

The Influence of Tribophysical Activation on Zn_2TiO_4 Synthesis

N. Obradovic¹, N. Labus¹, T. Sreckovic², M. M. Ristic³

¹Institute of Technical Sciences of SASA, Knez-Mihailova 35/IV, 11000 Belgrade, Serbia and Montenegro

²Center for Multidisciplinary Studies, University of Belgrade, Kneza Viseslava 1a, 11000 Belgrade, Serbia and Montenegro

³Serbian Academy of Sciences and Arts, Knez-Mihailova 35, 11000 Belgrade, Serbia and Montenegro

Abstract

The influence of mechanical activation on Zn_2TiO_4 synthesis along with the changes within powders during tribophysical treatment was observed. Mixtures of ZnO and TiO_2 powders were mechanically activated using high-energy ball mill during different time intervals from 0 to 300 minutes. XRD was performed in order to give information about phase composition varieties. Microstructure parameters were revealed from approximation method. Particle size distribution along with scanning electron microscopy gave very useful information about powder morphology.

Tab. 1. Microstructure parametare of ZTO-000 and ZTO-030 revealed from approximation method

mill. time	phase comp.	D (nm)				$\rho_D \cdot 10^{12} (cm^{-2})$				$\phi_{Hkl} \cdot 10^3$			
		(100)	(002)	(101)	(110)	(100)	(002)	(101)	(110)	(100)	(002)	(101)	(110)
0	ZnO	69.1	69.6	139.8		0.063	0.062	0.015		1.8	1.7	0.8	
	a- TiO_2			51.1				0.1				3.1	
	r- TiO_2				82.1				0.044				1.8
30	ZnO	17.4	52.4	34.9		0.9	0.1	0.3		6.7	2.1	3.2	
	a- TiO_2			68.1				0.065				2.3	
	r- TiO_2				41.1				0.2				3.6

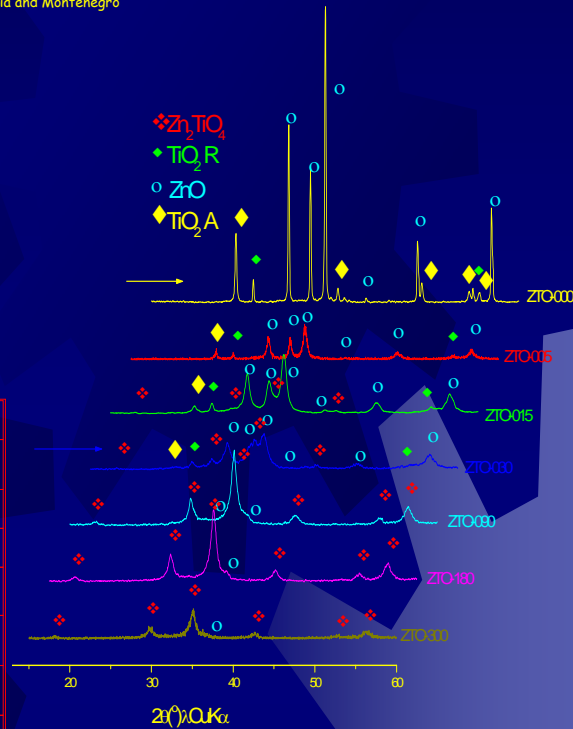
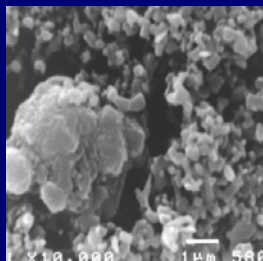
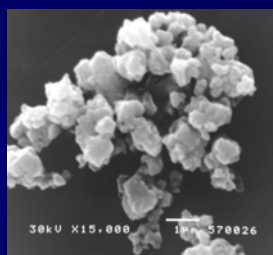


Fig. 1. X-ray diffraction patterns of unmilled and milled ZnO and TiO_2 powder mixtures



ZTO-000



ZTO-030

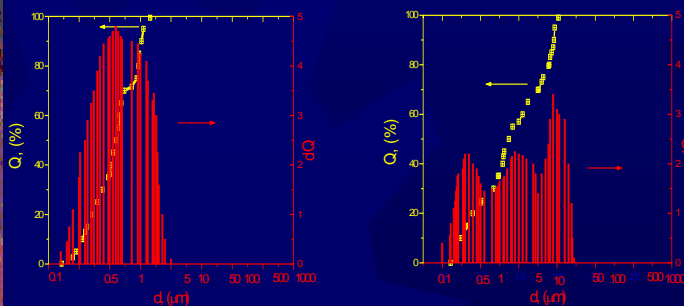


Fig. 2. SEM and particle size distribution of ZTO-000 and ZTO-030

Conclusions

In this paper the influence of tribophysical activation on Zn_2TiO_4 synthesis was studied. Based on these results, 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 tribophysical activation. Also, we found that tribophysical activation leads to particle size reduction, the increase of dislocation density and lattice strain. It is well known that the appearance and the increase of defects within observed material leads to better diffusion and accelerates the solid-state reaction. Scanning electron micrographs along with the particle size distribution indicate the difference between non-activated and activated samples morphology and in such a way confirm the changes going on during mechanical activation.

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