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Effects of Delignifying Treatments on Mechano-sorptive Creep of Wood I.

Instantaneous and total compliance of radial specimens

Wenbo Zhang[1)], Morihiko Tokumoto[2)], Takashi Takeda[2)] and Koh Yasue[2)]

1) The United Graduate School of Agricultural Science, Gifu University
2) Faculty of Agriculture, Shinshu University

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Abstract: Mechano-sorptive(MS)creep of wood occurs by the interaction of mechanical stress and moisture sorption. While there are different hypotheses on mechanism of this complicated phenomenon, knowledge on the behavior of wood has been accumulated. As one typical feature, it had been found that MS creep deformation under continuous load was equal to the superposition of additional creep under a single load and recovery under zero-load, and it seems as if wood acts by memorizing the range of moisture change under load. In this study, we focused on the effect of delignification on MS creep of radial specimens, and attempted to clarify the function of the hydrophobic constituent.

Specimens for bending creep tests were prepared by three different levels of delignification, and untreated specimens were also prepared as controls. Three loading conditions were used:"Ad" cycles(the first adsorption under load, subsequent desorption under zero-load, the next adsorption under load...), "Da" cycles(desorption under load, adsorption under zero-load...), and "AD" cycles under continuous load. Moisture cycles were repeated five times for all processes. The test temperature was constant at 20°C, and the relative humidity ranged from 40% to 94%.

When the delignification level was high, both instantaneous(J_0)and total(J_T)creep compliance were large as compared with the control specimens. J_T of the high

delignification level during the Ad, Da, and AD cycles were 5.1, 4.0, 5.2 times the value of the control specimens, respectively. J_T increased sharply as lignin content decreased, but the relationships between J_T and J_0 were proportional. The estimated J_T, which was calculated by superposition of Ad and Da cycles, agreed with experimental data of AD cycles. It was concluded that the effect of delignification on MS creep was quantitatively remarkable, but was qualitatively slight.

Keywords: bending creep, moisture cycling, superposition principle, MS creep coefficient, sodium chlorite method

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