The main goal of this project is to design and synthesize a new class of green nano- photoinitiating systems (PISs-CDs) and photoinitiator-catalysts (PICs-CDs) based on carbon dots with absorption from visible and NIR range. **The influence of structure on photophysical and electrochemical properties of PISs-CDs and PICs-CDs will be studied.** In the next step, the resulting impact on photopolymerization efficiency in a different type of photopolymerization processes, e.g.: cationic, free-radical, hybrid and photo-RAFT, photo-ATRP will be examined. **The project is focused on expanding the range of irradiating wavelengths able to activate the photopolymerization** via the conventional photopolymerization mechanisms and controlled radical photopolymerizations (photo-RAFT and photo-ATRP mechanism). The application and use of longer wavelength visible light and NIR light for cationic, free-radical, and controlled polymerization are underdeveloped. There is a high demand for innovative photoinitiators, and photoredox catalysts to improve, modify, and introduce completely new solutions in photopolymerization processes. This approach has advantages, including lower energy consumption and deeper photon penetration through materials like films and/or gels when longer wavelengths are employed. Although there exist some benefits to using visible or NIR light rather than UV as the source of activation (e.g., avoidance of monomer self-initiation, experimental safety, etc.), the potential mechanistic and structural benefits (i.e., minimization of side/termination reactions or direct thiocarbonyl degradation) require further examination. Moreover, obtaining new high-performance organic, metal-free, non-toxic, green, and biocompatibility PISs and PICs is essential in lowering the cost of the photoinduced processes and avoiding issues of toxic metal catalyst residues remaining in the polymeric products. **The exploration and investigation of the relationship between organic PISs-CDs / PICs-CDs structure and the performance during photopolymerization processes are planned**. The next step will be **to optimize the concentration of PISs-CDs / PICs-CDs and the optional additives to various monomers and the selection of suitable light sources** for photoinduced polymerization processes and perform polymerization upon exposure to visible light and NIR light. **The research proposed in this project is interdisciplinary and concerns fundamental issues** related to kinetics and the mechanism of cationic, free-radical, and living radical polymerization processes under light-controlled conditions. **Systematic investigation in this topic will significantly contribute to the development of knowledge and** result in new solutions in the field of synthesis of carbon dots materials with unique properties. **Consequently, this will lead to creating a completely new class of panchromatic initiators and catalysts based on carbon dots dedicated to photopolymerization under visible and NIR light.**