importance in order to evaluate the feasibility of the developed technology. Based on this issue, another goal of the research is to compare the effect of mechanical activation of various waste materials on the geopolymer properties in different mills and circumstances and introduce energy utilization factors. The effect of mechanical activation of fly ash, slag and coal mining gangue on the geopolymerisation was investigated with FT-IR, SEM and XRD analysis. Finally, the relationship between material characteristics (particle size distribution, specific surface area, mineral composition, particle morphology), geopolymer properties (compressive strength, specimen density, microstructure) and process parameters (grinding energy, residence time, energy intensity, rotor velocity) was revealed.

O-1

MECHANOCHEMICAL vs. CHEMICAL SYNTHESIS IN THE PREPARATION OF $YMnO_3$ CERAMIC MATERIALS

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Multiferroic materials simultaneously possess two or more ferroic orders, and enable a coupling interaction between them. The opportunity of controlling magnetic order via electric fields, and vice-versa, is captivating broad interest in developing multiferroic materials, for applications ranging from next generation data storage to sensing and energy conversion. The preparation of single-phase multiferroic materials is itself a very challenging task, involving innovative chemistry and/or combined synthesis methods.

$YMnO_3$ (YMO), as a representative of hexagonal family of rare earth manganites ($RMnO_3$), possesses useful and interesting magnetic, ferroelectric and optical properties. Under this motivation, we investigated the impact of different synthetic paths on the properties of the $YMnO_3$, both powders and ceramic materials. Precursor YMO powders were obtained by mechanochemical and chemical synthesis.

In mechanochemical approach, milling of the starting mixture (Y_2O_3 and Mn_2O_3) in high energy planetary ball mill resulted in the preparation of the metastable orthorhombic YMO phase. After sintering under different conditions, ceramic material with hexagonal YMO as a major phase was obtained. Even though these samples had satisfying magnetic properties, their density under 90% of

theoretical value along with pronounced inter and intragranullar cracks strongly influenced material's electric properties.

Polymeric precursor method, starting from yttrium and manganese citrate solutions, was used for the chemical synthesis. By optimization of sintering conditions of obtained polyphase powders, pure antiferromagnetic h-YMO ceramic materials were prepared, having densities higher than 95%. By comparing the ceramic materials prepared by means of two different methods, we could conclude that in case of $YMnO_3$ chemical synthesis resulted in the preparation of material with better phase composition, microstructural, magnetic and ferroelectric properties.

O-2

COATING OF CERIUM OXIDE NANOPARTICLES WITH DIFFERENT CARBOHYDRATES

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Cerium oxide nanoparticles ($nCeO_2$) are biomaterials with numerous applications in biomedicine, fuel additives and electronics. Since their low stability in aqueous media limited their practical application, the aim of this study was to improve the suspension stability of $nCeO_2$ by coating the particles. Glucose, monosaccharide, and levan and pullulan, microbial polysaccharides, were used as coating material. The coating was attempted under different synthesis conditions, by adding the carbohydrates during (direct coating) or after (subsequent coating) the synthesis of $nCeO_2$. X-Ray diffraction analysis, Fourier transform infrared spectroscopy (FT-IR), scanning electron microscopy (SEM) and transmission electron microscopy (TEM) were used for characterization of nanoparticles' powders. Measuring of hydrodynamic size, zeta potential and turbidity was used for