

Influence of Thermal Modification of Poplar Veneers and Plywood Construction on Shear Strength

Aleksandar Lovrić
Vladislav Zdravković
Nebojša Todorović
Goran Milić

University of Belgrade
Faculty of Forestry
Department of Technology, Management and Design of Furniture and Wood Products
Kneza Višeslava 1, 11000 Belgrade, Serbia

Background

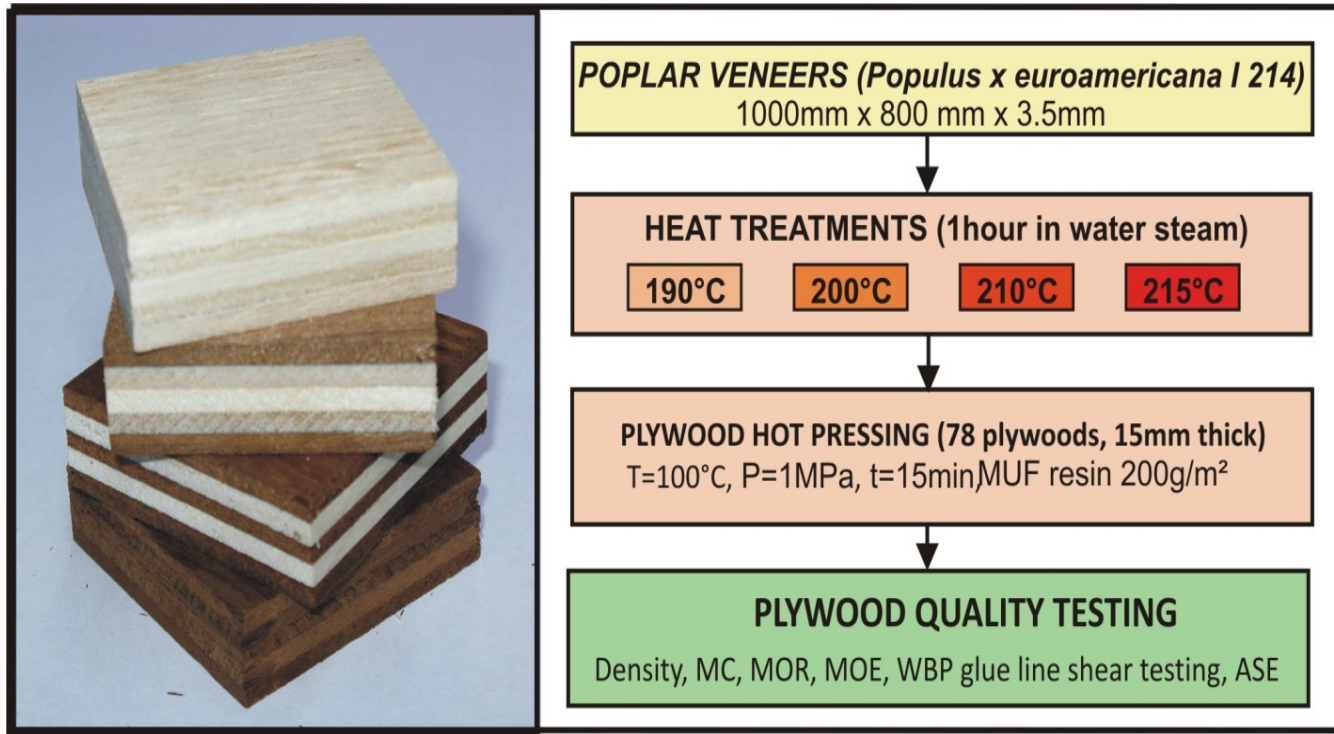
- There is limited research about thermal modification of wood based panels.
- First approach: Thermal modification of wood after panel production (Del Menezzi *et al.* 2009).
- Second approach: Thermal modification of wood before panel production (Zdravković *et al.* 2013, Fioravanti *et al.* 2013)- established gluebond strength is not weakened by additional thermal treatment during the plywood pressing.

Objective

- To obtain information about how different treatment temperatures and combinations of treated and untreated veneers in plywood constructions influence on physical and mechanical properties, and specially on gluebond strength.

Material and methods

Plywood samples and experimental flow chart



Material and methods

HEAT TREATMENTS (1hour in water steam)

190°C 200°C 210°C 215°C

The image is a composite showing the experimental setup. On the left, a forklift is loading a stack of wood into a large metal chamber. On the right, a computer monitor displays a software interface. The top part of the monitor shows a data table with columns for 'No.', 'Date', 'Time', 'Temp.', 'Humidity', 'Pressure', 'Flow', 'Status', and 'Action'. The bottom part of the monitor shows a graph with a red dotted line and a blue solid line, representing temperature and humidity over time.

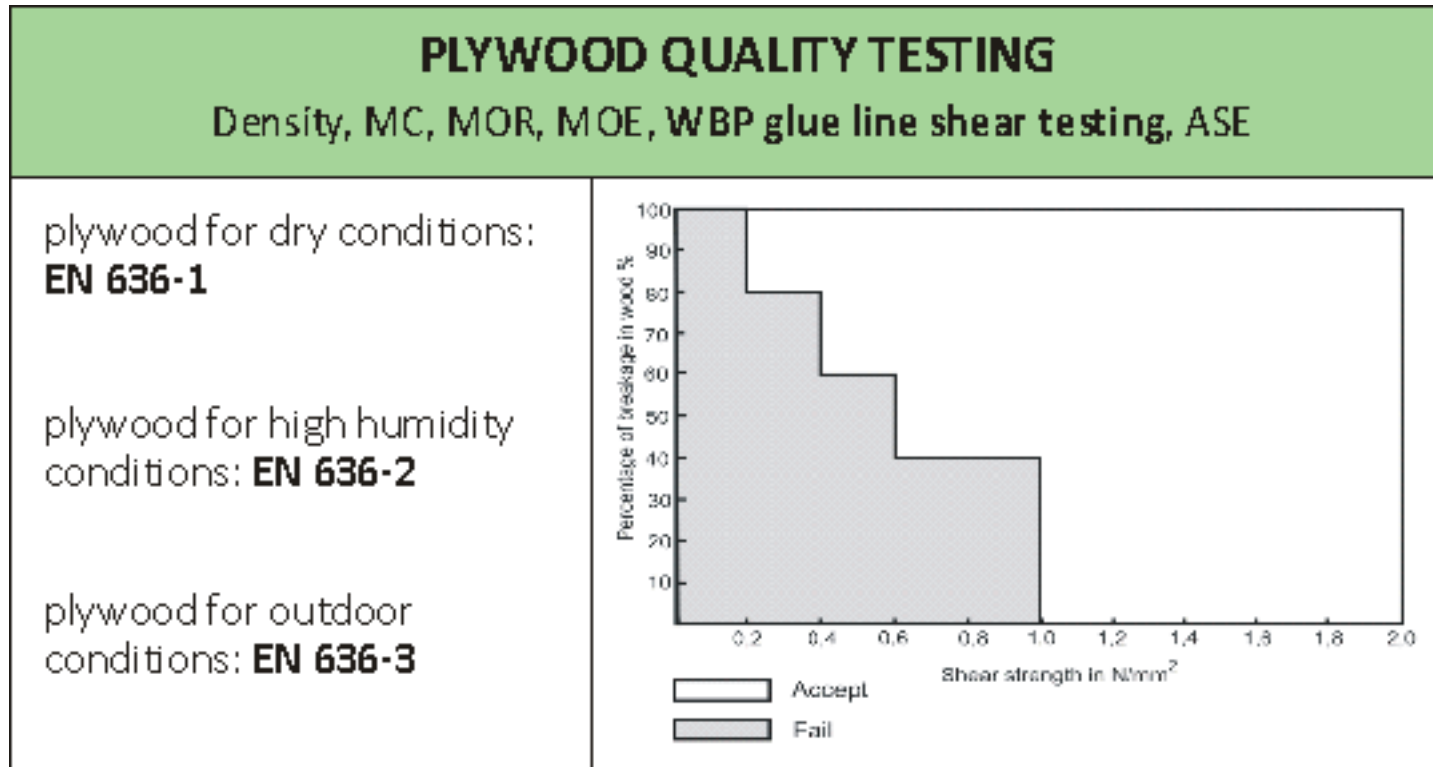
No.	Date	Time	Temp.	Humidity	Pressure	Flow	Status	Action
1	2015.08.25	10:00	190	95	1.2	0.5	OK	Start
2	2015.08.25	11:00	200	95	1.2	0.5	OK	Start
3	2015.08.25	12:00	210	95	1.2	0.5	OK	Start
4	2015.08.25	13:00	215	95	1.2	0.5	OK	Start
5	2015.08.25	14:00	190	95	1.2	0.5	OK	End
6	2015.08.25	15:00	200	95	1.2	0.5	OK	End
7	2015.08.25	16:00	210	95	1.2	0.5	OK	End
8	2015.08.25	17:00	215	95	1.2	0.5	OK	End

Material and methods

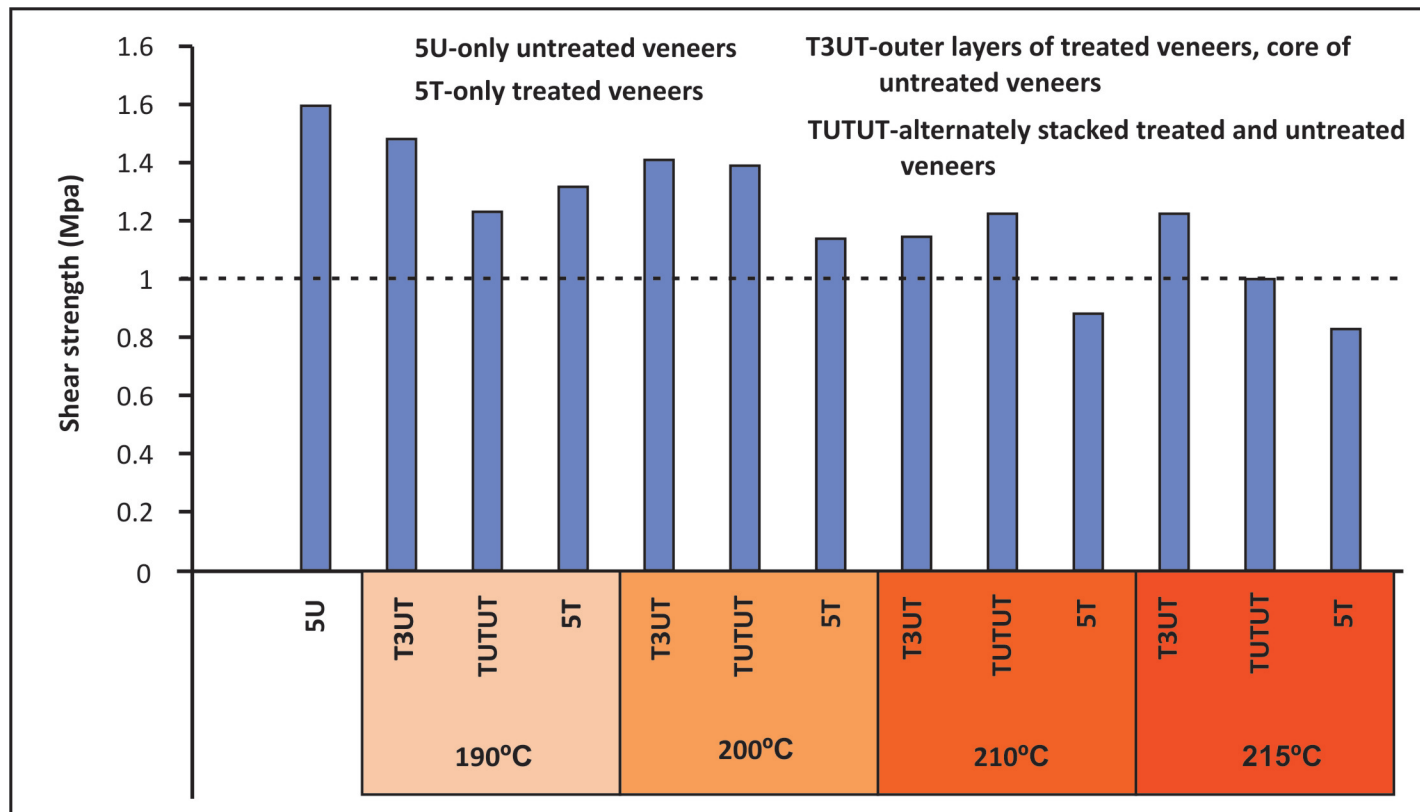
PLYWOOD HOT PRESSING (78 plywoods, 15mm thick)
T=100°C, P=1MPa, t=15min, MUF resin 200g/m²



Material and methods



Results and discussions



Results and discussions

- Gluebond strength drop, apart from decreasing of mechanical properties of wood, was probably caused by weakening of glue-wood relation.
- The decrease of wood failure percentage from 62.37% (plywood for dry conditions: EN 636-1) to 16.56% (plywood for high humidity conditions: EN 636-2) and 13.31% (plywood for outdoor conditions: EN 636-3) supports this statement.
- These results are in agreement with Fioravanti et al. (2013) who reported that gluebond strength of MUF adhesive decreased 64% in plywood for high humidity conditions, as compared to plywood for dry conditions.

Conclusions

- Increased gluebond strength may be achieved by better adhesive penetration into the wood before glue setting by using lower pressing temperature and longer pressing time. In addition to better plywood dimensional stability and more attractive appearance, such plywood would be of higher quality.

Thank you for your attention!