Vous êtes cordialement invités à la soutenance de Thèse de M.
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Lundi 08 octobre, 09h30, ENSAM (Amphi B)

Intitulée

DEVELOPPEMENT D'IMAGERIE THz DE CHAMPS DE TENEUR EN EAU ET DE TEMPERATURES EN VUE DE LA CARACTERISATION THERMIQUE ET MASSIQUE DE COEFFICIENTS DE DIFFUSIONS

Sous la direction:	Christophe PRADERE (CR CNRS - HDR)
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Abstract:

The investigation of water transport during drying processes represents a serious challenge for the wood-based material industry. In particular, the movement of water in glued products (such as cross-laminated timber or glue-laminated timber) can induce severe mechanical strains along the glued interfaces. Consequently, drying can lead to the spread of cracks within the material, voiding its use for construction. The simulation of the water movement in wood is complex and must be validated by measurements of water content fields on samples.

Accordingly, the aim of this study is to develop an experimental device able to measure the water content field on small wood samples during a drying (or wetting) process. The conventional techniques of humidity transport monitoring during drying or the imbibition process only allow access to global information, such as global mass diffusion coefficient and global water content losses or gains with time (sorption curves).

The goal is to show the efficiency of THz technique as a low cost, contactless and implementable technique in the industry for studying drying process that couples the heat and mass transfer. Due to the different sensitivity and time characteristic of each phenomenon, a separate study of the heat and mass transfer is carried out. Two experimental benches based on different detector technologies are developed for contactless estimation of temperature and water content. A high acquisition THz facility, based on infrared coupled with TTC (THz to Thermal Converter), is used for a new application as contactless measurement of transient temperature of insulating materials opaque in the visible or IR range (PVC, PMMA, PTFE and wood). Moreover, a mono-detector-based technique was employed for contactless estimation of the water content at local scale within homogeneous and heterogeneous samples (blotting paper and maritime pine).

Finally, these THz techniques permitted to estimate respectively the optical property of insulating materials and the hydric diffusion coefficient of hygroscopic materials. This shows the capability of THz to be used at different space and time scale. However, due to the wavelength, the technique does not allow to reveal submillimeter details such as wood growth rings. Moreover, the particularity of transient thermal measurement (contactless estimation of temperature part) is the large amount of information. Therefore, it is necessary to process the obtained images before estimating the indicated parameter by an inverse method.

Keywords:

Water content, transient heat transfer, THz, TTC, infrared camera, image processing, inverse method, optical properties, diffusion coefficient, hydric transfer.