The Serbian Society for Ceramic Materials
Institute for Multidisciplinary Research (IMSI), University of Belgrade
Institute of Physics, University of Belgrade
Center of Excellence for the Synthesis, Processing and Characterization of Materials for use in Extreme Conditions "CEXTREME LAB" - Institute of Nuclear Sciences "Vinča", University of Belgrade
Faculty of Mechanical Engineering, University of Belgrade
Center for Green Technologies, Institute for Multidisciplinary Research, University of Belgrade
Faculty of Technology and Metallurgy, University of Belgrade
Faculty of Technology, University of Novi Sad

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Branko Matović
Zorica Branković
Aleksandra Dapčević
Vladimir V. Srdić

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5CSCS-2019

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НАУКЕ И ТЕХНОЛОШКОГ РАЗВОЈА

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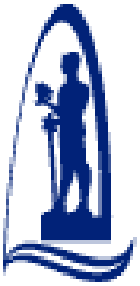

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THE EFFECTS OF MILLING MEDIA ON MORPHOLOGICAL AND STRUCTURAL CHANGES IN MECHANICALLY ACTIVATED ZnO

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Mechanical activation (MA), as a simple and low-cost method for modifying physico-chemical properties of disperse systems, is often used for obtaining powders. Prolonged milling in high-energy mills, necessary for obtaining nanoparticles, leads to contamination of the starting material, and it can be used as an additional route for introducing the milling assembly material as the desired dopant into a powder.

In the present work morphological and structural characteristics of ZnO nano-powders obtained by MA in a high-energy planetary ball mill with stainless steel (Fe), Y-stabilized zirconium oxide (Zr) and tungsten carbide (W) vials and balls were investigated. Knowing that microstructural characteristics of mechanically milled ZnO powder have strongly depended on milling conditions. The milling has been performed in a continual regime in air, with following conditions: the rotation speed of the disk was 400 rpm, ball-to-powder mass ratio was 40:1, and milling time was 300 min. The samples were characterized by scanning electron microscopy (SEM), equipped with an EDS, X-ray diffraction (XRD), Raman and UV-vis spectroscopy. In order to investigate the type of intrinsic defects and impurities introduced by milling, both milled and thermally treated milled ZnO were analyzed.

According to the SEM, the particles of various sizes (100–500 nm) were present in the sample before milling. After milling significant changes in particle shapes and sizes and very pronounced tendency to adhesion in agglomerates, with dimensions in the range of submicron up to a few micrometers, has been noticed.\

The phase analysis of both milled and thermally treated milled samples of powders indicates the presence of wurtzite ZnO refined in $P6_3mc$ space group [1]. The XRD patterns of milled samples of Fe-, W- and Zr-doped ZnO do not reveal the presence of other ZnO phases. On other side, in thermally treated milled samples of W- and Fe-doped ZnO the $ZnWO_4$ (samartinite, *P2/c*) and cubic spinel (*Fd-3m*) are present, respectively. In thermally treated milled Zr-doped sample monoclinic and tetragonal ZrO_2 ($P2_1/c$ and $P4_2/nmc$) are present, whereas $ZnZrO_3$ structures could not be refined due to very low peak intensities [2].

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