the use of different available wood species by adapting the fast-curing 1C-PUR adhesives, which modify the wood interface upon creating an intermediate modified wood layer. The use of additives in the adhesive composition avoids extra production steps, new machinery and longer processing time, making the process cheaper and the products more competitive. Therefore, an enhancement in terms of an increased adhesive performance and lower costs due to the availability of the compatibilizing additive can be achieved.



01 Basic principles observed · **02** Technology concept formulated · **03** Experimental proof of concept · **04** Technology validated in lab · **05** Technology validated in relevant environment · **06** Technology demonstrated in relevant environment · **07** System prototype demonstrated in operational environment · **08** System complete and qualified

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