Characterization of OSL response of LiF:Mg,Ti and microLiF:Mg,Ti to ^{60}Co gamma source

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I. Introduction

The OSL is a signal emitted by an insulating or semiconducting material when exposed to light, after being irradiated. The intensity of the OSL signal is proportional to the radiation dose absorbed by the detector.

II. Objectives

- ✓ To measure the OSL and TL response of the LiF:Mg,Ti and microLiF:Mg,Ti dosimeters;
- ✓ To study the reproducibility, dose response and lower detection limit by using TL and OSL techniques.

III. Materials and Methods

Dosimetric material

- ✓ 40 TL dosimeters LiF:Mg,Ti (TLD-100);
- ✓ 40 TL microdosimeters LiF:Mg,Ti.

Equipments

- ✓ Furnace *VULCAN* model 3-550 PD;
- ✓ Furnace *FANEN* model 315-IEA 11200;
- ✓ TL/OSL reader *Risø.*

Heat-Treatment

- ✓ 1h/400ºC + 2h/100ºC.

^{60}Co gamma irradiation

- ✓ ^{60}Co gamma source (656.4 MBq) of GMR/IPEN;
- ✓ ^{60}Co gamma source (12.46TBq) of CTR/IPEN;
- ✓ Free air, electronic equilibrium condition;
- ✓ TL response 5%.

TL/OSL Response

- ✓ Average of 5 reading;
- ✓ Error bars: standard deviation of the mean (1σ);
- ✓ TL Readings: 24h after irradiation;
- ✓ OSL Readings: immediately after irradiation.

IV. Results and Discussion

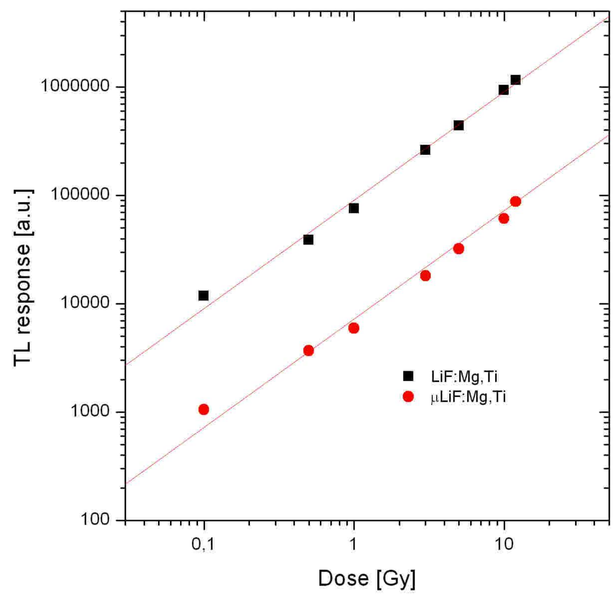
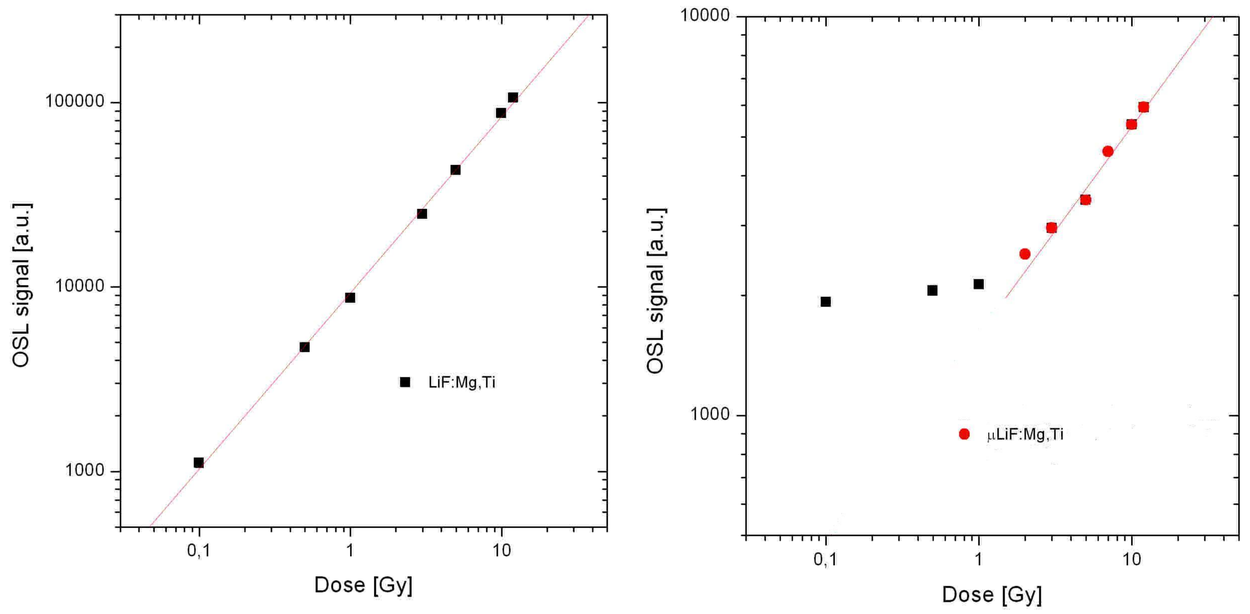


Fig. 1. TL Dose–response curves for the LiF:Mg,Ti and microLiF:Mg,Ti dosimeters.



(a) (b)

Fig. 2. OSL Dose–response curve for the LiF:Mg,Ti (a) and microLiF:Mg,Ti dosimeters (b) .

✓ **Dose-response linear behavior**

LiF:Mg,Ti	*microLiF:Mg,Ti*
TL/OSL – from 0.1 to 12Gy	TL – from 0.1 to 12Gy OSL – from 2 to 12Gy

✓ **LDL**

LiF:Mg,Ti	*microLiF:Mg,Ti*
TL e OSL – 0,1Gy	TL – 0,1Gy OSL – 2Gy

✓ **Reproducibility**

LiF:Mg,Ti	*microLiF:Mg,Ti*
TL - ≤ ±2.02%	TL - ≤ ±2.17%
OSL - ≤ ±1.61%	OSL - ≤ ±2.4%

V. Conclusion

- ✓microLiF:Mg,Ti dosimeters are more sensitive to the TL than OSL technique;
- ✓ Reproducibility of LiF:Mg,Ti and microLiF:Mg,Ti is in accordance with the literature (<± 5%) to OSL and TL;
- ✓ LiF:Mg,Ti can be indicated to be used in the OSL measures for application in gamma dosimetry.

Acknowledgments