

## **Tracking and Simulation of Dry Shell Formation in a Wood Drying Process by X-ray Spectroscopy**

**Asghar Tarmian<sup>\*1</sup>, Mehdi Faezipour<sup>2</sup>**

### **Abstract**

In this research, dry shell formation and receding of evaporation front through the thickness of beech and spruce boards were investigated during drying using X-ray spectroscopy.

Four surfaces of the boards were coated using epoxy resin to limit moisture flux through the board thickness. The boards were dried using a convectional drying method under the temperature of 60°C and relative humidity of 70%. The scanning process was conducted once in an hour during drying until the dry shell reached the core layer of the boards.

The results revealed that the dry shell was formed faster in the beech board in comparison with the spruce one; however, it reached the core layer of the spruce board in a shorter time. In addition, the pattern of dry shell formation was found to be different between the boards; a steady-state condition as a result of faster bulk flow of free water was observed during the early stage of drying of the spruce board.

In general, it can be concluded that the controlling factor in the dry shell development to the core layer is water vapor diffusion coefficient of the boards rather than their permeability.

**Key words:** Dry shell, X-ray spectroscopy, Bulk flow, Diffusion coefficient

---

\* Corresponding author: Email: [tarmian@ut.ac.ir](mailto:tarmian@ut.ac.ir)