The main goal of this project is the synthesis of high-performance new cationic photoinitiators based on the structure of iodonium salts enabling initiation of the cationic photopolymerisation process under near UV and visible light irradiation. In order to achieve this goal, compounds that efficiently absorb light in the above-mentioned range will be designed and synthesised, and then with their use new high-efficiency iodonium salts will be prepared, which will serve as photogenerators of the superacid in the process of photoinitiated cationic polymerisation. A wider range of absorbed light and increased salt photodissociation efficiency will allow the use of the increasingly popular LED (light-emitting diodes) light sources and will expand the spectrum of applications of these compounds. They will be used, among others, in 3D printing. Thus they will fill the gap because there is a lack of efficient iodonium salts absorbing lower energy radiation, including visible light. Currently the used salts decompose with acid secretion after irradiation with radiation from the middle ultraviolet range and require additional molecules acting as photosensitisers sensitising them to a wider range of light. Thus limiting their possibilities of use on many levels of science.

Due to the constant search for effective initiating systems that will be characterised by the highest solubility in monomers, as well as good matching of the absorption characteristics with the emission characteristics of modern, pro-ecological light sources, such as UV-LED and Vis-LED diodes, a research plan was proposed allowing to develop and determine the efficiency of the newly obtained cationic photoinitiators. The compounds planned in the proposed project in the form of iodonium salts will be characterised in terms of their absorption properties, ability to photodecomposition and quantum efficiency of generating a superacid, which is the actual initiator of the cationic polymerisation process. These pieces of information will allow the selection of the most active salts and determine their yield in kinetics measurements. The obtained iodonium salts will be tested in 3D printing to obtain information on their usefulness in this field. In turn, the planned kinetic studies of photopolymerisation reactions initiated by the new iodonium salts will allow an optimisation of the developed photoinitiators. Both quantitative and qualitative analysis will be carried out, and the efficiency of initiating systems in the field of initiation of cationic ring-opening polymerisation as well as chain photopolymerisation will be examined.

Therefore, the project result is expected **to obtain completely new chemical compounds in the form of iodonium salts efficiently generating a superacid after illuminating them with light from near UV-A or visible light**. In this way, new cationic initiators will be obtained, which will show a much better matching of the absorption characteristics to the emission characteristics of light sources such as UV-A LED and Vis-LED. In turn, the introduction of appropriate functional groups, alkyl or alkoxy, will provide these systems with the desired solubility in monomers. The photoinitiators obtained in this way with the appropriate absorption characteristics will be studied in terms of their performance and cationic photopolymerisation initiation efficiency. This treatment aims to select from among the developed cationic photoinitiators only highly efficient systems that will constitute effective initiators. Therefore, these compounds will be a real answer to the demand that is put to modern science focused on obtaining efficient acid generators active in visible light.

Detailed spectroscopic, photophysical and photochemical studies of both the new iodonium compounds and their chromophores planned for implementation, as well as research of structural factors that impact these compounds as to their effectiveness and the mechanism of their action will allow optimisation of the construction of new cationic photoinitiators. **These studies will provide the necessary guidelines for the design of new high-performance initiating systems.** Further research in this field will concern the issues of a thorough understanding of the mechanism of action of the developed systems as well as attempts to determine the catalytic effect of selected co-initiators and/or sensitisers on photopolymerisation processes.

In addition, their ability to efficiently initiate cationic polymerisation will enable their use in new, rapidly developing areas of human activity such as 3D printing, allowing obtaining new materials in a fast and energy-efficient manner. These compounds will respond to the demand for efficient acid generators that are active in visible light.

The interdisciplinary nature of the taken problem, as well as reliable preparation of the research path, will undoubtedly allow the creation of several new cationic photoinitiators along with the development of appropriate synthetic pathways. The innovative nature of the research will significantly expand knowledge of the design and synthesis of iodonium salts, and indirectly also in the field of photochemistry and polymer chemistry.