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## Fine Structure Changes of Wood during Moisture Adsorption and Desorption Process Analyzed by X-ray Diffraction Measurement

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**Abstract:** To investigate the fine structure of wood in the non-equilibrium moisture condition, X-ray diffraction (XRD) analysis was conducted during moisture content changes in Japanese red pine specimens. The XRD analysis used a novel measurement system consisting of an X-ray diffraction analyzer with a differential scanning calorimeter (DSC) and a humidifier attached. Moreover, thermogravimetric (TG) measurements were also carried out under the same condition as XRD to estimate the moisture content (MC) during XRD measurement. It was confirmed from TG measurements that MC changed exactly as the humidity changed. However, the value of heat flow of adsorption/desorption of moisture still changed even after MC finished its increase/decrease. Both the (200) peak due to cellulose crystal and the halo peak due to non-crystalline regions shifted to a higher angle with increasing moisture content, and shifted to a lower angle with decreasing MC. Moreover, there was a delay in the (200) peak shift in the desorption process compared with the change of MC. Furthermore, a similar delay in the relative crystallinity change was also observed. These results suggest that the fine structure does not follow RH changes regardless of the agreement between the changes of MC and of RH.

**Keywords:** X-ray diffraction, moisture condition, differential scanning calorimeter, thermogravimetric measurement

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