

Tensile properties of cork in axial stress and influence of porosity, density, quality and radial position in the plank

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Abstract

The behaviour of cork under tensile stress in the axial direction was studied for samples taken from cork planks of good (class 1) and poor (class 4) quality grades and at three radial positions within the plank (inner, mid and outer positions). The effect of cork density (ranging from 0.123 to 0.203 g cm⁻³) and porosity (ranging from 2.8 to 9.6% in the tangential surface) on Young's modulus and fracture stress and strain was studied.

The tensile stress-strain curves of cork showed an elastic deformation up to 2% strain with a Young's modulus of 30.8 MPa, and a fracture stress of 1.05 MPa at a strain of 7.1% for class 1, and Young's modulus of 26.1 MPa, and a fracture stress of 0.77 MPa at a strain of 5.5% for class 4. Fracture always started at a pore. The quality class and the radial position in the plank were highly significant factors of the tensile properties variation with good quality cork in the inner part of the plank showing the highest strength.

Density influenced the elastic behaviour of cork with a highly significant correlation of increasing E with density, but not so clearly the fracture stress and strain. The variability of tensile properties with porosity was large and although significant, the correlations were lower in spite of a decreasing trend of E with porosity. Fracture depended on the type of defects in cork.

Keywords: Fracture Stress; Radial Position; Tensile Behaviour; Quality Class; Outer Position