

## The photocatalytic and optical properties of nanoparticles ZnO synthesized by mechanochemical activation

Yanko Dimitriev<sup>1</sup>, Maria Mancheva<sup>2</sup>, Reni Iordanova<sup>2</sup>

<sup>1</sup>University of Chemical Technology and Metallurgy, 1756 Sofia, Bulgaria,

<sup>2</sup>Institute of General and Inorganic Chemistry, Bulgarian Academy of Sciences, 1113 Sofia, Bulgaria. *E-mail*: mancheva@svr.igic.bas.bg

T. Tsuzuki et al. [1,2] have used mechanical activation of solid - state displacement reaction  $\text{ZnCl}_2 + \text{Na}_2\text{CO}_3 \rightarrow \text{ZnCO}_3 + 2\text{NaCl}$  for ZnO nanoparticles manufacturing. In order to avoid the additional thermal decomposition of intermediate  $\text{ZnCO}_3$  and washing of NaCl we applied mechanically activation directly on  $\text{ZnCO}_3$ . The initial trade  $\text{ZnCO}_3$  (Fluka) which is a mixture of  $\text{Zn}_5(\text{CO}_3)_2(\text{OH})_6$  and  $\text{Zn}_4(\text{CO}_3)_2(\text{OH})_6 \cdot 2\text{H}_2\text{O}$  was subjected to intense mechanical treatment in air using a planetary ball mill (Fritsch – Premium line – Pulversette №7) up to 120 min. Stainless steel vials and balls with 5 mm in diameter were used. The balls to powder weight ratio was 10:1. The phase and structural transformations were investigated by X-ray diffraction (XRD) and infrared spectroscopy (IR). The optical properties of the ZnO powders were characterization by UV-VIS spectroscopy. Nanoparticles of ZnO single phase was obtained after 90 min milling time. Additional mechanical treatment did not lead to any phase and structural changes of ZnO. The ZnO powder synthesized by mechanochemical activation exhibits a photocatalytic activity in the degradation of Malachite Green (MG) under UV-light irradiation. According to UV-VIS spectra the obtained sample exhibits transparency above 360 nm.

### References

1. T. Tsuzuki and P. G. McCormick, *Scripta Mater.* 44 (2001) 1731.
2. A. Dodd, A. McKinley, T. Tsuzuki, M. Saunders, *J. Nanopart. Res.* 10 (2008) 243

### Acknowledgment

Thanks are due to the Financial Support of Bulgarian National Science Fund, Ministry of Education and Science Grants: TK-X-1702/07 and the National Science Fund of Bulgaria, National Centre for New Materials UNION, Contract No DO-02-82/2008.