

Laboratory of special microscopy and image analysis

The main objectives and activities

- Analysis and modeling of internal and external structures of length, area and 3D fibrous materials,
- Determination of procedures for evaluation of textile structures from the perspectives of their internal and external geometry,
- Reconstruction and digitization of textile and composite structures using computer aided design,
- Processing of image information during evaluation of morphology and defects of textile materials and composites.
- Analysis of soaking (permeation of liquids into porous materials, monitoring of water film stability etc.).

Specialization of the laboratory

- Basic and advanced light, fluorescent, confocal, scanning and X-ray microscopy,
- Non-destructive surface analysis,
- Basic and advanced image analysis (Nis Elements, MatLab, Comsol-Multiphysics).

Laboratories are equipped with classical and professional microscopes including set of analogous and digital cameras, monochromatic and polychromatic. Analyses are possible with the reflected or transmitted light using special illuminating techniques (transversal lighting, illuminating circles etc.) or using special polarization filters. For non-destructive surface analysis, we have reversed 3D reconstruction (system like Talysurf and system RCM).



Specific devices and outcomes

- **Optical microscopy** – basic and fully professional microscopes and macroscopes with the possibility of taking pictures from 0,5x up to 1000x of magnification, possibility of taking „big pictures“ with high resolution (taking pictures and assembling of particular pictures in x and y axis), possibility of taking 3D pictures (taking pictures and assembling of particular pictures in z axis for 3D visualization) for generating digital pictures, sequences of digital pictures, 3D visualizations, videos.
- **Fluorescent microscopy** – for macro and as well as micro objects in transmitted and reflected light (Nikon Eclipse Ti X cite 120q - 10x up to 60x magnification, special fluorescent filters, Olympus BX51 -1x up to 500x magnification, special integrated filters ND6, ND25, LBD, OP, exchangeable filters for observation of fluorescence: U-25ND6 and U-25ND25; filters for observation of objects in reflected light U-AN360-3 and U-PO3).
- **Compact micro CT system SkyScan 1174** – enables obtaining 2D sections by x-ray beams in observed 3D objects with subsequent reconstitution of 3D picture with specialized software package. It is possible to analyze these pictures from the perspective of length measurement, size of the object, shape of the object, orientation and porosity.

- **Talysurf CLI 500** – 3D measuring system of surface structure with a possibility of abrasiveness control in 2D. It is equipped with laser triangular probe with CLA confocal scanner that enables measurement with both contact and non-contact methods.
- **RCM systém** – Laboratory system for analyzing the surface of fabrics with the possibility of evaluating the roughness of fabrics, uniformity of structure - corduroy and pile fabrics, surface hairiness, piling.
- **Image analysis NIS-Elements 3.22** serves for interactive object and texture measurement of geometric parameters and characteristics of chromatic picture of textile and non-textile structures.
- **Special methods** – degree of bast fibres cottonization, geometric parameters of fibres, diameter and hairiness of yarn, lateral proportions of double twin yarn, yarn filling, twines of rotor yarn, determination of fibre coverage of spun yarn, fiber direction in yarn, areal coverage of fabric, geometry of threads linkage in the fabric from transversal slices, complex evaluation of areal structure of textiles, geometric parameters of rotor yarn, determination of lateral compressibility of yarns, bending rigidity of yarn, objective determination of degree of fabric pilling, evaluation of abrasion resistance of yarns, research of macroscopic structure of nonwoven textiles and fibrous system and concentration of contacts in nonwoven textiles.