Influence of mechanical activation on MgO-TiO_2 system

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Abstract

In this paper the influence of mechanical activation on MgO-TiO2 system has been investigated. Mixtures of MgO-TiO_2 were mechanically activated using high-energy planetary ball mill during 5, 10, 20, 40, 80 and 120 minutes. XRD analyses were performed in order to give information about phase composition and to determine variety of microstructure parameters using approximation method. The decrease in powder's particle size was noticed as the time of mechanical activation increased. Also, the effect of tribophysical activation on microstructure was investigated by scanning electron microscopy and differential thermal analyses.

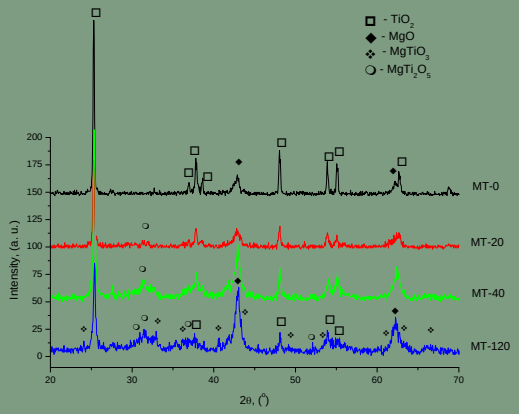

Fig. 1. X-ray diffraction patterns of unmilled and milled MgO and TiO_2 powder mixtures

TiO_2 (101) D_{hkl}= 73 - 50

MgO (220) D_{hkl}= 52 - 42

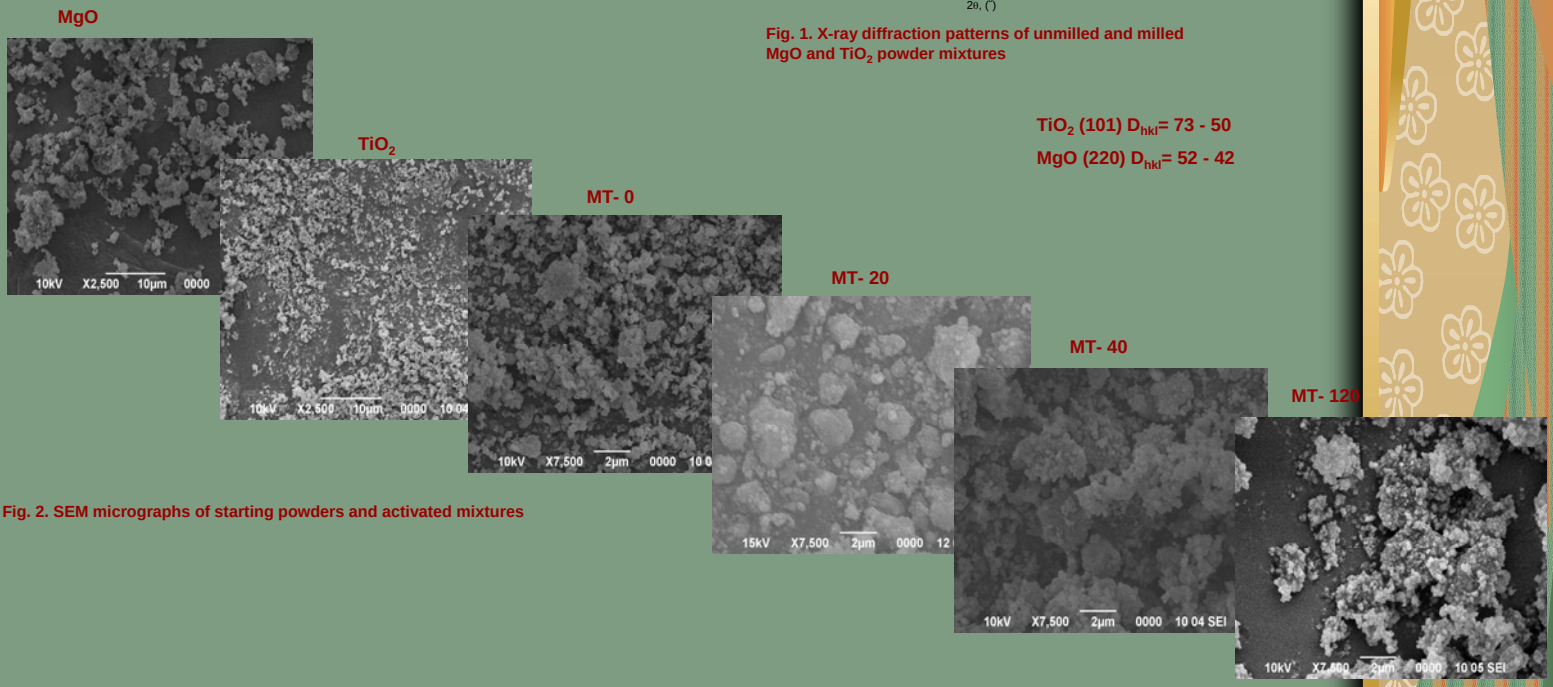

Fig. 2. SEM micrographs of starting powders and activated mixtures

Table 5 Characteristic temperatures obtained by DTA analyses

Sample	T_1 (°C)	Q_1 (J/g)	T_2 (°C)	Q_2 (J/g)	T_3 (°C)	Q_3 (kJ/g)
MT-0	388.86	15.13	448.37	25.33	1020.14	2.51
MT-20	370.47	10.45	-	-	980.50	0.54
MT-40	265.95	3.48	-	-	1011.46	1.06
MT-120	-	-	-	-	1010.85	1.03

Conclusion

In this paper the influence of mechanical activation on MgO-TiO2 system was studied. Scanning electron micrographs indicate a difference between the starting and activated powders morphology confirming the changes taking place during the mechanical activation. Based on these results, the first significant appearance of the magnesium titanate phases along with the starting phases were found to occur after 40 minutes of mechanical treatment.

Also, it has been found that mechanical 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 the observed material leads to a better diffusion, shifts the onset of reaction to lower temperatures and accelerates the solid-state reaction, wich is in a great accordance with data obtained using thermal analyses.