

## ABSTRACT

**Author:** mgr Przemysław Niemiec

**Thesis supervisor:** dr hab. Dariusz Bochenek

**Title:** „*Ferroelectro-ferrimagnetic ceramic materials based on multicomponent powders of PZT type and a ferrite powder*”

PhD thesis includes problems of obtaining two-phase ferroelectro-ferrimagnetics materials by means of conventional methods used to obtain ceramic materials by a solid-phase synthesis of a mixture of simple oxides and carbonates and application of pressureless sintering in air atmosphere. Doped PZT type powders of the so called morphotropic area, showing good piezoelectric parameters comprised the ferroelectric phase. Nickel-zinc ferrite ( $\text{Ni}_{0.64}\text{Zn}_{0.36}\text{Fe}_2\text{O}_4$ ), which belongs to the group of soft magnetic materials comprised the magnetic phase. The ratio of the ferroelectric phase to the magnetic phase was equal to 90:10 (90 wt.% ferroelectric phase, 10 wt.% magnetic phase).

The PhD thesis has been divided into six main chapters. The first chapter presents the idea of this dissertation. In the second chapter, the thesis has been formulated. Also the general and specific objectives of the work have been defined. The third chapter is the theoretical part divided into subsequent subchapters. This section provides information about the subject of the doctoral thesis including ferroic materials, multiferroics and magnetic also their physical properties. The current state of knowledge in the field of two-phase ceramic materials showing magnetoelectric effect (ME) has been also presented. Apart from that a review of research methods used to characterise the obtained ceramic materials has been presented.

The fourth chapter presents the experimental part of the doctoral thesis. This section presents the technological process of obtaining the designed ceramic materials. The results of the analyzes, which have been divided into physico-chemical, electrical, piezoelectric, magnetic and magnetoelectric, as well as interpretation of the studies are presented there. Each of the subsections related to the study of the obtained materials have been completed with a summary.

The conclusions which have resulted from the experimental part and showed that the thesis of this PhD thesis is true are contained in the fifth chapter.

The sixth chapter contains a list of literature cited in the doctoral thesis.