SUCCESS STORY

Wood K plus
WOOD: next generation materials and processes – from fundamentals to implementations

Programme: COMET – Competence Centers for Excellent Technologies

Programme line: COMET-Center K1

Type of project: Advanced Characterisation, 01/2019 – 12/2022, multi-firm

SAMPLE PREPARATION FOR ATOMIC FORCE MICROSCOPY AND INFRARED MICROSCOPY

ADVANCEMENT AND CHALLENGES FOR WOOD-BASED MATERIALS

Wood composites and laminates play an important role in today's furniture industry, especially when used in high-quality kitchen and dining room furniture. These areas of application put high demands on the surface quality of the materials used. Therefore, high quality standards are already required at the beginning of the value chain. This is accompanied by the interest in enabling the most efficient and meaningful sample characterisation possible, down to the micro- and nanometre scale.

Current sample preparation methods are mostly simple and rely on cutting and grinding the materials to be tested. However, a major limitation for microscopic investigations is, that the current methods result in smeared coatings on the sample cross-sections and high surface roughness. Therefore, they are not suitable for sample preparation in measuring AFM (atomic force microscopy) and IR microscopy. In the presented project, new preparation methods had been developed and implemented using various wood-based material samples. Based on the significantly improved sample preparation, a clear chemical and physical characterisation of the wood-based materials is possible over the entire sample cross-section or multi-layer structure.

Microscopy: multi-layer structure/impregnated paper

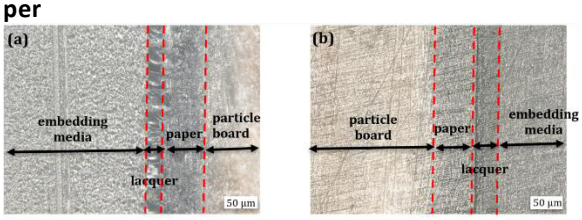

Figure 1: Cross-section image, no identifiable different lacquer layers after microtomy (a) and after additional grinding and polishing (b).

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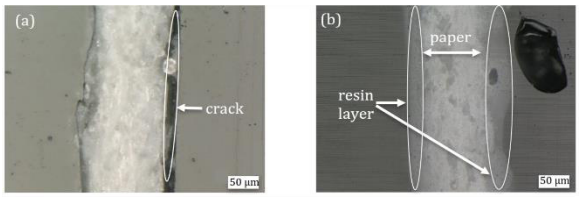

Figure 2: Embedded impregnated paper with (a) and without (b) crack formation, crack formation occurred due to no pre-hardening of the embedding medium, magnification 1000x.

Atomic force microscopy: impregnated paper

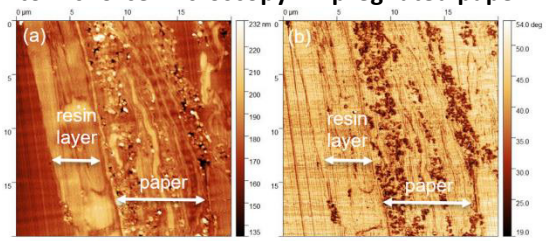

Figure 3: AFM measurements enabled due to new sample preparation (a) topography, (b) phase image

IR Microscopy – impregnated paper

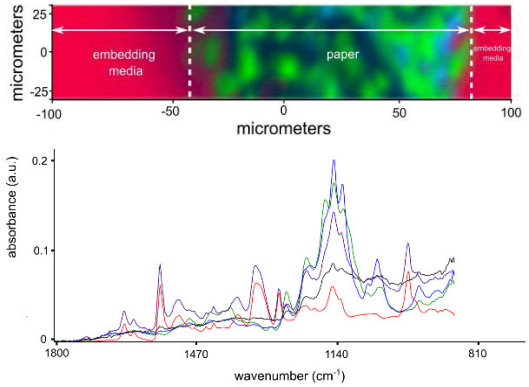

Figure 4: IR microscopy showing the sample cross-section (top: false-colour image – bottom: spectra of the layer structure)

Effects and impacts

The new sample preparation method (improved embedding and new technique for grinding and polishing) enables the characterisation of cross-section samples of difficult to examine wood-based materials. The knowledge of the exact layer structure makes it possible to draw conclusions about the final surface properties and thus to make adaptations for their optimisation in the manufacturing process at an early stage. This enables a quick reaction in production and avoids unnecessary rejects.

Project coordination (Story)
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Project partner

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- Graz University of Technology, Austria

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