Effect of Dy doping on the thermoluminescence properties of ZnO phosphors

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Introduction

The optoelectronic properties of ZnO have been the subject of a number of investigations. It is a non-toxic wide band gap (3.2 eV) semiconductor with a 60 meV exciton binding energy that can be obtained through low cost and easy synthesis routes[1]. In this work we report on the effect of Dy doping on the thermoluminescence (TL) characteristics of ZnO with the aim of proposing it as a TL dosimeter.

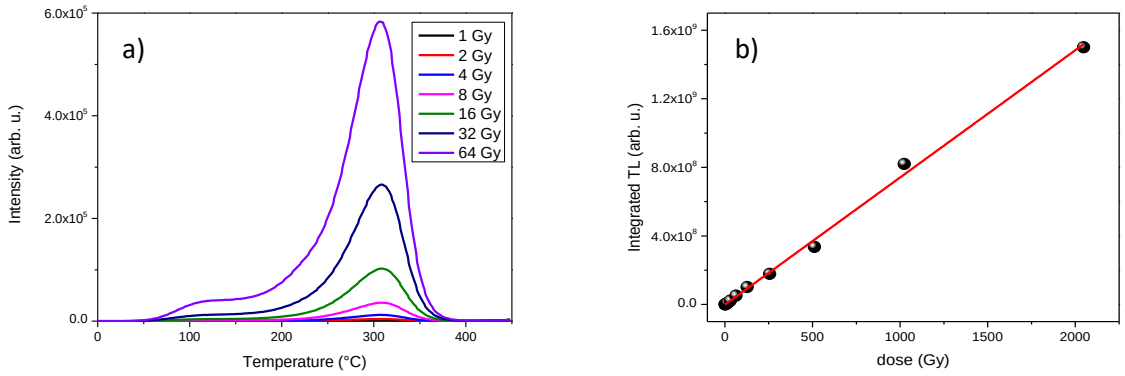
Materials and Methods

Dy doped ZnO was synthesized using a controlled precipitation reaction with weight percent Dy/Zn 5 % and sintered at 1000 °C for 48 h.

Results and Discussion

X-ray diffraction patterns revealed ZnO hexagonal wurtzite phase. The TL glow curves were recorded using a 5 °C/s heating rate (figure 1a). The integrated TL increases by increasing the beta particle irradiation dose and a linear behavior from 1.0 Gy to 2,048 Gy (figure 1b). A 10 % TL fading was observed 96 h after 20 Gy irradiation, and the reusability in 10 irradiation – normalized TL readout cycles presents a $\sigma = 0.0143$ standard deviation. The computed lower detectable dose was 3.6 mGy.

Figure 1: (a) TL glow curves and (b) integrated TL of synthesized ZnO:Dy as obtained after exposure to different doses of beta particle irradiation.



Conclusion

Based in the properties here reported, we conclude that Dy doped ZnO is a promising phosphor material for application in different branches of radiation dosimetry.

Bibliography

[1] Ü. Özgür, et al., A Comprehensive Review of ZnO Materials and Devices. J. Appl. Phys., 2005, 98, 12-15.