

Nowadays advanced ceramic materials are more often used in many fields (optoelectronics, metallurgy, medicine and space industry). Ceramic elements of complex shape and good properties, such as high mechanical strength of the green body and high fracture toughness of sintered bodies are desirable. The key stages in the preparation of ceramics by using additive manufacturing (AM) techniques is the development of stable and repeatable ceramic dispersions and selection of favourable curing mechanism.

Conventional methods of manufacturing of complex shaped ceramic products by hard machining is expensive, difficult, time consuming and highly waste process. Additive manufacturing techniques avoid these limitations by building objects from CAD projects from many thin liquid layers of a powder dispersed in a monomer which are solidified by photopolymerization with a UV light. The polymeric network generated by photopolymerization holds ceramic particles in its matrix to shape up 3D structure of the green body. In the processes consisting in polymer and ceramic sciences, in which radical mechanism of photopolymerization is used there are known many problems, such as relative large shrinkage, sensitivity to oxygen inhibition, low stability of photoinitiators and toxicity of used acrylate monomers.

Therefore, the main hypothesis of the project is the development of a photocurable dispersions based on new oxetane monomers which are characterized by low values of viscosity and low toxicity. It enables the addition of a large amount of solid phase to photocurable dispersion, what will result in obtaining a high density of manufactured samples. Furthermore, the application of cationic photopolymerization decreases the shrinkage and improves the adhesion of cured layers because of the living character of this mechanism.

The main stage of research will be the measurements of the cure depth of prepared dispersions after UV irradiation. The influence of the type of powder, solid loading, concentrations of photoinitiator, the type of the used new oxetane monomers on the rheological properties of the dispersions is going to be examined. Furthermore, for sintered samples obtained from dispersion of the most favourable composition by using additive manufacturing method, the degree of mapping the dimensions and shapes will be investigated. Microscopic analysis will allow to determine the density homogeneity of the obtained materials and their microstructure.