Implants with contrasting properties are desired to facilitate planning and performance of surgical procedures, as well as control of their position. Moreover, the increase of commonness and development of medical imaging techniques sets requirements for implantable materials to have multimodal contrasting properties. However, in many imaging techniques the distinction of polymeric implants in surrounding heterogenous soft tissues, is difficult due to naturally occurring artefacts.

Biodegradation is the advantage of many implants which functionality is finite in time. The usage of biodegradable polymer-based materials, like polycaprolactone (PCL), in manufacturing of implants is increasing. One of the approaches to improve the contrasting properties of polymer is addition of contrast agents (CA) as a filler. Additionally, with this method the composition may be optimized for visualization in many diagnostic techniques like e.g. NIR fluorescence imaging, X-rays based imaging. To this end the development of materials which possess aforementioned properties is needed.

X-rays based techniques, are one of the basic diagnostic methods of medical imaging. However, nowadays large interest in usage of the near-infrared fluorescence (NIRF) imaging is observed. It is a save method of imaging for both patient and medical personnel and can be used intraoperatively to control the position of the implant, also covered by tissue or blood.

CA for biodegradable polymer-based materials needs also to be biodegradable and easily excretable from the body. For X-rays imaging, slightly modified hydroxyapatite (HAP) may be a perfect candidate as it is a mineral occurring in bones and has higher radiodensity than soft tissues. For NIRF imaging, indocyanine green (ICG) should be investigated, as nowadays it is the only one fluorophore approved for human usage.

The aim of the project is to **develop HAP-ICG particles with contrasting properties for bimodal imaging (BI) using X-rays and NIRF** and to **investigate how newly developed HAP-ICG particles will influence the microstructure and properties of PCL-HAP-ICG composite.**

Although, thermal processing of similar biomaterials, e.g. PCL-HAP, with extrusion-based techniques of additive manufacturing was investigated by other researchers for bone tissue engineering applications, there is no studies using HAP-ICG as a contrasting filler in polymer-based composites for medical applications. Moreover, the recently published studies indicate the importance of comprehensive microstructure analysis. Even the little change of parameters of additive manufacturing process affects the microstructure and may affect the mechanical and biological properties which are very important in e.g interaction with tissues.

Therefore, the proposed systematic study will allow us to establish key-factors affecting cell response and stability of contrasting and mechanical properties of PCL-HAP-ICG composite. Moreover, the planned in this project multi-technique study of developed HAP-ICG particles and PCL-HAP-ICG composite will provide new information about materials for bimodal medical imaging.