Structural and Electrical Properties of Sintered Zinc-titanate Ceramics

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Abstract

The aim of this work was an investigation of structural and electrical properties of sintered zinc-titanate ceramics obtained by mechanical activation. The mixtures of ZnO and TiO_2 were mechanically activated in a planetary ball mill up to 90 minutes and sintered isothermally in air for 120 minutes at 1100°C. Phase composition in the ZnO-TiO_2 system after milling and sintering was analysed using XRPD method. Microstructure analyses have been performed using SEM. The results of electric resistivity, capacitance and loss tangent of the sintered samples were obtained.

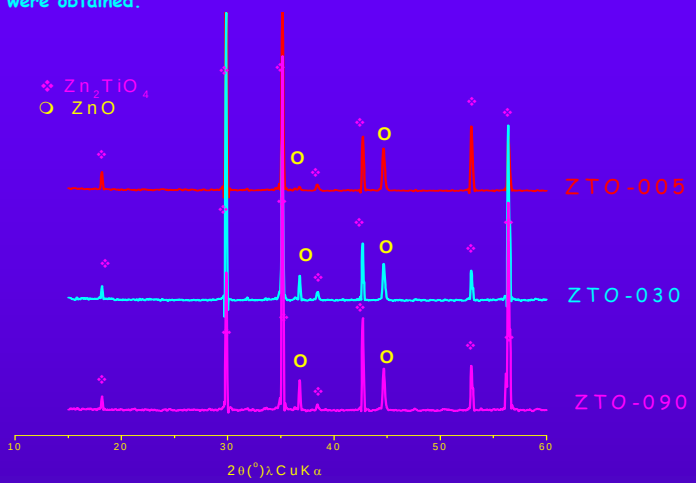


Fig. 2. XRD patterns of samples activated 5, 30 and 90 min and sintered on 1100°C for 2 hours

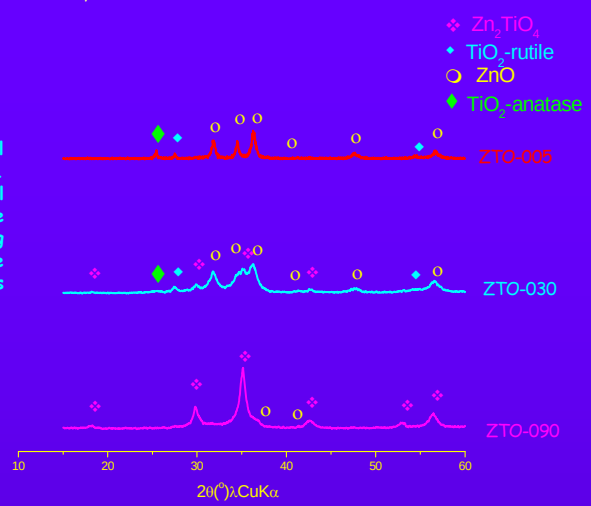


Fig. 1. XRD patterns of samples activated 5, 30 and 90 minutes

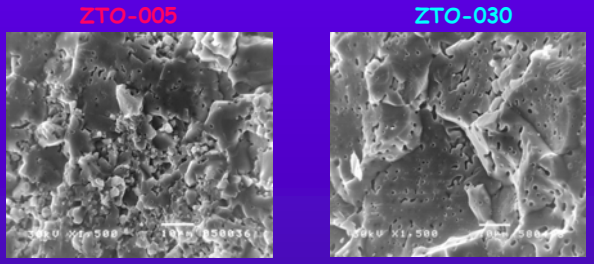
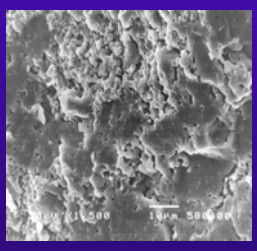


Fig. 3. SEM micrographs of samples activated 5, 30 and 90 minutes and sintered on 1100°C for 2 hours

Electrical properties and relative densities of samples activated 5, 30 and 90 minutes and sintered on 1100°C for 2 hours at the 4 MHz frequency

Sample	ρ_s, TD, (%)	ε_r	tgδ*10^{-3}	ρ (Ωm)
ZTO-005	90.93	10.06	8.52	4.02
ZTO-030	92.20	12.15	2.59	1.02
ZTO-090	90.40	11.92	3.77	1.45

ZTO-090



Conclusions

In this article the influence of mechanical activation of ZnO-TiO_2 system on structural and electrical properties of sintered zinc titanate ceramics has been examined. It was noticed that the first significant appearance of zinc titanate phase along with all the starting phases is established to be after 30 minutes of mechanical treatment, although the very first diffraction peaks are detectable after 15 minutes of activation. A pure zinc titanate phase with a small amount of unreacted ZnO in all samples has been synthesized successfully after sintering process. Microstructure analyses showed that mechanical activation led to the increase of contact necks and strengthening of boundary regions of neighboring grains thus influencing the final density and electrical properties of the samples.

Acknowledgment

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