Glazes are defined as completely or partially vitreous coatings having a thickness from 0.15 mm to 1 mm applied to the ceramic products. There are variety of glazes, which are caused by differences in the requirements for the properties of these coatings, depending on the function they have to perform on the product. The purpose of the glazing is to improve functional and the physical parameters of the final product. Glaze coating seals the surface of the product, makes it impermeable to liquids and gases, easy to clean and improved chemical resistance. Appropriately selected glaze can increase the mechanical strength of the product and resistance to scratches or abrasion.

Improve the performance of aluminosilicate glazes is possible by, amongst other things, introducing zinc oxide (ZnO) into their composition. Zinc oxide is a flux which has particularly strong effect in glazes with a high content of silica (SiO_2) and aluminium oxide (Al_2O_3). In small quantities, ZnO increases the shine, reduces thermal expansion coefficients and increases glaze elasticity. A high content of ZnO often causes crystallization of zinc silicate – willemite (Zn_2SiO_4), which leads to formation of decorative glass-crystalline glazes. The basic problem in designing aluminosilicate glazes which contain zinc ions is mostly the lack of knowledge of the role of zinc and aluminium in their structure and, as a result, materials with uncontrolled mechanical, physical and chemical parameters are often obtained.

Therefore, the main scientific objective of the project is the determination of the role of zinc and aluminium oxides in the structure of aluminosilicate glazes from the multi-ingredient system of SiO_2-Al_2O_3-CaO-MgO-K_2O-Na_2O-ZnO which contain a systematically changing quantity of ZnO with a constant or variable SiO_2/Al_2O_3 ratio. The performance characteristics offered by us glazes depend largely on their structure, microstructure and the amount and type of crystalline phase. The research on a large group of glazes with a systematically changing chemical composition will make it possible to determine the role of individual ions, which, in turn, will make it possible to freely control the properties of obtained materials. To achieve this is also necessary to determine the influence of the structure and microstructure of glazes on their performance which result from their intended use: thermal stability, chemical resistance, optical properties and mechanical parameters.

The subject of the research will include thin amorphous and/or vitreous-crystalline layers, hence, the measurement methods must be adapted both to the kind of the existing order (amorphous or vitreous-crystalline) and the form of the material (thin layers), therefore the most important research for the realization of the project are structural test. In the case of aluminosilicate glazes with the addition of zinc ions, structural problems mostly boil down to the determination of coordination of the Zn^{2+} and Al^{3+} ions, determination of their role in the structure of analyzed glazes - as a structure-forming element (CN=4, structural position) or as a structure modifier, (CN=6, intermodal, interstitial positions), where CN means the coordination number. As planned in the project, the determination of the influence of the chemical composition (variable number of zinc ions with a constant and variable SiO_2/Al_2O_3 ratio) on the coordination of aluminium and zinc ions, will make it possible to propose a coherent model of the structure of obtained glazes and define the influence of these parameters on the process of their crystallization. This will certainly have an influence on supplementation and further development of knowledge concerning the chemistry of vitreous and vitreous-crystalline materials.

The final objective of the project is obtaining functional glazes, as a result of which, appropriate tests will be performed on all glazes obtained to define their fitness for their intended use. The results of the tests of properties: optical ones (whiteness, shine), mechanical ones (hardness, abrasion, fracture toughness), thermal ones and chemical resistance of the obtained glazes will be correlated with the results of tests of their structure and microstructure. This will make it possible to propose the most appropriate model of the structure for the obtained glazes and informed designing of glazes in accordance with their intended use.