



Dynamic behavior of phenol-formaldehyde modified wood under cyclic loading

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Introduction

Wood modification treatments can be applied to improve certain mechanical properties. Of these properties, fatigue life and cyclic creep performance are often neglected. This study investigated the effect of impregnated phenol formaldehyde (PF) resin on dynamic mechanical properties of Scots pine (*Pinus sylvestris* L.) and European beech (*Fagus sylvatica* L.).

Materials and Methods

- 1 Modification:** Low-molecular weight PF resin impregnation of wood specimens.
- 2 Testing:** Cyclic three-point bending testing using 10 Hz loading speed with 10^6 cycles as a measure of fatigue life divided by various stress levels.
- 3 Evaluation:** cyclic fatigue strength, creep rate and cyclic modulus of elasticity.

Results

Cyclic fatigue strength:

→ Unmodified (Ref) samples meet 67 % ultimate strength, modified pine 58 % and beech 53 %.

Cyclic creep rate (CR) and modulus of elasticity (cMoE):

- **CR** showed a constant behavior during the secondary* creep stage, followed by a rapid increase during the tertial** creep stage resulting in sudden failures in the case of modified wood.
- **cMoE** showed slower reduction in elasticity for modified specimens but exhibit intensive reduction when reaching failure.
- Brittle failures occurred for both modified wood species-without indication of plastic deformation.

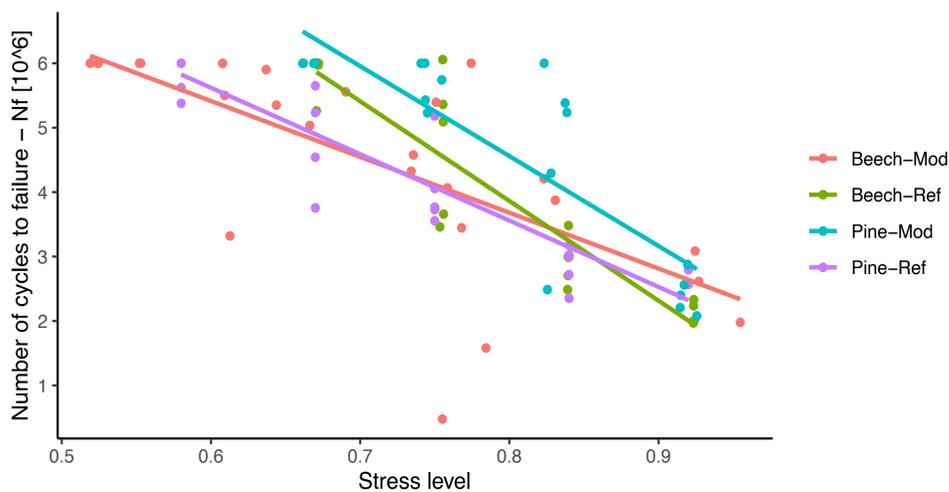


Figure 1: Cyclic fatigue strength

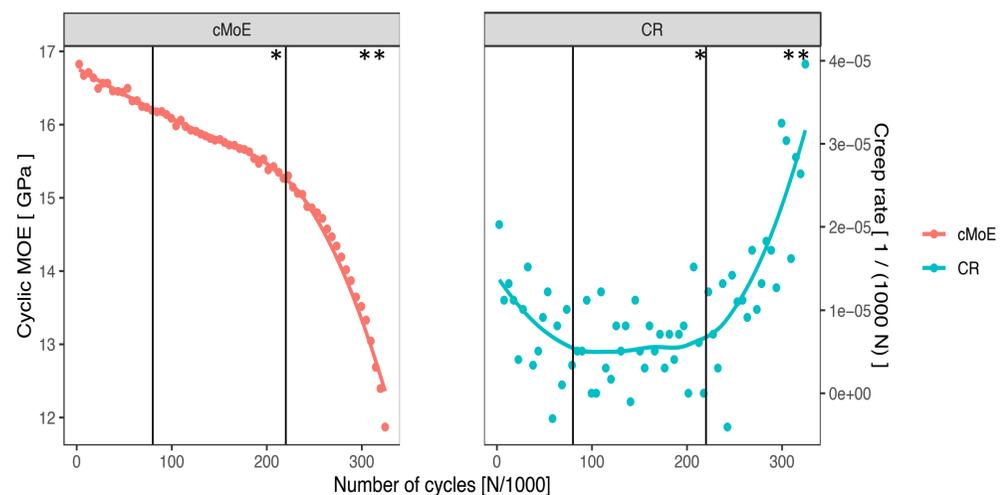


Figure 2: Cyclic modulus of elasticity (left) and creep rate (right)