



# Development and Dose Evaluation of Natural Topaz for Dosimeter Radiation

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## Abstract

In the present work, natural colorless topaz from Pakistan were irradiated gamma ray at different dose from 50 - 400 Gy. The samples were characterized by thermoluminescence (TL) and electron spin resonance (ESR) spectroscopy. The TL results showed that the luminescence center of topaz was appeared at 150 and 225 °C. The intensity of TL was increased with increased radiation dose. The ESR signals with  $g = 1.966$  and  $2.012$  due to  $Ti_3^+$  and  $(AlO_4)^-$  centers, respectively and increased with radiation dose. Percent error of evaluation dose from TL and ESR signals were 8 and 3, respectively. This study showed that the topaz can be used a radiation dosimeter.

## Introduction



## Objectives

1. To studies the characteristic of topaz signal from TL and ESR spectroscopy before and after irradiation in ranges 50 to 100 Gy.
2. To evaluates the dose radiation and calculates the percentage error of dose radiation from topaz.

## Experiment

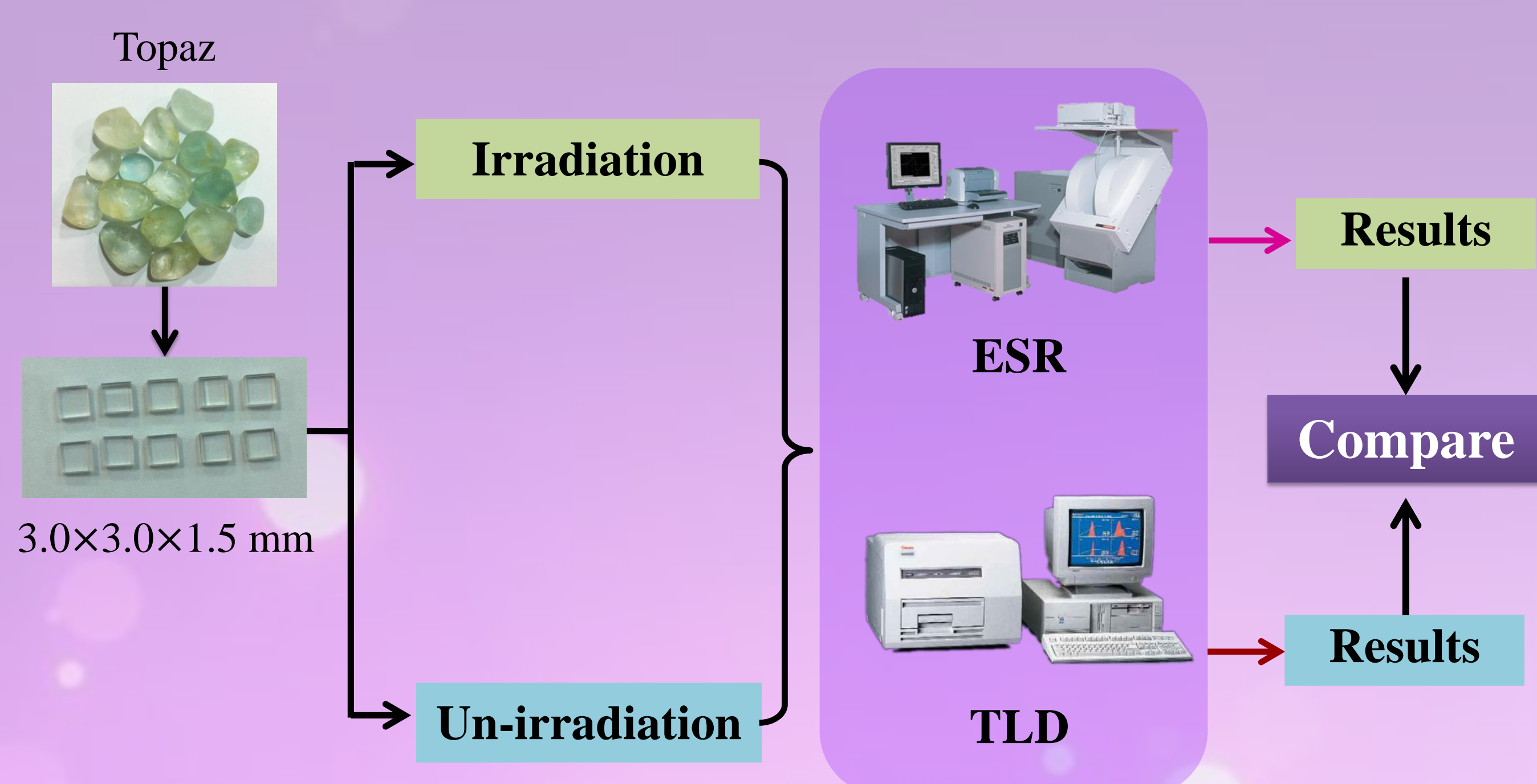


Figure 1. Diagram of characterization of topaz dosimeter

## Results

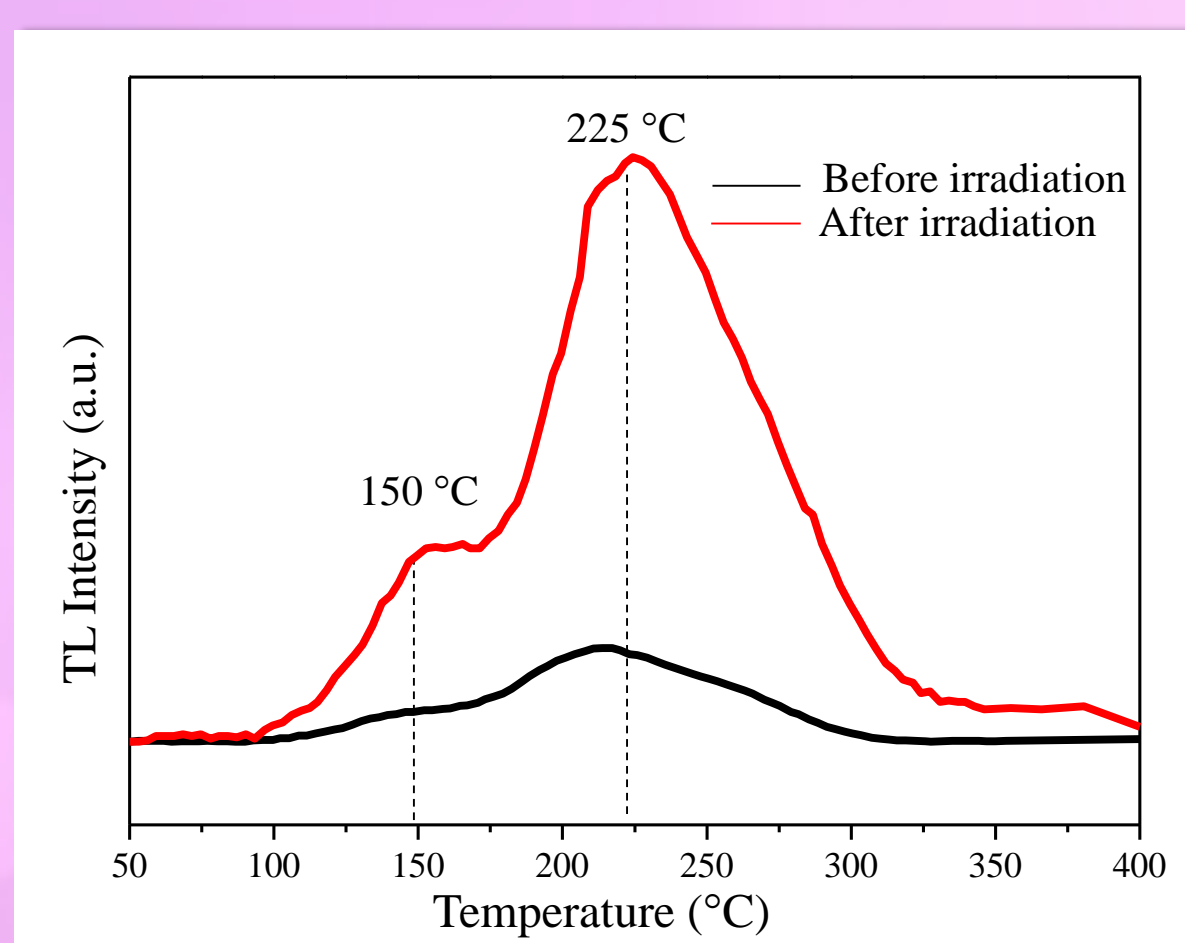


Figure 2. Thermoluminescence signal of topaz before and after irradiation.

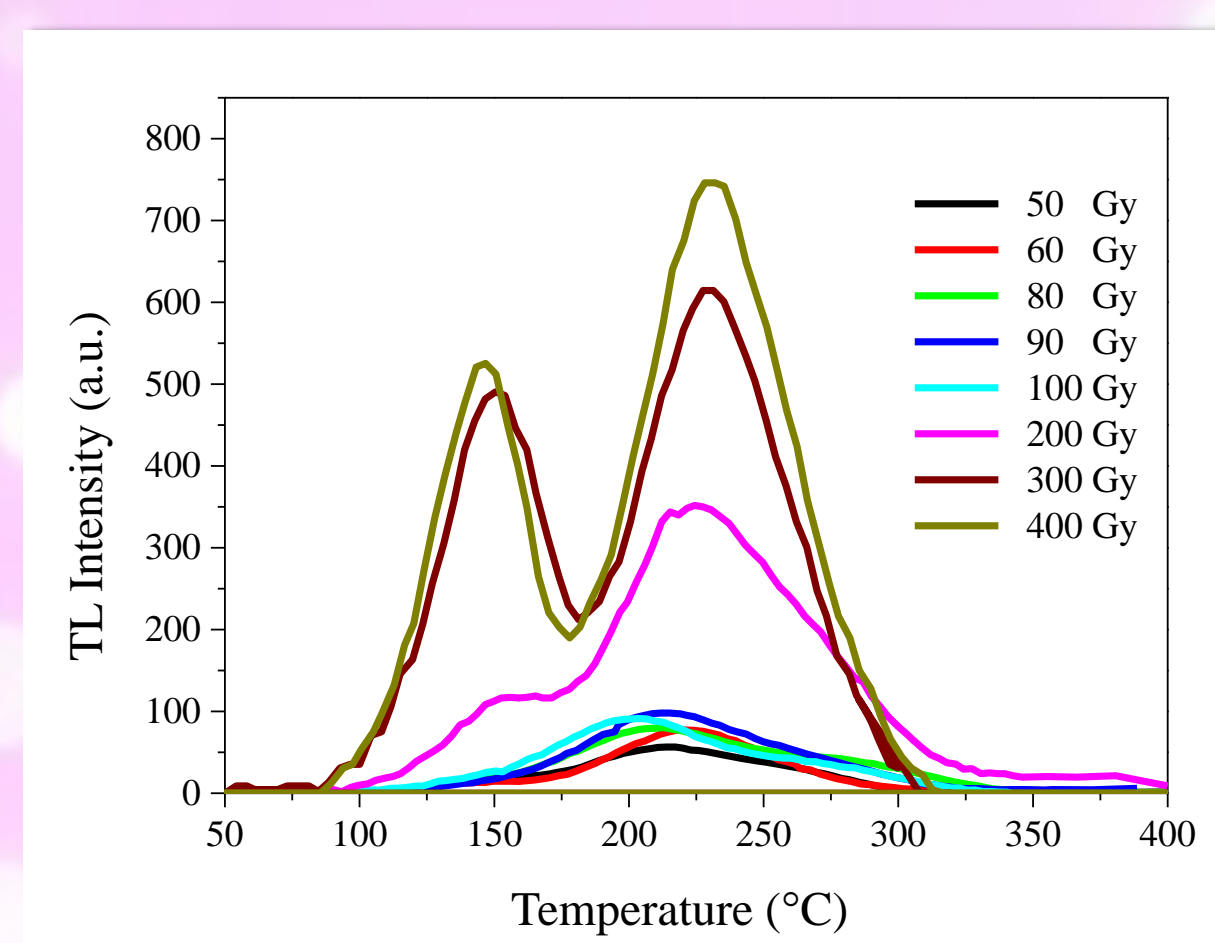


Figure 3. Relationships between TL intensity and temperature of topaz after were irradiated at 50 - 400 Gy.

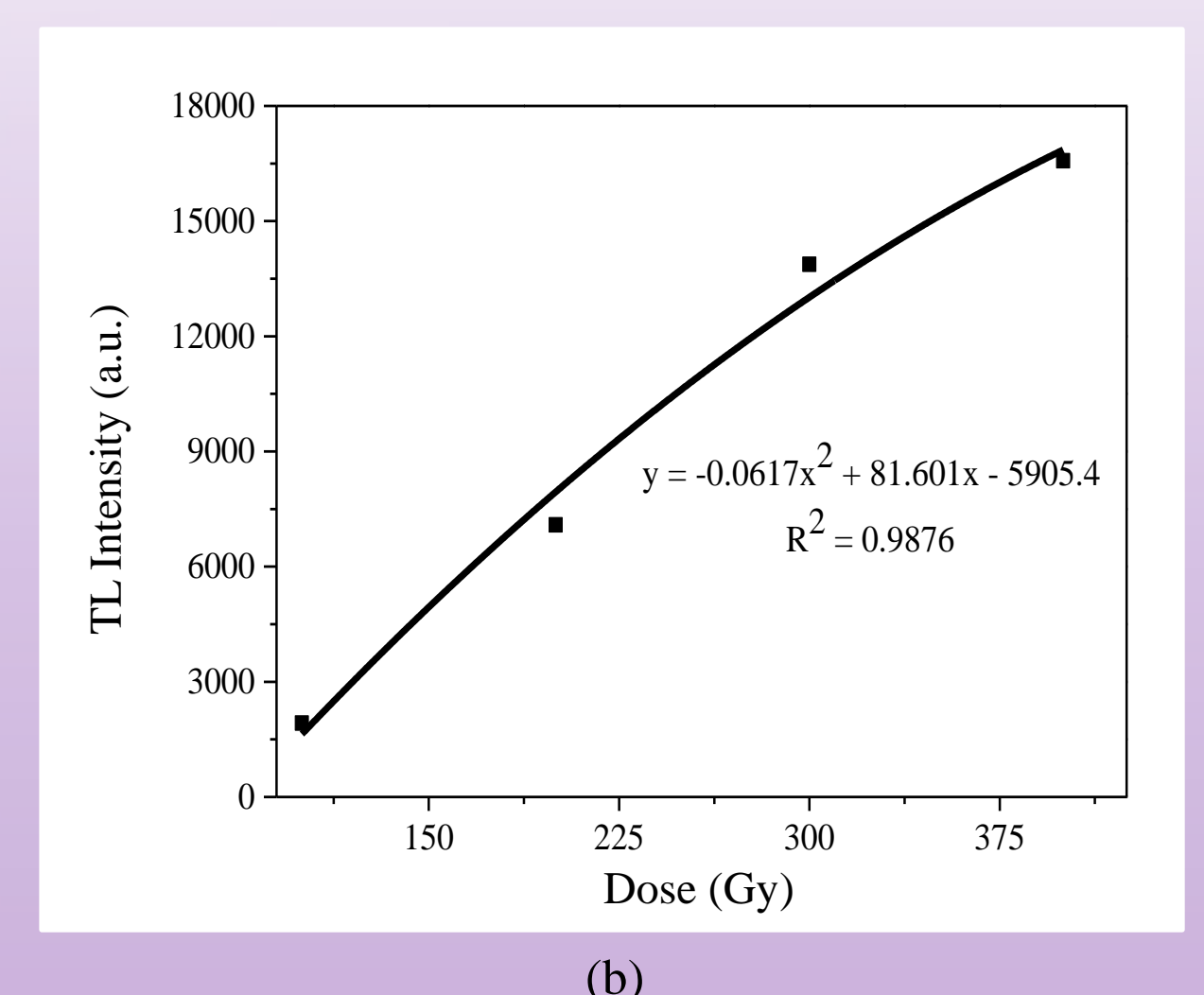
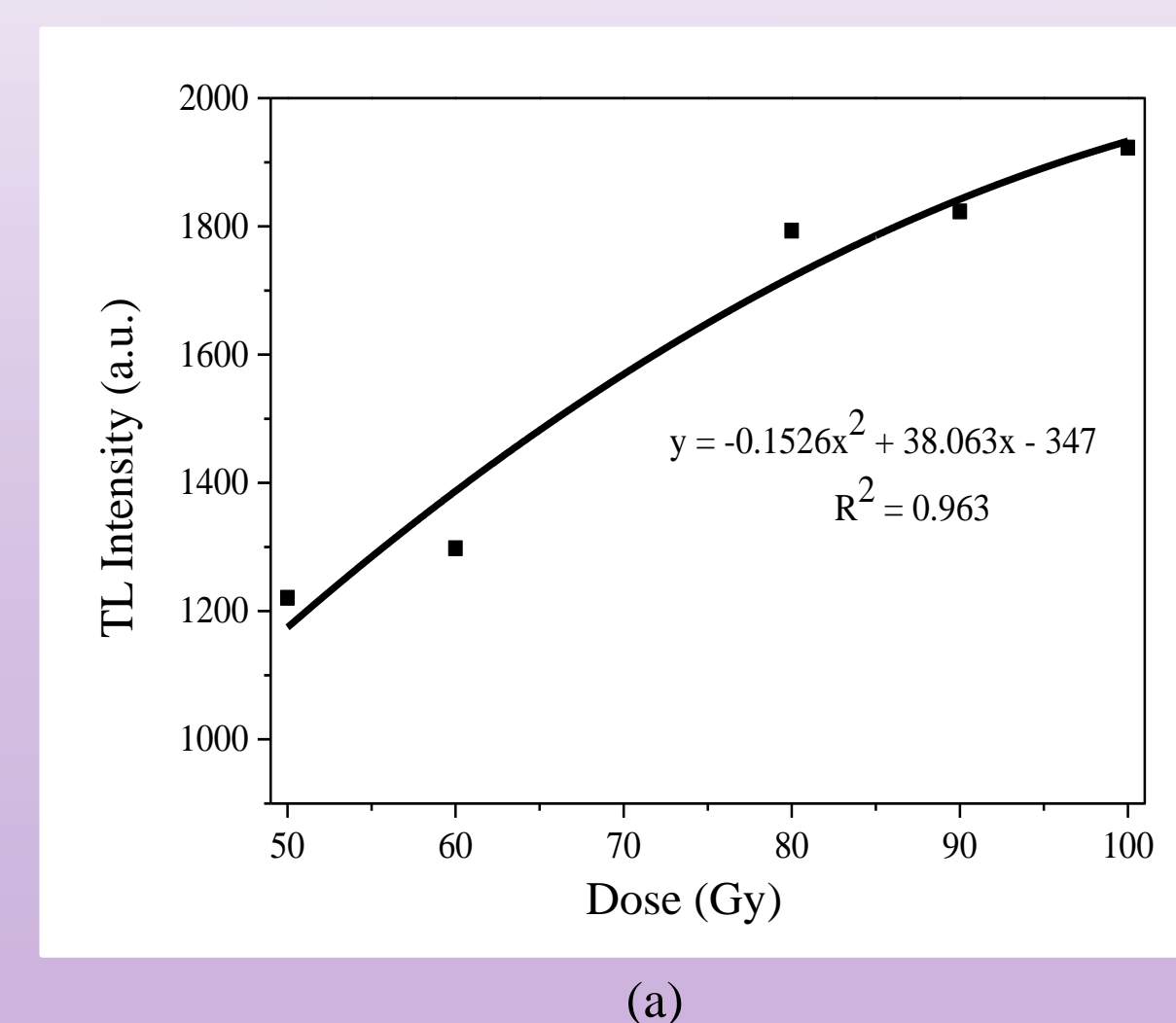


Figure 4. Relationships between TL intensity and radiation dose at (a) 50 - 100 Gy and (b) 100 - 400 Gy

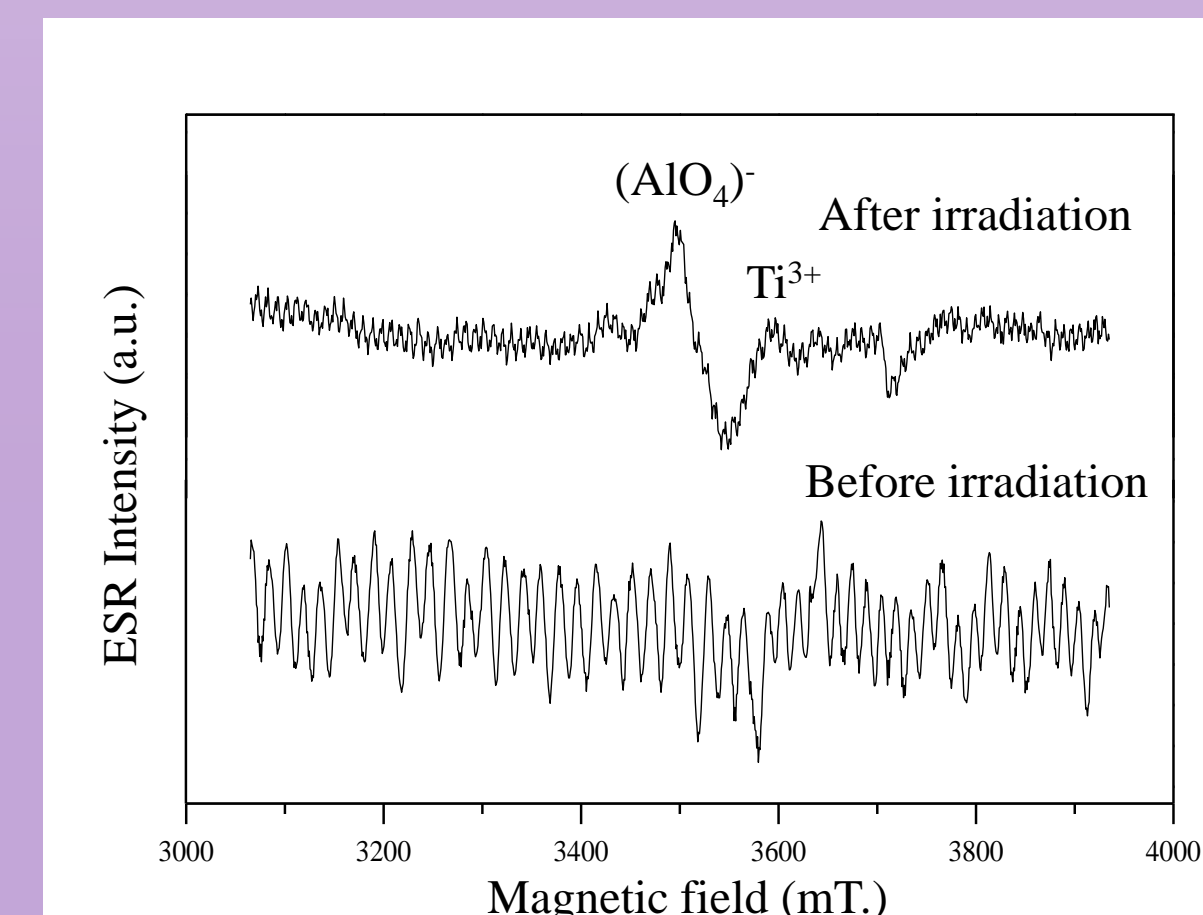


Figure 5. ESR spectra of topaz before and after irradiation.

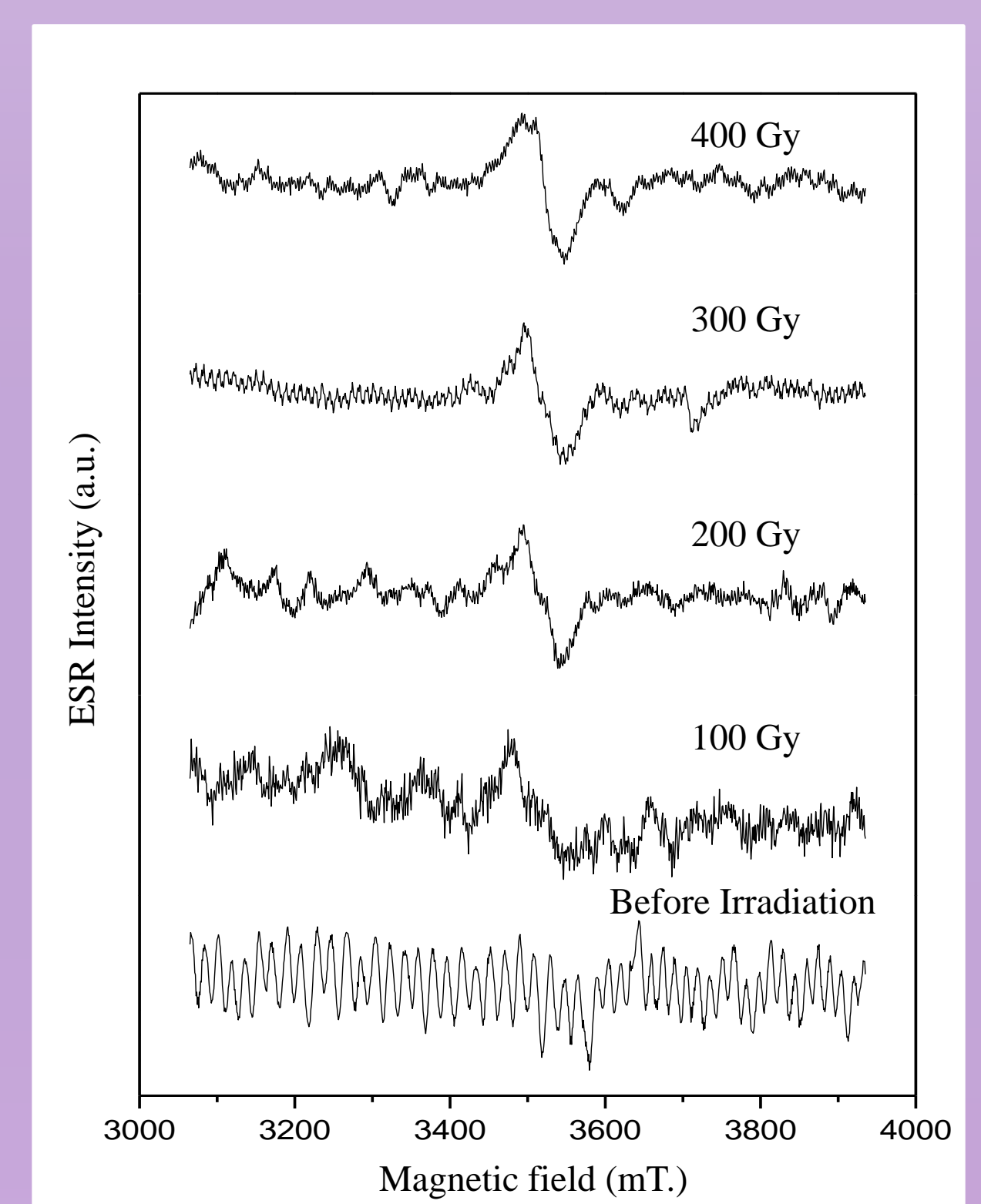


Figure 6. ESR spectra of topaz before and after irradiation at 100 - 400 Gy.

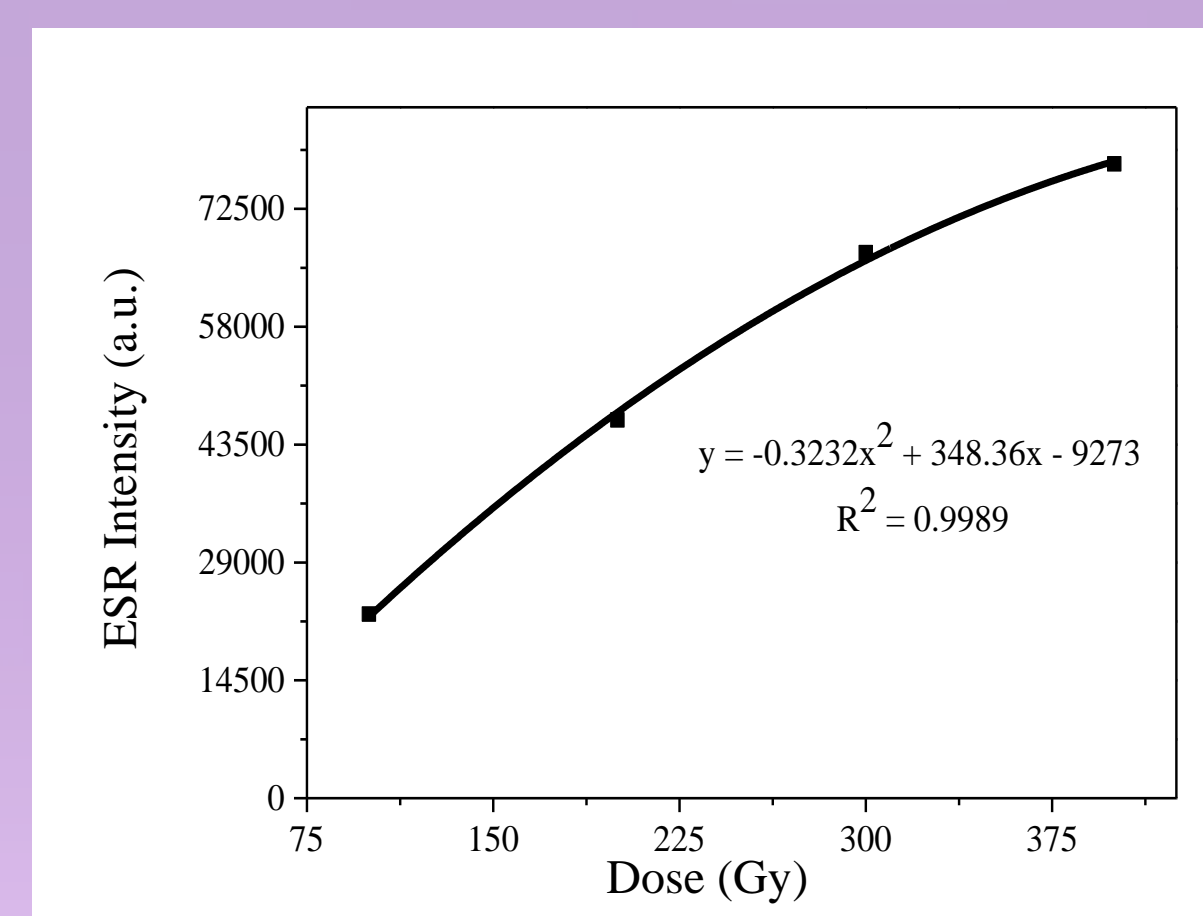


Figure 7. Relationships between ESR intensity and radiation dose of topaz at 100 - 400 Gy.

### Percentage error

Thermoluminescence (TL) spectroscopy = 8%  
Electron spin resonance (ESR) spectroscopy = 3%

## Conclusions

The topazes after irradiation from 50 to 100 Gy were characterized via thermoluminescence and electron spin resonance spectroscopy. The thermoluminescence and electron spin resonance signal of topaz were appeared at 150, 225 °C and  $g = 1.966$ ,  $2.012$ , respectively. The  $g$  factor of ESR indicated that are the  $Ti_3^+$  and  $(AlO_4)^-$ . The signal and dose evaluation from the both spectrometers were depended on dose radiation and could be used as routine dosimeter.

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## References

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