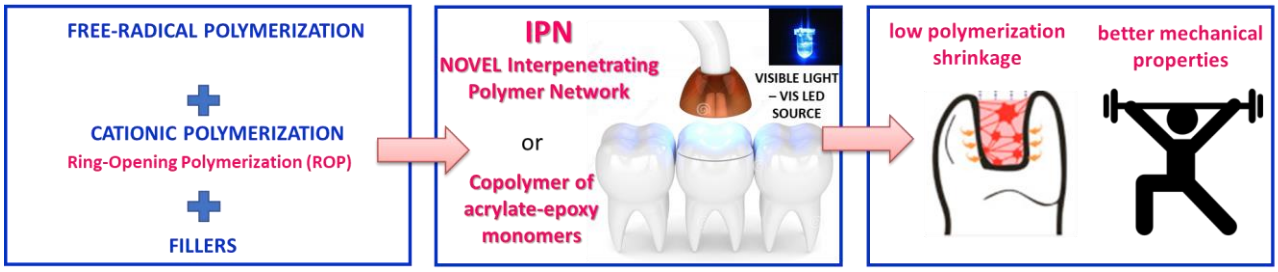
Development and evaluation of physicochemical and mechanical properties of photocurable polymer composites with reduction polymerization shrinkage under visible light

The aim of the project is to obtain new class of photocurable polymer composites generated *in situ* in the process of addition-fragmentation-chain transfer free-radical photopolymerization and ring opening cationic photopolymerization under visible light, determination of their physico-chemical and mechanical properties, as well as the explanation of reaction chemistry of their formation. Radical photopolymerization with addition–fragmentation-chain transfer gives the possibility to gain control over the photopolymerization process, and as a consequence to obtain materials of a regular structure, greater degree of conversion, good mechanical properties and of reduced polymerization shrinkage. What is more, free-radical photopolymerization ACFT process, in connection with a simultaneous cationic photopolymerization with ring-opening, which also guarantees obtaining polymer materials of reduced polymerization shrinkage, gives the possibility to obtain a new group of materials which may replace the materials containing standard matrices based on methacrylic systems of BisGMA/TEGDMA type. The combination of unique characteristics of polymer matrices obtained by cationic photopolymerization with ring opening and addition-fragmentation-chain transfer free-radical photopolymerization with specific characteristics of the fillers of polyhedraloligomericsilsesquioxanes type containing photopolymerisable terminal double bonds (with possible modification with standard fillers) should result in obtaining new-generation composite materials of improved properties.



Obtaining new type of photocurable polymer composites requires both basic, and advanced knowledge concerning kinetics and the reaction mechanism of their formation, as well as mechanical properties extended with the aspects connected with the research deciding on the possibility of their use for biomedical applications. All these issues will be raised in the project and examined in the function of polymer structure, filler type and photo initiators type and structure. Photocurable polymer composites of optimized composition will be examined as materials dedicated for applications in conservative dentistry.

The proposed project has been developed in response to the demand for innovative photocurable composite materials obtained by Vis-LED type light source of a visible range use, characterized by reduced polymerization shrinkage and improved mechanical properties.

In addition, it is expected that new, photocurable polymer composites will demonstrate improved mechanical properties, and above all, significantly reduced polymerization shrinkage, as these properties are necessary for photocurable filling materials used in dentistry.

The research proposed within the project is innovative and its implementation will significantly enrich available knowledge, both in the field of polymer photochemistry, as well as in terms of knowledge on composite materials.