



# Yuri Vozniak

ASSOCIATE PROFESSOR – CMMS PAS

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## Currently held positions

Centre of Molecular and Macromolecular Studies of the Polish Academy of Sciences

ASSOCIATE PROFESSOR

Łódź

## Scientific profile and collaborations

My scientific work lies at the intersection of polymer physics, materials science, and high-pressure rheology. I specialize in the structural modification of polymer materials in both molten and solid phases under high-pressure and shear deformation, aiming to enhance or tailor their physical and mechanical performance. My research bridges fundamental insights with technological innovation, particularly in the fields of **biopolymer-based nanocomposites, ultra-high plastic deformation, and stimuli-responsive functional materials**.

A significant part of my work involves the development of **bioinspired lattice materials** using advanced **3D printing technologies**. These include hydrogel-based metamaterials for biomedical applications—such as artificial intervertebral disc annulus structures—that mimic the anisotropic mechanical behaviour of natural tissues. In collaboration with international partners, I have studied and engineered 3D-printed TPU-based lattice structures and hydrogel-inspired substitutes for the annulus fibrosus in cooperation with the University of Lille (France). Together, we are also developing **continuum-based constitutive models** that describe deformation mechanisms across different phases using elasto-viscoplastic and viscohyperelastic coupling formulations.

In parallel, I collaborate with the University of Rome Tor Vergata (Italy) on the fabrication of **multiple-shape memory polymeric materials**, and with the Karlsruhe Institute of Technology (Germany) on the challenges of **mixing immiscible polymers** in the solid state under severe plastic deformation conditions. These interdisciplinary efforts contribute to the development of advanced multifunctional polymer systems with tunable structures and properties.

## Selected publications

- 2025 *Recycling Plastic Waste by Solid Phase Mixing* [\[link\]](#)
- 2021 *Design of hybrid PLA/PBS/POM composite based on In-Situ formation of interpenetrating fiber networks* [\[link\]](#)
- 2021 *A novel bio-inspired hydrogel-based lattice structure to mechanically mimic human annulus fibrosus: A finite element study* [\[link\]](#)

## Research grants

**Principal Investigator:** 3 grants: NCN, NASU

**Scientific supervisor:** 1 grant: NCN

**Co-Investigator:** 7 grants: NCN, NCBiR, NASU

## Obtained patents

14 patents Polish & International

## International research stays

**France,** University of Lille, in the team of Prof. Fahmi Zaïri

**Italy,** University of Rome Tor Vergata, in the team of Prof. Loredana Santo