Development of Solid State UV Detector Using Commercial TLD and \( \text{Ln}_2\text{O}_3: \text{RE}^{3+} \) (\text{Ln}=\text{Y}, \text{La}, \text{Gd}; \text{RE}=\text{Tm}, \text{Tb}, \text{Eu}, \text{Er}, \text{Pr})

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To my love mother
and my wife
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Abstract

Dosimetry of terrestrial ultraviolet (UV) using thermoluminescence (TL) material is an attractive method for a number of reasons. Such as the low cost per phosphor, the possibility to produce them in laboratory with simple facilities, the absence of any associated electronics at the site of measurement and the small size of solid phosphors which can also be used in personal dosimetry.

In this research, we are searching for a suitable lanthanide oxide powder and commercial TLD material that can detect solar UV radiation using intrinsic method. The investigated lanthanide oxide powders include Gd₂O₃, La₂O₃ and Y₂O₃ doped with different rare earth elements. They were sintered in air at temperature of ~1200°C. The studied commercial TLD include TLD-100H, TLD-700H, TLD-200, TLD-500 and TLD-900. These materials were exposed to UV lamp and sunlight to check their response to UV radiation. Some of them such as Gd₂O₃:Pr³⁺, Y₂O₃:Pr³⁺ and TLD-400 showed no response to this radiation. TLD-500 and TLD-900 showed high sensitivity to UV radiation. TLD-900 has a linear response to UV lamp and sunlight being similar to UV photometer in its response.

In general, the glow peak at low temperature is not stable in the dark at room temperature. Only the glow peak at high temperature is stable and can be used in UV dosimetry. It has been found that, ordinary light is also play the main role in the TL fading of this material. It can remove ~100% of TL intensity caused by UV radiation.
Abstrak

Pengukuran paras sinaran UV di permukaan bumi menggunakan bahan termoluminesens (TL) merupakan salah satu kaedah yang baik kerana kos pembuatananya yang rendah, dapat dihasilkan dengan menggunakan peralatan makmal yang ringkas. Di samping saiznya yang kecil, dedahan boleh dilakukan tanpa sebarang peralatan elektronik.


Bahan-bahan termoluminesens ini didedahkan kepada lampu UV dan sinar matahari untuk melihat keupayaan mengesankan sinaran UV. Ada antaranya seperti Gd₂O₃:Pr⁺³⁺, Y₂O₃:Pr⁺³⁺ dan TLD-400 tidak menunjukkan sebarang tindakbalas langsung. Sebaliknya, TLD-500 dan TLD-900 juga menunjukkan kepekaan yang tinggi terhadap sinaran UV. TLD-900 menunjukkan tindakbalas linear terhadap sinaran dari lampu UV dan matahari, iaitu sama seperti dengan respon dari meter UV.
Abstrak

Secara amnya, puncak bara pada suhu rendah adalah tidak stabil apabila disimpan pada suhu bilik dalam gelap. Hanya puncak bara pada suhu tinggi adalah stabil dan boleh digunakan dalam dosimetri UV.

Cahaya biasa juga didapati memainkan peranan dalam kelunturan TL kekaburan dalam bahan ini. Ia boleh menyahkan 100% keamatan TL yang disebabkan oleh sinaran UV.
Contents

Acknowledgement II
Abstract III
Abstrak IV

Chapter 1: Introduction

1.1 UV radiation (UVR) 1
1.2 Solar UV radiation 2
1.3 Solar radiation and zenith angle 3
1.4 Level of solar UV radiation 4
   1.4.1 Stratospheric ozone 4
   1.4.2 Time of day 5
   1.4.3 Time of Year 5
   1.4.4 Latitude 5
   1.4.5 Altitude 5
   1.4.6 Weather condition 6
   1.4.7 Reflection 7
1.5 Attenuation of solar UV radiation 7
   1.5.1 Rayleigh scattering 7
   1.5.2 Mie scattering 8
   1.5.3 Cloud reflection and absorption 9
   1.5.4 Aerosols attenuation 9

VI
Chapter 1: Ozone

1.6 Ozone

1.6.1 Ozone depletion

1.6.2 Ozone and chlorofluorocarbon (CFCs) compounds

1.7 Health effects from UV radiation

1.7.1 Eye

1.7.2 Skin

1.8 Dosimetry method for solar UV radiation

1.8.1 UV detector

1.8.1.1 Spectroradiometers

1.8.1.2 Broad band instruments

1.8.1.2.1 Thermal detectors

1.8.1.2.2 Photoelectric detectors

1.8.1.3 Personal dosimeters

1.9 UV radiation safety

1.9.1 UV index

1.9.2 UV radiation exposure limits

1.9.3 Protection against solar UV radiation

1.10 UV radiation units

1.11 Objective of the project

Chapter 2: Thermoluminescence

2.1 Introduction

2.2 Luminescent and trap center
2.3 A general model for thermoluminescence

2.4 The glow curve

2.5 Typical TL response

2.6 Measurement of UV radiation using TL materials
   2.6.1 Transferred method
   2.6.2 Intrinsic method

2.7 Commercial TLD
   2.7.1 CaF$_2$
   2.7.2 CaSO$_4$
   2.7.3 Al$_2$O$_3$:C

2.8 Oxide, Borate and sulfate compound phosphor
   2.8.1 Gd$_2$O$_3$:Eu
   2.8.2 BaSO$_4$:Eu
   2.8.3 MgO

2.9 Doped alkali halides
   2.9.1 NaCl:Ca(T)
   2.9.2 KBr:Eu$^{3+}$
   2.9.3 KCl:Eu$^{3+}$

2.10 Handling technique of TL dosimeter
   2.10.1 Annealing
   2.10.2 Irradiation
   2.10.3 Storage and handling
   2.10.4 Readout
      2.10.4.1 TLD reader
Chapter 3: Experimental set-up and method

3.1 Introduction

3.2 Preparation of the powder
   3.2.1 Fabrication of TLD chips
   3.2.2 The range of percentage error in the reading of the chips

3.3 Calibration
   3.3.1 Calibration of Minolta UV meter
      3.3.1.1 Calibration result
   3.3.2 Calibration of deuterium UV lamp
      3.3.2.1 Irradiance measurement of deuterium UV lamp at 8 cm

3.4 Measurement of UV radiation using TL materials
   3.4.1 Lanthanide oxide (Ln$_2$O$_3$:RE$^{3+}$)
   3.4.2 Commercial TLD

3.5 Exposure
   3.5.1 UV lamp
      3.5.1.1 Safety with UV lamp
   3.5.2 Sunlight

3.6 The electronic circuit noise of TLD reader
   3.6.1 PMT noise
   3.6.2 Background noise
3.6.3 Test light

3.6.4 The noise reading of TLD reader

3.7 Reading of the TLD chips

3.8 Thermal and light fading

3.9 Reproducibility

3.10 Reuse of TLD materials

3.11 Estimation of TL parameters (E & s)

3.12 Measurement of solar UV radiation using UV meter

3.13 Calibration of TL material

Chapter 4: The sensitivity of Ln2O3 to UV radiation

4.1 Introduction

4.2 Sensitivity to UV radiation

4.2.1 Y2O3

4.2.2 La2O3

4.2.3 Gd2O3

4.3 Sensitivity to sunlight

4.3.1 Long period of exposure

4.3.2 Short period of exposure

4.4 Glow curve

4.4.1 Glow curve after direct exposure to UV lamp

4.4.2 Glow curve for Y2O3 after 24 hours of exposure

4.4.3 Glow curve for La2O3 after 24 hours of exposure

4.4.4 Glow curve for Gd2O3 after 24 hours of exposure
4.5 Stability of TL intensity at room temperature
4.6 Effect of light on TL intensity
4.7 conclusion

Chapter 5: The sensitivity of commercial TLD to UV radiation
5.1 Introduction
5.2 Sensitivity to UV radiation
5.3 Sensitivity to sunlight
5.4 Glow curve
   5.4.1 UV Lamp
   5.4.2 Sunlight
5.5 Effect of light on TL intensity
5.6 Stability of TL intensity at room temperature
5.7 Reproducibility chart
5.8 Conclusion

Chapter 6: Observation of solar UVR in Campus of university of Malaya
6.1 Introduction
6.2 Average daily UV irradiance
6.3 Accumulation of UV radiation
6.4 Hourly percentage variations of UV radiation
6.5 Direct and indirect measurement of solar UV radiation
6.6 The effect of the climate changes in the intensity of solar UV radiation
6.7 Conclusion