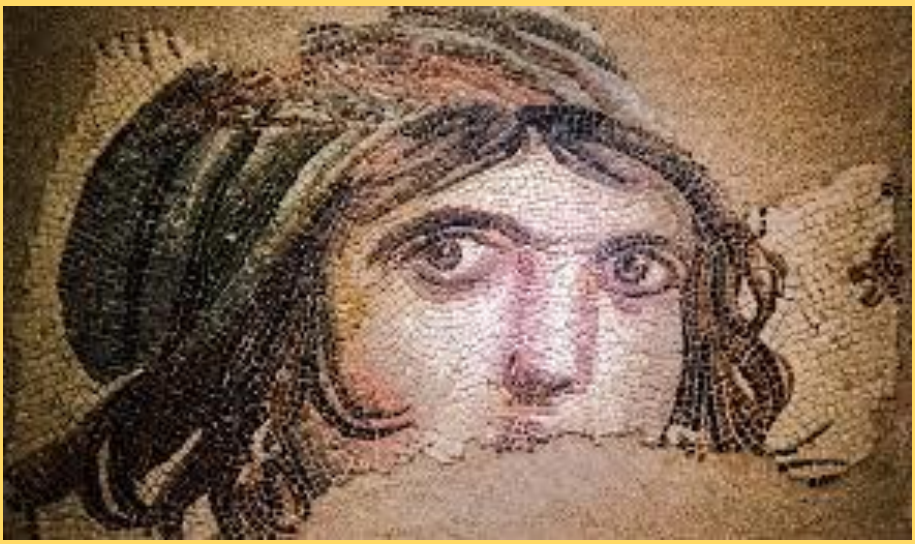

11th INTERNATIONAL LUMINESCENCE AND ESR DOSIMETRY CONGRESS

05-07 SEPTEMBER | GAZİANTEP, TURKEY

EDITORS

A. NECMEDDİN YAZICI

VURAL EMİR KAFADAR

HÜSEYİN TOKTAMIŞ

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LumiDoz-11
BOOK OF ABSTRACTS

EDITORS

A. NECMEDDİN YAZICI
VURAL EMİR KAFADAR
HÜSEYİN TOKTAMIŞ

Dear Colleagues,

Welcome to the International Conference on Luminescence and ESR Dosimetry (LumiDoz-11) held at Gaziantep University, Gaziantep, TURKEY between the dates of 5-7 September, 2018. We are very appreciative that national and international colleagues have accepted our invitation to make a considerable contribution to our conference. We hope it's an exciting time on related issues to meet and bring inspired people together.

Thanks to these types of meetings, Universities and Research Centres all over the world are sharing their experiences in their environment and expressing their expectations as regards their contribution to regional, national and international innovation. We intend in this conference to discuss and compare all applicable methods in Luminescence Mechanisms, Luminescence Materials, Electron Spin Resonance, Applied Radiation Physics, Dosimetry Physics, Detection of Irradiated Foods, Archaeological and Geological Dating and Other Related Issues as Health Physics and Medical Physics.

Besides this conference is important for sharing and exchanging knowledge between these related communities with the goal of creating an enriching dialog across the disciplines. We'd like to express our special thanks to the all Organizing and Scientific Committee members for their supports and also each of you for attending and bringing your expertise to LumiDoz-11.

LumiDoz-11 Organizing Committee

11th International Conference on Luminescence and ESR Dosimetry was supported by the Scientific and Technological Research Council of Turkey (TUBİTAK) with National Scientific Meetings Grant Programme 2223-B.

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INVITED SPEAKERS' ABSTRACTS

Luminescence emission of biogenic materials

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Abstract

The luminescence properties of inorganic materials could be potentially employed for dosimetric purposes in the case of radiation accident or radiological terrorism where conventional monitoring has not been established. This work focuses on the thermo- (TL) and cathodoluminescence (CL) emission of several biogenic materials including winkle shell (made of Ca-rich carbonates -calcite 90% and aragonite 10%-), kidney stones and gallbladder (Ca-rich oxalates –whewellite-) and bones (Ca-rich phosphates –hydroxyapatite-) previously characterized by Environmental Scanning Microscope (ESEM) and X-ray diffraction (XRD). All of them displays complex CL wavebands peaked in the red region (linked to point defects) and the more intense emission appearing at higher energies (mainly associated with structural defects). The TL emission exhibits a complex structure too, where it is not possible to detect groups of components that could be potentially employed for dose assessment. The UV-blue TL emission of the samples displays (i) different threshold to ionizing radiation sensitivity depending on the composition, (ii) linear dose response in the range that changes with the sample, but all of them (iii) exhibit a stability of the induced TL signal after one month of storage.

Keywords: *Thermoluminescence, Cathodoluminescence, Calcite, Aragonite, whewellite, hydroxyapatite.*

Acknowledgement: *This work was partially supported by CAM (PEJ15/BIO/AI-0418).*

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Synthesis of Luminescent Borate Compounds and Multi Functional Mesoporous Silicates for Poor Water Soluble Drug's Delivery

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Abstract

In this presentation, the synthesis methods applied in our research group for the production of two different type of materials will be discussed. Modified high temperature solid state synthesis methods such as as solution and microwave assisted solid state synthesis were used in order to prepare aluminum, copper, manganese and silver oxides doped lithium triborate, LiB_3O_5, and lithiumtetraborate, $Li_2B_4O_7$. Our aim has been to measure their thermoluminescent glow curves and detect their possible usage as radiation measurements in personnel dosimeters. In additon to the same type of synthesis methods, the hydrothermal method was also applied to prepare rare earth metal oxides doped lanthanum and gadolinium orthoborate, $LaBO_3$ and $GdBO_3$ to investigate their photoluminescence properties for possible LED (Light Emitting Diode) applications. Moreover, we are also working on surface functionalized mesoporous silicate compounds for drug delivery systems to enhance the bioavailability of poor water soluble drugs. In their production, generally we are using template assisted hydrothermal self assembly method. Our main aims are tuning the properties of materials by applying appropriate synthesis methods and characterizing them.

Keywords: synthesis, borate, mesoporous silica, rare earth, doped, surface.

Acknowledgement: *This work was supported by BOREN and TUBITAK in scope of 213M182, 114Z719 and 216Z038 projects.*

ESR Dating in Geology and Archeology

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Abstract

Electron Spin Resonance (ESR) spectroscopy, a magnetic resonance technique that detects unpaired electrons in paramagnetic substances, is a very powerful tool that can provide valuable structural and dynamic information about a wide variety of molecular systems. ESR has been systematically applied as a dating method in geology and archaeology since 1975 when a stalactite from the Akiyoshi cave in Japan was dated by Motoji Ikeya. The basic principles of ESR dating are very similar to those for luminescence in that it is based on measurements of the trapped electrons in crystal lattices of rocks, sediments or other materials. In this case, however, the electrons are not released by heat or by light. Rather their abundance is estimated on the basis of their paramagnetic properties. The method has widely and reliably been used for geological&archeological materials, because it provides several important advantages such as; having a large dating range (~0.1 ka - 10 Ma) that covers completely the Quaternary period currently with 5–8% precision, non-destructive analysis property, short measuring time, a low costing (when the instrument is available), being applied to both organic and inorganic materials. ESR dating has been successfully applied to the various geological materials such as speleothems, travertines, mollusc shells, corals, sulfite deposits, quartz etc. and various archeological materials such as tooth enamel, pottery, historic goods etc. In addition to being able to be used as a dating method, the most important advantage of the ESR technique is that the intrinsic and impurity origin radicals in the materials can be directly determined and the information obtained can be related with the paleoenvironmental and paleoclimatic properties. In this presentation the principles of ESR dating will be briefly explained and examples about the various applications in geology and archeology will be shown.

Keywords: *Electron Spin Resonance (ESR), ESR dating, Geology, Archeology*

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ORAL PRESENTATIONS

The studying kinetic parameters of thermoluminescence glow peaks-from $Li_2B_4O_7$:Ag,Gd phosphor

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Abstract

Lithium tetraborate ($Li_2B_4O_7$) has received great interest due to its high stability of optical properties, physical and chemical stability, along with a wide range of forbidden energy gap. Moreover, $Li_2B_4O_7$ is currently considered as a wide potential application field including dosimetry.

The aim of this study is to determine the kinetic parameters of Thermoluminescence (TL) glow-peaks, including the activation energy (E), frequency factor (s), and order of kinetics (b), of silver and gadolinium co-doped lithium tetraborate ($Li_2B_4O_7$:Ag,Gd) phosphor. Four different experimental techniques were applied, including Fractional Glow Technique (FGT), Computerized Glow Curve Deconvolution (CGCD) method, as well as both isothermal TL (ITL) and optically stimulated luminescence (OSL) at various stimulation temperatures. The TL glow curve of the phosphor was determined to be composed of the three peaks having the temperatures of maximum peak intensities located at ~80 (Peak 1), ~200 (Peak 2) and ~360 °C (Peak 3) with the heating rate of 2 °C /s after 10 Gy beta dose. Nevertheless, the second peak is definitely complex. The reusability of the phosphor was studied up to 20 experimental cycles using beta dose values of 0.5, 5 and 10 Gy. FGT could be considered as a multiple initial rise at increasing temperatures. The plot of activation energy on the stimulation energy yields a smooth continuum, with the presence of three, not so prominent plateau regions. Each plateau is expected to correspond to an individual peak within the TL glow curve of the phosphor. On the contrary, the deconvolution analysis indicated the presence of five TL peaks with increasing activation energy values ranging between 0.7 and 1.25 eV. The ITL results indicate that for the main dosimetric peak, the activation energy is less than 0.5 eV, while

the corresponding OSL results of the same peak indicate an activation energy value of 0.85 eV. The results of both FGT and ITL techniques suggest the presence of localized transitions to the material. This conclusion was further supported by the plot of the normalized ITL decay curves at various temperatures; beyond the temperature of 150 °C all normalized ITL curves coincide. This latter discrepancy observed for the results of the aforementioned various techniques will be further discussed in the framework of the existing models.

Keywords: *kinetic parameters, thermoluminescence $Li_2B_4O_7$:Ag,Gd*

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Thermally Stimulated Luminescence Properties of Rare Earth Doped Lithium Yttrium Borate Phospors

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Abstract

Lithium yttrium borate phosphors doped with rare earth ions were synthesized with conventional solid-state reaction method at 560 °C for 5 h, at 660 °C for 5 h 750 °C for 2h. Thermally stimulated luminescence (TSL) glow curves of the synthesized phosphors doped with 1 mol % dysprosium (Dy), terbium (Tb) and neodymium (Nd) ions was carried out using Harshaw 3500 TLD reader. TSL properties of the phospors were investigated after X ray, beta, UV irradiation. The dyporsium doped lithium yttrium borate phosphor shows TSL glow peaks at around 190 and 260 °C after beta irradiation, 185 and 240°C after X -ray irradiation and 105 and 220 °C after 254 nm UV irradiation, respectively. The neodymium doped lithium yttrium borate phosphor exhibits TSL glow peaks at around 130 and 200 °C after beta irradiation, 150 and 230°C after X -ray irradiation and 270 and 360 °C after 254 nm UV irradiation, respectively. On the other hand, the terbium doped lithium yttrium borate phosphor exhibits TSL glow peaks at around 145 and 220°C after beta irradiation, 105 and 270°C after X -ray irradiation and 105 and 250 °C after 254 nm UV irradiation, respectively. It is not yet possible to offer detailed models of the TSL response but further researches are in progress to explain the effect of different rare-earth ions doped in lithium yttrium borate phosphors.

Keywords: *Lithium yttrium borate, Thermoluminescence, Rare earth Elements*

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Electron Spin Resonance (ESR) analysis of irradiation effects on Ventolin drug

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Abstract

Radicals can be formed in the drug substance exposed to radiation for various reasons such as the patient using the drug is exposed to radiation for diagnostic and/or therapeutic purposes or sterilization of drug (or APIs) with radiation. Due to the irradiation the structure of the drug may be impaired, and radiation induced radicals may have adverse effects on human health. In this study the effects of radiation on Ventolin Tablet drug containing Salbutamol, an agent that is used in the prevention of bronchospasm and in the treatment of asthma, were determined using Electron Spin Resonance (ESR) spectroscopy. For this purpose, the ESR spectra of pulverized sample that are natural and irradiated between 10-1100Gy dose range, were recorded at several spectrometer conditions by JEOL JesFa-300 X-band ESR spectrometer. Microwave and temperature dependence of the ESR signals observed in the spectral pattern were investigated and radiation induced radicals belonging to these signals were characterized. ESR dosimetric properties of the drug tablets were investigated for the studied dose range considering the radiation sensitivity and stability of the signals.

Keywords: *Electron Spin Resonance (ESR), Ventolin, Irradiation, Radical*

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The OSL dating of the terrace deposits of the main branch of the Seyhan River (Adana, Turkey)

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Abstract

In this study, we dated the three different terrace deposits of the Seyhan river to reveal the incision of the river by OSL technique. The Seyhan River initiated at the southern part of the Aladağ Mountains and crosses the city of Adana through Mediterranean Sea. The first deposits of the Seyhan river in the city of Adana located at the northern part of the city and at an elevation of 200 to 150m. Through its life span, the Seyhan River changed its bed four times. The river has 3 past terrace deposits and the last one is its current river bed. We collected samples from these 3 past terrace deposits at elevations of 193m (the oldest), 117m (median) and 67m (the youngest) for OSL dating. The quartz grains separated following the conventional techniques within dark room conditions illuminated by soft red light.

The results of OSL dating are concordant with the geological records. The oldest terrace deposits have an age of 98.5±2.9 Ka, whereas the median terrace deposits have 81.9±4.1Ka and the youngest one has 28.3±1.4Ka.

These ages indicate that after the first river bed, the Seyhan River incised the ground at a very high ratio between 100Ka and 80Ka whereas the incision rate slows down after this time and continued through 30Ka and Recent.

Keywords: *Adana, Seyhan River, OSL dating, Terrace deposits.*

Acknowledgement: *This work was supported by Çukurova University (FBA-2017-9055).*

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New Generation Drug Carrier Systems: Releasing and monitoring

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Abstract

Bortezomib is the first Proteosome inhibitör approved by US FDA for treatment of multiple myeloma and mantle cell lymphoma. However, since its solubility in water is low its bioavailability is limited and it is not stable in conventional chemotherapy. Therefore, it is necessary that new and efficient drug delivery systems are developed. Mesoporous materials endowed with photoluminescence property upon functionalization are of potential in the drug storage/release fields [1,2]. The design and preparation of non-toxic, stable systems with luminescence property have key role in realizing this application. This is important regarding its monitoring.

In this study, new mesoporous $MMoO_4$:Eu^{3+}-MCM-41 (M: Ca^{2+}, Sr^{2+}, Ba^{2+}) nanostructures were prepared and Bortezomib was loaded onto them in supercritical carbondioxide (sC-CO_2) medium. The obtained composites were characterized via XRD, FT-IR, SEM, N_2 adsorption/desorption analysis and PL spectra. Drug release was investigated via UV-Vis spectrometry

Keywords: *Luminescence, Bortezomib, sustainable drug release.*

Acknowledgement: *This work was supported by TUBITAK, The Scientific and Technological Research Council of Turkey, (Project Number :116Z402)*

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[2] Sauer J., Marlow F., Spliethoff B., Schuth F., Chem. Mater. 14 (2002) 217.

Image Formation in Magnetic Resonance Imaging and Factors Affecting Image Quality

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Abstract

Scientific and technological developments in Medicine are rapidly advancing and new medical imaging devices are being produced. However, each medical imaging device is differentiated and based on different physical Principles. For this reason, it is important to know how the patient's image is acquired, especially in the MRI device, and the quality of the image for quality Examination. Thus, it is aimed to give information about the factors affecting image formation and image quality in MRI device.

Keywords: Magnetic resonance imaging, Image formation

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Investigation of Testicular Dose by TLD in Radiotherapy for Rectal Cancer

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ABSTRACT

Objective: This study is aimed to examine the doses of testes which are outside of the treatment field with TLD in the radiotherapy for rectal cancer.

Materials and Methods: In the study, human-like phantom was used. The testicular structure was formed by mixture of wax and paraffin (Figure 1) then fixed on phantom. The cross-sectional images were obtained with the GE-Light speed RT computerized tomography device for dose calculations in the Precise treatment planning system. A three-dimensional conformal radiotherapy plan of 28 fractions with 180 cGy doses per day was designed by using 18MV photon energy in the treatment planning system and then the dose of the defined points in the testis was calculated. According to the treatment plan, the phantom was irradiated in the linear accelerator by placing the TLDs in the testicle structure at the defined points and also in the two points 1.5 cm away from iso-center of plan. The TLD100 (LiF: Mg, Ti) solid pellets of 4.5 mm diameter and 0.9 mm thickness was used MTS (MTS-N Poland). Two TLD chips were placed in every selected position. After the exposure of TLDs, the pre-read heating processes was per-formed (100℃ for 1h). The luminescent signals were counted by an automated TLD reader RADOS RE-2000RT (RadRro Int. GmbH Germany). Before exposure, the TLDs were annealed at 400℃ for 1 h and 100℃ for 1 h using a PTW high temperature oven (PTW Freiburg GmbH). TLD measurements were done two times for each examination. TL-count conversion to MU was done for 18 MV photon beam at 10 cm depth in slap phantom with 100 cm source surface distance and 10x10 cm^2 field size. The applied monitor units were 260,130, 60, 30 and 15 MU for obtained doses of 202, 101, 47, 23, and 12 cGy respectively.

Results: The calculated and measured point doses that, reflect treatment dose for isocenter were in good agreement with difference lower than 1% (Table 1). The testis point dose that was placed at the closest and the farthest to the edge of the field were 206 cGy and 82 cGy, respectively for a total treatment of rectum cancer (Table 2).

Conclusion: The calculated dose by treatment planning for organs that placed in treatment field generally was good correlated with dose measurements but, the dose difference was occurred when the organs placed on the out-side of treatment field. The result of our study showed that, TLDs could be confidently used for in-field and out of field dose measurements in radiotherapy.

Keywords: *Rectal Cancer, Conformal Radiotherapy Technique, TLD, Out of Field Dosimetry.*

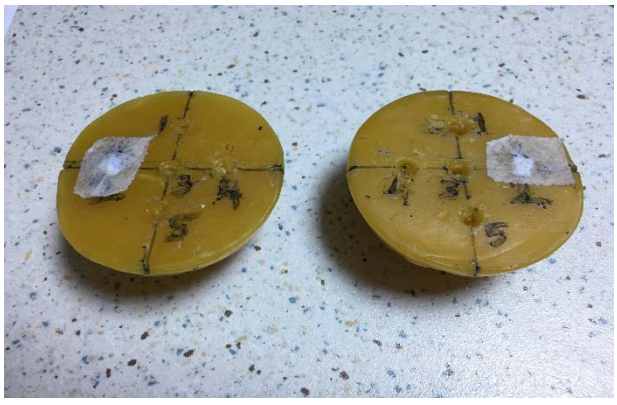
Table 1. The dose results of isocenter for one fraction from treatment planning system and TLDs

Measurement Point	1.5 cm left lateral from isocenter	1.5 cm right lateral from isocenter
TPS Dose (cGy)	183.20	183.00
TLD Dose ± SD (cGy)	183.90±1.30	184.30±3.70
Difference %	0.38	0.71

Table 2. The dose results of testis point for whole treatment from treatment planning system and TLDs

Measurement Point	No. 1	No. 2	No. 3	No. 4	No. 5
The distance from the edge of field	4 cm	6.0 cm	4.2 cm	2.5 cm	3.5 cm
TPS Dose (cGy)	134.40	70.00	126.00	204.00	154.00
TLD Dose ± SD (cGy)	117.12±0.40	82.26±20.00	122.36±4.20	205.60±0.70	139.67±10.50
Difference %	12.86	17.51	2.89	0.78	9.31

Figure 1. Placement of TLDs in the testicular structure



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Determination of the Minimum Detectable Dose of TLD-200

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Abstract

In the present study, three CaF_2:Dy chips, known as TLD-200 dosimeter, were irradiated beta dose of 11 cGy and then its thermoluminescence glow curves were recorded using different four filters in order to determine the most suitable filter pack. The minimum detectable dose of TLD-200 dosimeters was calculated with $D_0=(B^*+2\sigma_B)F$ formula, where B* is the mean TL background signal, σ_B is the standard deviation of the mean background and F is the TL system calibration factor, and the MDD value was found to be as 45.66 ± 0.72 μGy.

Keywords: *Thermoluminescence, TLD-200, Minimum detectable dose, Filter packs.*

Acknowledgement: *This study was carried out at the Çukurova University. The authors are grateful to Research Fund of the Çukurova University for its financial support under the contract number FAY-2015-4735 to purchase lexsyg smart TL/OSL equipment.*

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The validity of analytical stopping power for flux-based dose measurements in carbon ion therapy

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Abstract

The main purpose of radiotherapy is to minimize the radiation damage to the healthy organ tissues in the environment while delivering the dose towards the target. Carbon ion beams have a limited range and a sharp high-dose Bragg peak. At the carbon ion Bragg peak, the ionization is very large and has high biological effects. Therefore, carbon ions among various ion species are preferred in the treatment of cancer in that radiotherapy has optimal properties for biologically effective dose localization to achieve these basic principles. However, in the case of charged particle treatment planning, the correct prediction of particle range in patients has a critical presupposition for conformal dose delivery to the target while risky organs in the environment are being protected. The range of the fragment is determined by the ratio of the stopping power of the body tissues to the water along the path of the beam in each patient. Uncertainties in the estimation of the stopping power can lead to considerable range ambiguity. To fully exploit the advantages of charged particle therapy, these uncertainties must be minimized. In this study, stopping power, range and dose calculations of different target materials were performed for carbon ions with various energies. As the target material, water which is mostly used in tissue formation and used as the most frequently used reference material in radiotherapy studies, and polyethylene which is widely used in phantom material and space applications for armor purposes has been chosen. Effective charge approach was used for stopping power calculations and continuous slowing down approach (CSDA) and Simpson method were used for range calculations. For electronic charge density, atomic natural orbital (ANO) and STO-3G type orbitals from Gaussian type orbitals were used. The dose calculations were carried out that the calculated stopping power data was used in the Geant4 simulation program for flux-based dose measurements based on the Bragg-

Gray theorem. The obtained data were compared with the experimental, theoretical and simulation results available in the literature. According to this, the percentages of compliance with ICRU 73 for the calculated stopping power values in the therapeutic energy range were 7.10% for ANO, 6.61% for STO-3G with water, 8.78% and 10.55% for polyethylene, respectively. The agreement rates of range values with ICRU 73 were 3.15% for ANO for water and 4.93% for STO-3G. It was observed that the depth-dose profiles were consistent with the experimental and simulation results in the literature. These values can be used as input data to investigate the relative biological effects of charged particle treatment planning system and particle radiotherapy in flux-based dose calculations.

Keywords: *Stopping power, range, dose, carbon.*

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Improving TL properties of natural quartz by doping with some of I-IV group elements and high dose application

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Abstract

In the dosimetric application quartz is one of the most famous natural materials have great attention and extensive researches have been done regarding its thermoluminescence (TL) properties. In this study it is targeted to improve TL characteristics of natural amethyst quartz samples doped with some of I-IV group elements (Li, Al, In, Tl, Pb, As, Sb, S, Se, Te) and with Li_2O, MgO and Al_2O_3 compounds and their TL glow curves were recorded. According to preliminary results it is decided to study properties of MgO and Li_2O doped quartz samples in detail: characterization studies (XRD, SEM, FTIR), the glow curve structure, dose response, reusability, sensitivity and fading. In additions the effect of high dose carried out and great improvements on TL properties were observed. TL sensitivity was enhanced to nearly 19 times under high beta dose exposure for MgO doped quartz. There are a great change on morphology of Li_2O doped quartz observed depending on dopant ratio. When the dopant ratio increased quartz samples react with lithium oxide and turns in form of lithium disilicate ($Li_2Si_2O_5$) which shows excellent TL properties. Consequently, this newly synthetized phosphor can be used in many fields concerning with the dose range from 0.1 to 100 Gy.

Keywords: *natural quartz, XRD, SEM, FTIR.*

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Synthesis and Investigation of Luminescence Properties of Barium Tetraborate

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Abstract

In this study, barium tetraborate (BaB_4O_7) phosphors were synthesized by different methods. BaB_4O_7 samples were produced with solution-assisted method, high temperature solid state synthesis method and microwave assisted solid state synthesis method. Crystal structure, morphology, vibrational band modes, thermal behavior and photoluminescence properties of synthesized phosphors were characterized by X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), Attenuated Total Reflectance (ATR), Differential Thermal Analysis (DTA), Thermogravimetric Analysis (TGA) and Fluorescence spectrometers, respectively. The colors of luminescence phosphors were detected with CIE 1931 color space chromaticity coordinates. Highest luminesence intensities were obtained from phosphors synthesized by microwave assisted solid state synthesis method.

Keywords: *Barium tetraborate, Photoluminescence, Characterization Techniques*

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Measurements of Gamma Radiations in Soils of Kapadokya Region (Turkey)

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Abstract

The assessment of the radiation doses to humans from natural sources is of particular importance because they contribute significantly to the collective dose of the world population. The great interest expressed worldwide for the study of naturally occurring radiation and environmental radioactivity has lead to the performance of wide studies in many countries of the World. In the present study the concentration of natural radionuclides ^{226}Ra, ^{232}Th and ^{40}K in soils of Kapadokya, Turkey was determined by gamma ray spectrometry. The average concentration of the ^{226}Ra, ^{232}Th and ^{40}K in soil samples comes out to be 68, 74 and 996 Bq kg^{-1}. Finally, absorbed dose rate in air values were calculated from the naturally occurring radionuclide concentration in soils. The results are compared with values giving in UNSCEAR and literature.

Keywords: *Kapadokya, Dose, Gamma, Radionuclide, Soil.*

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Effect of Boric Acid Concentration of Thermally Stimulated Luminescence Characterization of Lithium Borate Phospors

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Abstract

The aim of this study is to investigate the effects of different boric acid concentrations on thermally stimulated luminescence (TSL) response of thulium doped lithium borate phosphors. Thulium doped lithium borate phosphors were synthesized by conventional solid state synthesis method. The synthesis was carried out at a temperature 1150 °C and three different materials were synthesized using different amounts of boric acid concemtration. X-ray diffraction (XRD) analysis was performed to determine if the synthesized structures were formed. Thermally stimulated luminescence glow curves of the synthesized thulium doped lithium borate phosphors doped with 1 mol % Tm ions was carried out using Harshaw 3500 TLD reader. The TSL of the phospors were investigated after X ray, beta, UV irradiation. Since it is apparent that there are changes in the form of the glow curves and peak temperatures with not only different boric acid concentrations, but also with the type of excitation, a great deal of more investigation is required. Hence, this work is the start point of the investigations of the TSL properties of thulium doped lithium borate phosphors.

Keywords: *Lithium borate, Thulium, Thermoluminescence.*

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Paramagnetic properties and ESR dating of caliche samples from Konya, Turkey

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Abstract

Caliche formations are seen at different locations in Konya, Turkey. Calich is a terrestrial near surface accumulations that is mainly formed from calcium carbonate, which found in different forms from powdery to nodule to hardpan and the term "Dolocrete" is usually used when the main carbonate phase is dolomite. The caliche is very important material because of the information it gives in paleoenvironments and paleoclimates studies. The study locations are: Hatip where the caliche are nodules that scattered in a red zone of sediments, the second and the third locations Dokuzun Beli and Seha Altı respectively the caliche are laminal in light colores. The ages of caliche samples in this study are identified by using the Electron Spin Resonance (ESR) technique. ESR is a spectroscopic technique that both allows a direct view of the paramagnetic defects of crystalline solids and provides the dating of samples using radiation sensitive of stable defects created by the natural radiation. Here for caliche samples g=2.0035, g=2.0045 and g=2.0044 were used as dating signals and by irradiation with ^{60}Co gamma source, all of signals intensity were increased. The equivalent dose (D_E) values of H4FAK, ST1K, ST2K, ST3K and DB1K caliche samples are 116.9±5.5 Gy, 238.9±11.9 Gy, 216.2±26.7 Gy, 214.4±10 Gy and 817.3±315.5 Gy respectively. The quantities of available radioactive substances in and around the samples were determined by ICP-MS analysis to calculate the *D* values, which is the dose absorbed within one year of caliche samples calculated from ESR dose response graphs. As a result, the ages of caliche samples are 292.86, 271.58, 259.99, 217.47 and 389.85 ka, respectively, and according to the geological time scale the caliche ages came in Quaternary period that is in agreement with stratigraphic record.

Keywords: *Electron Spin Resonance, Caliche, Dating, Konya.*

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ANALIYSIS OF KINETIC PARAMETERS WİTH COMPUTER GLOW CURVE DECONVOLUTION (CGCD) BY MAKING NUMERİCAL SOLUTİONS OF IMTS MODEL

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Abstract

In this study, the differential equations governing the interactive multiple trap system (IMTS) was solved numerically with the aid of Mathematica program. The TL glow curves were generated for different kinetic parameters. At each time, one parameter was kept constant and others were changed. The entire numerically obtained glow curves were then analyzed using two Computerized Glow Curve Deconvolution (CGCD) programs (GLOCANIN and Microsoft Excel Spreadsheet). The results of the CGCD programs were compared with the input kinetic parameters entered in the numerical solutions, and the success and failure of the CGCD methods were investigated as a function of input parameters. When the results were compared, it was seen that the success of the CGCD method depends on the electron transfer coefficients (An/Ah), in all analyzes, as the number of peaks in the glow curves increases, it is difficult to obtain accurate results from the analysis. However, the increase in the number of peaks in the IMTS method is negative in the analysis of GLOCANIN, while the analysis made by Excel allows us to obtain more reliable results. This offers great advantages of the analysis made by Excel in terms of both these aspects and providing opportunities for making analysis much easier by saving it from the chaos of difficulty.

Keywords: Thermoluminescence, computer glow curve deconvolution method, trap parameters numerical analysis, IMTS

Keywords: *Luminescence, ESR dosimetry, Physics, Dating, Irradiation.*

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OSL from BeO:Al,Ca ceramics synthesized using sol-gel method

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Abstract

Beryllium Oxide (BeO) ceramic has been widely used for numerous applications in different fields of technology such as nuclear and technological research. Special interest in BeO as a material for personal dosimetry is because of its effective atomic number (Z_{eff} =7.13), which is close to biological tissue (Z_{eff} =7.42). In this study, BeO nanophosphors were synthesized for dosimetric purposes, and doped with aluminum and calcium using sol-gel method. BeO:Al,Ca pellets were prepared from pressed and sintered BeO:Al,Ca nanophosphors at 1600 °C. The structural characterization analysis of BeO:Al,Ca pellets were carried out using *X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FT-IR)* and *Scanning electron microscope (SEM)* methods. The results of these structure analysis showed that BeO:Al,Ca pellets were successfully produced using the sol-gel method. Luminescence properties of the ceramic pellets produced using BeO nano-phosphors were investigated by TL and OSL techniques. The bright OSL signal from BeO:Al,Ca was found as a combination of three decay components using general order kinetic fitting. Decay lifetimes of these components were determined as 5.16, 37.02 and 262.84 s, respectively. Additionally, TL glow curve of BeO:Al,Ca showed three peaks approximately located at 200, 350 and 520 °C. Optically active parts of TL glow curve were determined comparing TL glow curves obtained directly and following blue led stimulation. In order to understand mechanism of luminescence, thermal stability experiment was studied, and the source of the OSL signals was found associated with both the 350 and 520 °C TL peaks. OSL signals indicated very good reusability over 10 cycles and the most deviated value from the first readout was ~ 3 %. The beta dose response was found to be nearly linear in the range 0.1-100 Gy. Furthermore, X-ray

luminescence, dark fading and minimum detectable dose properties of the OSL signal were investigated.

We concluded that BeO:Al,Ca pellets with the bright OSL signals and low fading characteristics are good luminescent dosimetric materials for detection radiation dose between the dose range of 0.1 Gy to 100 Gy.

Keywords: ***OSL, BeO:Al,Ca***.

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Effects Of Doping Ions in Luminsescence and Structural Properties of $CaAl_2O_4$: Eu^{2+}, Nd^{3+} Nanophosphors Synthesized by Combustion Method

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Abstract

In this study, the effects of Eu and Nd lanthanide elements doped in $CaAl_2O_4$ nanophosphor synthesized by combustion method on luminescence properties were investigated. The Eu activator was kept constant, and the co-activator Nd doped ratios were changed. The obtained nanophosphor was characterized by X-ray diffraction technique (XRD). The surface morphology was determined by scanning electron microscopy (SEM). Also photoluminescence spectra (PL), characterization were done. It was observed, that PL emission was obtained at max 440 nm corresponding to blue and IR region of the spectrum, for 320 nm excitation. To increase the relative intensities of CaAl2O4: Eu, Nd nanophosphor, the concentration of Nd used as co-activator was changed by keeping the Eu concentration constant. The highest intensity was found to be 1: 4 mole ratio.

Keywords: *Luminescence, Lanthanide, Combustion Method, Nanophosphor.*

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Response of nanodot optically stimulated luminescence dosimeters to therapeutic photon beams

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Abstract

A portable dosimetry system called the microStar and based on Optically Stimulated Luminescence (OSL) technology has been developed by the Landauer. OSL using aluminium oxide doped with carbon (Al_2O_3:C) has been used extensively in dosimetry for measuring personel dose for many years. It has the advantages of low detection threshold and re-analysis. Recently, nanodots of OSL material and a portable reader microStar have been developed with a view to medical applications.

After delivering the same amount of dose (100 cGy) to Al_2O_3:C-based nanoDots the responses of them were studied for the dosimetry of 6, 10 and 18 MV therapeutic photon beams. 0.15, -0.49 and -0.22% deviations in the response was observed with the change in the energy of x-rays for the field size from 10 cm × 10 cm, respectively. The dose linearity was observed in the response up to 1000 cGy. The fading of the transient signal was observed for 20 min, 1 h, 1 day, 5 days and 7 days. The depletion of OSL signal per readout in 10 successive readouts was also found to change with dose per readout at 1, 5, 10, 50, 150, 500, 800 and 1000 cGy. For the determination of angular dependence, the nanodots were placed on the solid water underneath bolus. Another slab of solid water is placed on top of the bolus to place the nanodots at a depth of d_{max} and irradiated to 100 cGy from the AP, LAT, and PA directions. The AP reading was taken as the standard for comparison. The standard deviations were found as 0.53% and 0.27%, respectively.

Keywords: *Luminescence, ESR dosimetry, Physics, Dating, Irradiation.*

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ESR analysis of plasma modified cellulosic materials by PECVD method

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Abstract

In this study, the surfaces of the materials having cellulosic natural polymer structure were modified by using Plasma Enhanced Chemical Vapor Deposition (PECVD) Method; with argon and nitrogen plasma and a nano-sized thin film was formed by coating in order to impart hydrophobic property to the surface. Electron Spin Resonance (ESR) analyzes of the PECVD modified samples were performed and the type, density and stability of the paramagnetic centers formed in the materials depending on the different modification process parameters were determined. In addition, contact angles were measured after plasma etching and coating, and the relations between contact angles and the ESR parameters of paramagnetic centers formed in the material were interpreted.

By the PECVD method used; plasma polymerisation offers a great advantage in that the substrates can be coated without exposing the cellulose-containing material to high temperature and only changes ocur in the chemical and physical properties of the substrate surface with little deforming the structure of the monomer. Furthermore, in the coating process under vacuum conditions, when a vacuum is formed and maintained, a homogeneous coating is obtained. This method is preferred because better process control can be achieved due to the adjustable process parameters of the PECVD method and also it is very important to obtain films with the desired properties for various applications, optimize process parameters and understand the relationships between the parameters. ESR is the only spectroscopic technique used for direct identification of paramagnetic centers and is very important in nanotechnological studies because it has non-destructive, repeatable and easy measurement advantages.

Keywords: *PECVD, Electron Spin Resonance (ESR), plasma modification, paramagnetic center, cellulosic materials.*

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POSTER PRESENTATIONS

TL and OSL Characteristics of Ca doped BeO ceramics

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Abstract

Beryllium oxide (BeO) has attracted significant attentions since about 1950, because it possesses high heat conductivity (as high as that of aluminium), high chemical and thermal stability, hardness, a wide energy gap of about 10.6 eV, high radiation stability to different forms of photon and corpuscular radiation, high melting point (2570 ^{o}C). Since BeO is a tissue equivalent material (Z_{eff} =7.13), which is close to biological tissue (Z_{eff} =7.42), it has attracted the attention of many researchers in radiation dosimetry applications. In this study, calcium doped BeO phosphors synthesized using sol-gel method. Using BeO:Ca nanopowders, some dosimetric pellets were prepared with evacuable dies. Luminescent signals of BeO:Ca ceramic pellets were studied using OSL and TL techniques. Some dosimetric experiments, such as the beta dose response, minimum detectable dose, reusability and the effect of OSL measurements on TL signals were performed. According to the results, one may say that TL glow curve of the BeO:Ca pellet consists of the four peaks approximately located at 80, 200, 370 and 520 °C. 370 °C TL peak of BeO:Ca pellets might be the source of OSL signals. OSL decay curve is a combination of two decay components with the decay times of 21.22 and 23.55 s. BeO:Ca has nearly linear dose response curve in the range 0.1-100 Gy and a stable OSL signal during reusability of the sample up to 10 repeated experimental cycles.

It can be concluded that BeO:Ca pellets is a promising dosimetric material for radiation dosimetry applications, and further investigations on this material are needed to understand its mechanism of luminescence.

Keywords: *TL, OSL, BeO ceramics*

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Development of Phosphor Composit Materials Using Friction Stir Processing

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Abstract

Studies on the development of physical properties of the material is rapildly growing with changing the chemical composition and a rapidly evolving into two categories namely increased without changing. The purpose of this study was to investigate the availability of a phosphors-containing layer of phosphors powder material on the metallic substrate surface using friction stir processing thecnique. The yttrium stannate ($Y_2Sn_2O_7$) phosphors doped with Tb, Eu and Dy rare earth ions prepared by solid state reaction and this phosphors material was deposited on metallic layer using friction stir processing thecnique. The thermoluminescence (TL) glow curves of yttrium stannate phosphors doped with Tb, Eu and Dy are investigated after X ray irradiation using thermoluminescence dosimeter (TLD) reader with a linear heating rate of 2 Ks^{-1}. The thermoluminescence glow curve of deposited phospors showed glow peaks at 225°C for $Y_2Sn_2O_7$:Tb, 185 and 295 °C for $Y_2Sn_2O_7$: Eu and 150 and 260 °C for $Y_2Sn_2O_7$: Dy after excited X-ray radiation.

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Keywords*:* Friction Stir Processing, Yttrium Stannate, thermoluminescence.

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Thermoluminescence Response of TLD-600 and TLD-700 Dosımeters to Neutron+Gamma and Beta Radiations

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Abstract

In this study some of the thermoluminescent properties such as glow curve structure, relative thermoluminescence sensitivity, dose response linearity of lithium fluoride thermoluminescent dosimeters TLD-600 (^{6}LiF: Ti, Mg) and TLD-700 (^{7}LiF: Ti, Mg) were investigated after irradiation ^{252}Cf neutron+gamma and ^{90}Sr-^{90}Y beta sources at room temperature and then with obtained results were compared. The kinetic parameters of TL glow peaks namely the order of kinetics (*b*), activation energy (E_a) and the frequency factor (*s*) of these dosimeters have also been obtained using the computerized glow curve deconvolution (CGCD) program. In addition, the effect of heating rate on the TL glow curves of dosimeters has been investigated. They were found that the maximum TL glow peak intensities and the total area under the glow curves of both dosimetries are decreasing with increasing heating rate. There is no good agreement with the kinetic parameters calculated by CGCD program for both radiation sources.

Keywords: *TLD-600, TLD-700, kinetic parameters, neutron dosimetry*

Acknowledgement: *This work was supported by Gaziantep University Research Fund.*

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Brakiterapide Kapsülün Etkin Atom Numarasının Doz Dağılımı Üzerindeki Etkisinin İncelenmesi

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Özet

Kanser tedavisinde uygulanan radyoterapi yönteminin özel bir alanı olan brakiterapi, kapsüle edilmiş radyoaktif bir kaynağın doğrudan tümör içerisine ya da tümöre yakın bölgeye yerleştirilmesiyle uygulanır. Bu çalışmasında radyoaktif kaynağı kaplayan kapsül materyali, belirlenmiş bir aralıkta düzgün olarak artan etkin atom numaralarına sahip element karışımlarıyla değiştirilerek hipotetik kaynaklar tasarlanmıştır. Hipotetik element karışımları hazırlanırken doku uyumluluğuna ve elementlerin kimyasal özelliklerine dikkat edilmiştir. İstenilen etkin atom numarasının hesaplanabilmesi için Brute Force yöntemi kullanılarak bir algoritma oluşturulmuştur ve karışımda kullanılacak element oranları elde edilmiştir. Tüm etkin atom numaraları için EGSnrcMP GUI Monte Carlo (MC) simülasyonprogramı kullanılarak ayrı ayrı tesir kesitler ICRU standartlarında hazırlanmıştır. EGSnrc simülasyon koduyla her karışımdaki tüm etkin atom numaraları için iyot spektrumu kullanılarak su fantomunda doz dağılımları hesaplanmıştır. Simülasyon sırasında Amersham Health Model 6711 ^{125}I LDR brakiterapi kaynağı, geometrik modellemesi ve içerdiği radyonüklid değiştirilmeden doğrudan kullanılmıştır. Sonuç olarak hesaplanan dozimetrik parametreler orijinal değerlerle kıyaslanmış ve ileriye dönük çalışmalarda kapsül materyali için geniş bir etkin atom numarası skalası elde edilmiştir.

Anahtar Kelimeler: *Brakiterapi, Etkin Atom Numarası, Monte Carlo Simülasyonu.*

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Effects Of Annealing Temperature On Trap Parameters Of Seashell

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Abstract

The sellfish exoskeleton is mainly composed of calcium carbonate minerals with very minute traces of silicate minerals. In this study, the kinetic parameters of the traps found in the biogenic minerals present in the seashell samples at different temperatures (from 300 ^{o}C to 1100 ^{o}C) by using a computer glow curve deconvulation program were obtained and analysed how the kinetic parameters vary at different annealing temperatures. All samples were irradiated about 35 Gy by the beta source and read out by the TLD reader at 1^{o}C/s after each annealing process.

Keywords: *Thermoluminescence, seashell, kinetic parameters*

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Determination of Kinetic Parameters of Sr-doped magnesium tetraborate (MBO) nano phosphors

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Abstract

In this study we have investigated the thermoluminescence (TL) properties of Sr-doped magnesium tetraborate (MBO) nano phosphors, which were synthesized by using the high temperature solid-state and solution combustion method. The glow curves of the samples were evaluated by using ^{90}Sr-^{90}Y (≈ 0.04 Gy/s) beta source for different dose levels between 0.2 Gy and 288 Gy and the kinetic parameters such as activation energy (E_a), and order of kinetics (b) were calculated by using different methods. The experimental results for Sr-doped MBO nano phosphor indicated that it has main glow peak with highest intensity at approximately 200 °C with good linearity of the dose–response up to 570 Gy.

Keywords: *Thermoluminescence, dosimeter, kinetic parameter, MgB_4O_7:Sr, nanoparticle.*

Acknowledgement: *This work was supported by Gaziantep University Research Fund.*

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Thermoluminescence properties of Sm^{3+} doped ZnB_2O_4 phosphors synthesized by low temperature chemical synthesis method

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Abstract

This study reports on the effect of (0.115-69 Gy) beta radiation dose at room temperature (RT) on the thermoluminescence (TL) properties of $ZnB_2O_4:xSm^{3+}$ phosphors with various Sm^{3+} concentrations (x = 0.01, 0.02, 0.03, 0.04, 0.05 mol) were synthesized by the low temperature chemical synthesis metod. The structural properties of $ZnB_2O_4:xSm^{3+}$ phosphors were characterized by using the X-ray powder diffraction (XRD). The influence of different rate dopant concentration, i.e. Sm^{3+}, beta radiation dose and heating rate (0.5-10 °C/s) on thermoluminescence (TL) intensity of Sm^{3+} doped ZnB_2O_4 phosphors and reproducibility are investigated using a lexsyg smart TL/OSL reader system. The influence of the concentration of 2% Sm^{3+} doped ZnB_2O_4 gives optimum TL response. The relationship between intensity of the glow peaks and increase of beta doses were linear. The peaks of TL glow curves shift towards the higher temperature side with increase in heating rate as the total area under the glow peak remains the same. Kinetic parameters were determined using by computer glow curve deconvolution (CGCD) method and Arrhenius plot obtained from initial rise (IR). So, it is shown that there is a correspondence between kinetic parameters calculated by IR method and peaks deconvoluated by CGCD technique. The maximum variation range between the ten sequential measurements for 20.7 Gy irradiation was less than 3 % for $ZnB_2O_4:0.02Sm^{3+}$.

Keywords: *Thermoluminescence, ZnB_2O_4, Irradiation. XRD*

Acknowledgement: *This work was supported by Cukurova and Uludag University. All authors would like to thank Cukurova and Uludag.*

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Investigation of Thermoluminescence Properties of YGAG:Ce Phosphors Irradiated with Beta Radiation

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Abstract

The present study is involved in the thermoluminescence (TL) properties of cerium doped yttrium gadolinium aluminum garnet phosphors having different gadolinium and yttrium concentrations (YGAG:Ce) prepared by wet-chemical route. Thermoluminescence glow curves of YGAG:Ce with Gd varying from 0 to 100% in terms of mole at a heating rate of $2°Cs^{-1}$ were investigated after beta irradiation. TL has been performed on several YAG:Ce doped with Gd. The most striking feature of these analyses clearly is the number of different luminescence sites which exist. The TL glow curves of undoped and doped samples indicates a high sensitivity to beta irradiation. The introduction of the doping ions induces changes in the trapping processes and the TL efficiency. It was suggested that trap concentrations in the presence of Gd are suppressed while the thermoluminescence signal of the Gd-doped samples is strongly reduced.

Keywords: *YGAG, Cerium, Thermoluminescence*

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Investigation thermoluminescence properties of boron doped indium oxide thin films growth by spray prolysis

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Abstract

In this study, we have succeeded in using chemical spray prolysis technique to grow high transparent and low resisteve boron doped indium oxide films. The films were deposited on glass substrates at 380 0C. The molarity of the boron were setted as 0.02, 0.03, 0.05, 0.07, 0.09 and 0,1 mol. All irradiations will be performed at room temperature with beta rays from a ^{90}Sr-^{90}Y source. The irradiation equipment is an additional part of the 9010 Optical Dating System which is also available in physics department. The glow curves will be obtained by QS 3500 manual type TL reader interfaced to a PC where the TL signals are analyzed. The additive dose (AD), variable heating rate (VHR), initial rise (IR), computer glow curves deconvolution (CGCD) and peak shape (PS) methods have been used for the evolution of TL glow peaks. These methods were used to determine the number of peaks and kinetic parameters.

Keywords: *Luminescence, ESR dosimetry, Physics, Irradiation, Boron doping, spray prolysis, Indium oxide.*

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Natural Radioactivity Study of Soil Samples from Some Villages in Mersin

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Abstract

The aim of this study is to determine the level of natural radioactivity occured by radionuclides, ^{226}Ra, ^{232}Th and ^{40}K, in soil samples collected from some villages in Mersin, Turkey. The mean activity concentrations of ^{226}Ra, ^{232}Th and ^{40}K are measured over all collected soil samples as 19.96 ± 2.34 Bq/kg, 42.8 ± 3.28 Bq/kg and 388.68 ± 5.26 Bq/kg, respectively using gamma ray spectroscopy by HPGe dedector. It was observed that these activity concentrations are mostly in agreement with the world activity averages of 35, 30 and 400 Bq/kg for ^{238}U, ^{232}Th and ^{40}K, respectively, indicated in UNSCEAR 2008 report. Mean ^{232}Th activity was achieved a bit higher than the avarage. However, the average annual effective dose equivalent was calculated as 0.062 mSv/y and found to be lower than the worldwide avarage value of 0.063 mSv/y.

Keywords: *Natural radioactivity, Soil samples, Annual effective dose equivalent.*

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Thermoluminescence dose response of the crystals grown naturally on rocks

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Abstract

The relation between thermoluminescence (TL) intensity and absorbed dose is known as TL dose response and it is one of the essentials for a TL dosimeter. An obviously desirable property of a thermoluminescence dosimeter (TLD) detector is that it exhibits a linear relationship between thermoluminescence intensity and absorbed dose. However, many TL materials exhibit a non-linear growth of TL glow intensity with absorbed dose over certain dose ranges. In the study, thermoluminescence dose responses of the crystals grown naturally on rocks were investigated. Different radiation doses from a beta sources were applied to the sample and obtained a relation between applied dose and area under the TL curve.

Keywords: *Thermoluminescence, dose response, crystals.*

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Calclulation of kinetic parameters of calcite mineral conducted by bacterial calcium carbonate ($CaCO_3$)

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Abstract

The glow-curve computerized deconvolution analysis (GCD) is the most recent and widely used technique for determining the kinetics parameters. It has to be emphasized that it is possible, in principle, to deconvolute a complex, and even a single peak, in a very large number of different configurations and to choose that one or those which give the best figure of merit (FOM). In this study, the kinetic parameters (such as kinetic order, activation energy, peak integral and frequency factor) of calcite mineral conducted by bacterial calcium carbonate ($CaCO_3$) were calculated by a computer glow curve deconvolution method. And it was investigated that how the kinetic parameters are affected by the variation of cycle of measurement.

Keywords: *Thermoluminescence, bacterial calcium carbonate, kinetic parameters*

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Thermoluminescence Response of Rare Earth Elements Doped Barium Aluminate Phosphors

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Abstract

Sm, Tb, Pr and undoped barium aluminate phosphor compounds were successfully synthesized by combustion synthesis at 600 °C as well as with the solid-state reaction at 1500 °C. The doping concentrations of Sm^{3+}, Tb^{3+} and Pr^{3+} were kept constant at 2 mol% of the Ba amount. The structure of $BaAl_2O_4$ compounds was monitored by X-ray diffraction and found a single phase of $BaAl_2O_4$ with a hexagonal structure and space group $P6_3$ were found and no formation of other complex aluminate phases were observed and the doping amount of rare earth ions does not make any disruptive changes to the $BaAl_2O_4$ host structure. The morphological observation of the phosphor samples was monitored by environmental scanning electron microscope (ESEM) coupled to an energy dispersive X-ray spectrometer (EDS). Thermoluminescence (TL) behaviour of synthesized phosphors were studied after the irradiation with $^{90}Sr/^{90}Y$ source with the dose rate of 0.115 Gy s^{-1}. Performing a series of TL measurements for the temperature range from room temperature to 400 °C, the effect of beta radiation dose on TL response, various TL heating rate (HR) properties of undoped and Sm^{3+}, Tb^{3+} and Pr^{3+} doped $BaAl_2O_4$ phosphors were investigated. Peak shape method was also utilized to assess the trap parameters. TL glow curves obtained from undoped, Pr^{3+} and Tb^{3+} doped $BaAl_2O_4$ decrease with increasing HR value (varying from 0.5 to 15 °C s^{-1}) in a way matching with thermal quenching effect. Contrary to expectations, anomalous HR dependence was observed on Sm^{3+} doped $BaAl_2O_4$ sample and a semi-localized transition model has been used in order to explain such behaviour.

Keywords: *Barium aluminate, combustion synthesis, solid state reaction, Thermoluminescence*

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INVESTIGATION OF THERMOLUMINESCENCE PROPERTIES OF METAL DOPED LITHIUM BORATE PHOSPHORS

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Abstract

Superiorities of borate material are effective atomic number nearly equal to human tissue value, high thermoluminescence (TL) emission, wide dose range and low energy dependency, which make it promising for personal dosimetry [1]. In this study, thermoluminescence (TL) properties of metal ions (Cu, Cu and Ag) doped lithium tetraborate (LTB) and metal ions (Al, Al and Cu or Al and Ag) doped lithium triborate (LBO) samples with various doping systems such as single dopant and double-dopant systems were studied. TL results demonstrated that 0.08% Cu and 0.04% Ag doped LTB synthesized with solution-assisted method has the highest dosimetric sensitivity among the LTB samples. According to TL results of LBO samples, 1% Al doped LBO sample gave the best TL properties in terms of peak shape and intensity among the synthesized LBO samples.

Furthermore, TL characters of produced samples were determined by investigating TL properties including glow curve structure, TL sensitivity, and linear range, dark fading. TL results demonstrate that 0.08% Cu and 0.04% Ag doped lithium tetraborate synthesized with solution-assisted method has the highest dosimetric sensitivity. Kinetic parameters (trap depth and order of kinetic) of this sample were calculated using peak shape, variable heating rate and computer glow curve deconvolution methods.

Keywords: Lithium tetraborate, synthesis methods, characterization, thermoluminescence characterization, kinetic parameters.

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SYNTHESIS AND CHARACTERIZATION OF Tb^{3+} DOPED AND Ce^{3+}/Tb^{3+} CODOPED $GdBO_3$ CRYSTALS

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Abstract

In this study $GdBO_3$ crystals was prepared by solid state reaction method and characterized through their structural and photoluminescence properties. Also, the effect of doping concentration on photoluminescence character of $GdBO_3$ was examined. The structural characterization was made by X-Ray Diffraction and Attenuated Total Reflectance Infrared Spectroscopy method. There were no phase change in the crystal structure and this was also proved with Infrared spectrum by looking boron-oxygen bonds. The photoluminescence characteristics were examined by photoluminescence spectrometer. For this purpose, photoluminescence (PL) spectrum was observed at 545 nm and photoluminescence excitation spectrum (PLE) at 331 nm and 357 nm for different concentration of doping.

Keywords: Luminescence, Inorganic Semiconductors, Rare Earth Metals
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Drug Delivery Applications of Silica Coated, Luminescent $GdBO_3$:Ce/Tb Core/Shell Nanophosphors

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Abstract

In this study, luminescent core/shell silica nanoparticles were synthesized and used in celecoxib drug delivery system. Luminescent core is composed of Ce and Tb doped $GdBO_3$ and it was synthesized by Pechini sol-gel method. In order to get the highest luminescence intensity, different proportions of $GdBO_3$: Ce/Tb were synthesized and $GdBO_3$: 5% Ce,5% Tb (mol %) was determined as the best luminescent core. Silica coating was done by modified Stöber method. The obtained silica coated nanoparticles are in 70-110 nm and they have a reduced but still high luminescence intensity. For the characterization of core/shell nanoparticles, X-Ray Diffractometry (XRD), Scanning Electron Microscopy (SEM), Photoluminescence (PL), Thermogravimetric Analysis (TGA), Brunauer–Emmett–Teller (BET) analysis and Fourier-Transform Infrared Spectroscopy (FTIR), techniques were used. For drug loading-release studies, TGA, XRD, FTIR, BET, PL and Ultraviolet–visible spectroscopy (UV-VIS) were used. Rare earth borates were coated with silica to provide luminescence property to the drug carrier which makes drug release viewable.

Keywords: *Luminescence, drug-delivery, core-shell, borate, gadolinium, silica.*

Acknowledgement: *This work was supported by Middle East Technical University. All authors would like to thank METU.*

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Natural Radioactivity Concentration of Macroalgeas, İskenderun

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Abstract

The aim of this study was to evaluate the level of natural radioactivity in macroalgea samples collected by İskenderun, Turkey. The concentrations of natural radioactivity were measured in macroalgae species seasonally in January, April, August and October 2016 at İskenderun coastal station. The collected macroalgae species are Jania rubens, Padina pavonia. It was observed that the mean activity concentration values obtained for jania rubens were lower than that of Padina pavonia.

Keywords: *Natural radioactivity, macroalgea, İskenderun*

Acknowledgement: *This study was supported by Research Fund of the Çukurova University (Project number ID: 4953 and 11046)*

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Design and Implementation of an optical Illumination Profilometer

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Abstract

Illumination patterns of real light sources convey critical information about their optical design. In a wide range of lighting applications, it is required a precisely well-defined illumination pattern which depends upon the geometric and photometric parameters of the optical source. In OSL dosimetry studies the uniformity of stimulating light falling on the sample is of vital importance. Since these types of illuminating sources (LEDs and lasers) tend to have non-uniform emission patterns as a consequence of their complex designs, we are presenting herein a design of an easy-to-use device for measuring illumination patterns of laboratory constructed light sources. The device is based on an automated linear optical scanner realized by using open-source software and hardware.

A stepper motor-driven linear stage is used to scan the illuminated surface using a mounted light detector (Photodiode with a controllable-gain amplifier). The system is controlled by Arduino NANO microcontroller board based on ATMEL ATmega328P chip that can allow scanning with a resolution of 7 micron per step. In addition, we have achieved data acquisition using Python and build a user interface that can provide several options for scanning and then visualize the light intensity per position results obtained with data live streaming.

We have thoroughly inspected and tested our measuring device on many light sources and maintained a precise measurement of their illumination patterns.

Keywords: Optically Stimulated Luminescence (OSL), light sources, illumination, Measurement, Instrumentation.

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Investigation of Dosimetric Properties of Autoclaved Aerated Concrete (AAC) by Electron Spin Resonance (ESR) Technique

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Abstract

Many new construction materials have been developed in recent years in order to increase construction speed, thermal insulation and decrease economic costs. One of these materials is Autoclaved Aerated Concrete (AAC) which is used for both internal and external construction. In the present work, dosimetric potential of Autoclaved Aerated Concrete (AAC) was investigated by Electron Spin Resonance (ESR) technique. For this purpose, powder forms of the samples were irradiated at 9 different doses with gamma irradiation between 0.5-10 kGy dose ranges. ESR signals of un-irradiated AAC samples exhibit a weak sexted signal which is attributed the Mn^{2+} ions. After irradiation, a new signal appeared between third and fourth lines of sexted signals at g=2.0 region. This new signal is sensitive to applied gamma radiation dose. The change of the radiation induced ESR signal in intensity was monitored for a long period in the laboratory conditions. Thermal decay process of the radiation induced radicals were also investigated between 363-503K. Isothermal decay curves were ploted, and used to determine activation energy of the radiation induced radicals.

Keywords: *ESR dosimetry, Autoclaved Aerated Concrete, Gamma Irradiation.*

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Annealing Effect on Deep Traps as PTTL Sources of $CaSO_4$:Mg

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Abstract

This study of synthetic $CaSO_4$:Mg (0.1% M) dosimetric material presents the blue light effect on deep trap population using the high-temperature annealing and high beta dose. $CaSO_4$:Mg irradiated with 100 Gy beta dose was annealed in the oven with different temperatures until to be sure that the deep traps of the sample were still filled to observe phototransfer TL curves. TL readout of the samples after the 100 Gy beta irradiation and blue light illumination was performed. It was shown that the electron transfer to shallow traps from deep traps with blue light stimulation was not observed after oven annealing of the samples at 600 °C. Under blue light effect, the changes in the TL glow curve showing the charge transfer from deep traps to shallow traps were presented. The $CaSO_4$:Mg sample was stimulated with blue light at different times (between 0.5 and 7 min) after exposure to different beta doses (0, 2, 4 and 20 Gy). It was seen that the total area change in the TL glow curve increased with increasing blue light stimulation duration. As a result, it was indicated that the intensity of the PTTL peak in the region 100-240 °C increased when the duration of blue light stimulation increased, and the PTTL peak intensity reached saturation after 5 minutes blue light stimulation.

Keywords: *Thermouminescence, Opticallt Stimulated Luminescence, Photo-transfered Thermoluminescence, Calcium Sulfate*

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TL-OSL Correlation in $CaSO_4$:Mg dosimetric phosphor

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Abstract

In this study, the relationship between thermoluminescence (TL) and optically stimulated luminescence (OSL) traps of $CaSO_4$:Mg was presented. The $CaSO_4$ phosphor obtained by the precipitation method was doped with Magnesium (Mg) ions during the production. The effect of the blue light on the TL glow curve was investigated and it was shown that the blue light affected the all TL peaks of the TL glow curve. The Phototransfer thermoluminescence (PTTL) signal clearly appeared in the region between 100-240 °C when the first two peaks in the TL curve completely erased (with pre-heat at 300 oC) and followed by blue light stimulation performed at different times (50, 100, 200, 300, 400, 600, 800, 1000, 1400, 1800 and 2000 s). The PTTL signal showed a linear increase with increasing beta dose (1, 2, 5, 10, 20, 50, 100 and 150 Gy). Activation energies for all trapping groups were estimated as in the region 0.85-1.95 eV and 0.88-2.20 eV, by Fraction Glow Technique (FGT) and Computerized Glow Curve Deconvolution (CGCD) methods, respectively. As a result, it may be concluded that the PTTL signals originate from trapping groups located at 300 ^oC and higher temperatures.

Keywords: *Thermouminescence, Opticallt Stimulated Luminescence, Photo-transfered Thermoluminescence, Calcium Sulfate*

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OSL characteristics of BeO:Al ceramics

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Abstract

The aim of this study is to investigate the relevant dosimetric and luminescent properties of BeO:Al ceramic pellets synthesized using sol-gel method. In order to investigate the crystal structure and the surface morphology, *X-ray diffraction (XRD)*, *Fourier transform infrared spectroscopy (FT-IR)* and *Scanning electron microscope (SEM)* analysis were performed.

Luminescence properties of the pellet dosimeters were investigated by OSL technique. OSL decay curve of the sample after 0.2 Gy beta dosewas recorded. A linear combination of first order exponential components was assumed and blue light stimulated OSL decay curves were fitted with two first order exponentially decaying components. The X-ray emission spectra of BeO:Al pellets was obtained as a broad peak in the region 200 – 450 nm with a maximum around 250 nm. Some dosimetric experiments, such as the beta dose response, minimum detectable dose (MDD), reusability properties were studied to determine the dosimetric characteristics of the material. The experimental results showed that BeO:Al pellets have nearly linear dose response in the range between 0.1 and 100 Gy and OSL signals were found stable during readouts repeated up to 10 cycles. MDD of BeO:Al ceramic pellets was evaluated as ~4 mGy.

The range of sensitivity of BeO:Al is such that its most probable use will be in clinical therapy dosimetry as well as in health physics.

Keywords: *OSL, BeO:Al*

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Investigation of Thermoluminescence Properties of Natural Calcite Minerals in Karaca Cave

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Abstract

In this study, the thermoluminescence properties of natural calcite minerals in the Karaca Cave which is located in the village of Cebeli of Torul district of Gümüşhane province have been investigated. The aim of this study is to invesitigate the usability of natural calcite minerals as dosimeter. The crystal structure of the dust calcite samples was investigated by X-ray diffraction (XRD) analyzer at Physics Department of Karadeniz Technical University. The XRD pattern of the samples belongs to almost pure calcite mineral. Moreover, it has some traces of goethite, aragonite and dolomite mineral peaks. The thermoluminescence (TL) measurements of the samples were recorded with Harshaw 3500 TLD reader. TL glow curves of the samples were obtained in the temperature range 50 to 450 °C with linear heating rate of 5 °C.s^{-1} in nitrogen atmosphere after irradiation ultraviolet (UV) light of a wavelength with 254 and 302 nm. The dose response and fading properties of the calcite samples were investigated after UV irradiation. In this preliminary work, the usability of natural calcite minerals collected from Karaca Cave as a UV dosimeter was examined.

Keywords: *Natural Calcite, Thermoluminescence (TL), Ultraviolet (UV)*

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Thermoluminescence Characteristics of KCl doped zinc borate (ZnB_2O_4) nano phosphors

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Abstract

In this study we have investigated the thermoluminescence (TL) properties of KCl doped zinc borate (ZnB_2O_4) nano phosphors, which were synthesized by using solution combustion method. The glow curves of the samples were evaluated by using ^{90}Sr-^{90}Y (≈ 0.04 Gy/s) beta source for different dose levels between 0.2 Gy and 288 Gy and the kinetic parameters such as activation energy (E_a), and order of kinetics (b) were calculated by using different methods. The experimental results for KCl doped ZnB_2O_4 nano phosphor has shown that it has a broad glow curve structure, which consists of nine glow peaks. The fading characteristics of the samples were also studied over a period time. The samples were irradiated and stored in a darkroom at room temperature. At the end of the planned storage times the normalized TL area, of KCl doped ZnB_2O_4 reduced typically 50% and reduced 70% of its original value.

Keywords: *Thermoluminescence, dosimeter, kinetic parameter, KCl, ZnB_2O_4, nanoparticle.*

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11th INTERNATIONAL CONFERENCE ON LUMINESCENCE AND ESR DOSIMETRY 2018 | 05-07 SEPTEMBER, GAZIANTEP		
LumiDoz-11 Conference Programme		
05.09.2018 Wednesday		
09.00 to17.00	Registration	
09.00 to 10.20	**Coffee Break**	
10.20 to 11.10	Official Opening	
11.15 to 12.00	**Plenary Session**	**Chairman: Enver Bulur**
Ayşen Yılmaz, METU		***Synthesis of Luminescent Borate Compounds and Multi Functional Mesoporous Silicates for Poor Water Soluble Drug's Delivery***
12.30 to 13. 30	**LUNCH**	
13.45 to 14.30	**Plenary Session**	**Virgilio Correcher, CIEMAT**
Chairman: Mustafa Topaksu		***Luminescence emission of biogenic materials***
14.30 to 15.30	**Oral Session-1**	**Chairman: Zehra Yeğingil**
14.30 to14.50	**Arzu Ege**	
	Thermally Stimulated Luminescence Properties of Rare Earth Doped Lithium Yttrium Borate Phospors	
14.50 to15.10	**Kemal Fırat Oğuz**	
	Determination of the Minimum Detectable Dose of TLD-200	
15.10 to15.30	**İbrahim Aslıyüce**	
	Image Formation in Magnetic Resonance Imaging and Factors Affecting Image Quality	

15.30 to 16.00	**Coffee Break**	
	Poster Session	
16.00 to 17.00	**Oral Session-2**	**Chairman: Arzu Ege**
16.00 to16.20	**Sibel Uysal Satılmış**	
	Effect of Boric Acid Concentration of Thermally Stimulated Luminescence Characterization of Lithium Borate Phospors	
16.20 to16.40	**Yusuf Ziya Halefoğlu**	
	Effects of Doping Ions in Luminsescence and Structural Properties of $CaAl_2O_4$: Eu^{2+}, Nd^{3+} Nanophosphors Synthesized by Combustion Method	
16.40 to 17.00	**Emel Ece**	
	Electron Spin Resonance (ESR) analysis of irradiation effects on Ventolin drug	
17.00 to 17.20	**Serpil Aközcan**	
	Measurements of Gamma Radiations in Soils of Kapadokya Region (Turkey)	
19.00 to 22.00	***CONFERENCE OPENING DINNER GAÜN SEYİRTEPE SOSYAL TESİSLERİ***	

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LumiDoz-11 Conference Programme		
06.09.2018 Thursday		
09.00 to17.00	Registration	
09.30 to 10.15	**Plenary Session**	**Ülkü Sayın, Selçuk University**
Chairman: Turgay Karalı		***ESR Dating in Geology and Archeology***
10.15 to 10.45	**Coffee Break**	
	Poster Session	
10.45 to 12.05	**Oral Session-3**	**Chairman: Sibel Uysal Satılmış**
10.45 to 11.05	**Zehra Yeğingil**	
	Response of nanodot optically stimulated luminescence dosimeters to therapeutic photon beams	
11.05 to 11. 25	**Volkan Altunal**	
	OSL from BeO:Al,Ca ceramics synthesized using sol-gel method	
11.25 to 11.45	**Fatih Karaoğlan**	
	The OSL dating of the terrace deposits of the main branch of the Seyhan River (Adana, Turkey)	
11.45 to 12.05	**Adnan Özdemir**	
	The studying kinetic parameters of thermoluminescence glow peaks-from $Li_2B_4O_7$:Ag,Gd phosphor	
12.05 to 13. 30	**LUNCH**	

13.30 to 14.50	**Oral Session-4**	**Chairman: Belgin Küçükömeroğlu**
13.30 to 13.50	**Sera İflazoğlu**	
	Synthesis and Investigation of Luminescence Properties of Barium Tetraborate	
13.50 to14.10	**Ünal Yıldırır**	
	Analysis of kinetic parameters with Computer Glow Curve Deconvolutıon (CGCD) by making numerical solutions of IMTS model	
14.10 to14.30	***Fatih Mehmet Emen***	
	New Generation Drug Carrier Systems: Releasing and Monitoring	
14.30 to 14.50	***Necmettin Nur***	
	Improving TL properties of natural quartz by doping with some of I-IV group elements and high dose application	
14.50 to 15.10	**Coffee Break**	
	Poster Session	
15.10 to 16.30	**Oral Session-5**	**Chairman: Serpil Aközcan**
15.10 to 15.30	**İsmail Karakuş**	
	Investigation of Testicular Dose by TLD in Radiotherapy for Rectal Cancer	
15.30 to 15.50	***Metin Usta***	
	Karbon iyon terapide akı tabanlı doz ölçümleri için analitik durdurma gücünün geçerliliği	
15.50 to 16.10	**Zeynep Melek Oktay**	
	ESR analysis of plasma modified cellulosic materials by PECVD method	
16.10 to 16. 30	**Swan Alfatlawi**	
	Paramagnetic properties and ESR dating of caliche samples from Konya, Turkey	

16:30 to 17.30	***CLOSING CEREMONY***
20.00 to 23.00	***CONFERENCE GALA DINNER*** ***KIRKAYAK ANTEP EVİ***

11th INTERNATIONAL CONFERENCE ON LUMINESCENCE AND ESR DOSIMETRY 2018 | 05-07 SEPTEMBER, GAZIANTEP	
LumiDoz-11 Conference Programme	
07.09.2018 Friday	***SOCIAL EVENT: GAZİANTEP CITY TOUR*** ***SOCIAL EVENT: RUMKALE TOUR***
09.00 to17.00	

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LumiDoz-11 Poster Presantations	
LM.ESR.P.01	TL and OSL Characteristics of Ca doped BeO ceramics ***Adnan Özdemir***
LM.ESR.P.02	Development of Phosphor Composit Materials Using Friction Stir Processing ***Belgin Küçükömeroğlu***
LM.ESR.P.03	Thermoluminescence Response of TLD-600 and TLD-700 Dosimeters to Neutron+Gamma and Beta Radiations ***Büşra Yazıcı***
LM.ESR.P.04	Brakiterapide Kapsülün Etkin Atom Numarasının Doz Dağılımı Üzerindeki Etkisinin İncelenmesi ***Dilara Tarım***
LM.ESR.P.05	Effects of annealing temperature on trap parameters of seashell ***Dilek Toktamış***
LM.ESR.P.06	Determination of Kinetic Parameters of Sr-doped magnesium tetraborate (MBO) nano phosphors ***Dündar Evis***
LM.ESR.P.07	Thermoluminescence properties of Sm^{3+} doped ZnB_2O_4 phosphors synthesized by low temperature chemical synthesis method ***Kenan Bulcar***
LM.ESR.P.08	Investigation of Thermoluminescence Properties of YGAG:Ce Phosphors Irradiated with Beta Radiation ***Md. Nasir Uddin***
LM.ESR.P.09	Thermoluminescence Properties of Boron doped Indium Oxide Thin Films Growth by Spray Pyrolysis Method ***Mehmet Temiz***
LM.ESR.P.10	Natural Radioactivity Study of Soil Samples from Some Villages in Mersin ***Mehmet Yüksel***
LM.ESR.P.11	Thermoluminescence dose response of the crystals grown naturally on rocks ***Muhammed Kahlavi***
LM.ESR.P.12	Calculation of Kinetic Parameters of Calcite Mineral Conducted by Bacteria Caicium Carbonate ($CaCO_3$) ***Muhammed Khatib***
LM.ESR.P.13	Thermoluminescence Response of Rare Earth Elements Doped Barium Aluminate Phosphors ***Mustafa Topaksu***
LM.ESR.P.14	Investigation of Thermoluminescence Properties of Metal Doped Lithium Borate Phosphors ***M. Gencay Çelik***
LM.ESR.P.15	Synthesis and Characterization of Tb^{3+} doped and Ce^{3+}/Tb^{3+} co doped $GdBO_3$ crystals ***Oğuzcan Taneroğlu***

LM.ESR.P.16	Drug Delivery Applications of Silica Coated, Luminescent $GdBO_3$:Ce/Tb Core/Shell Nanophosphors ***Pelin akman***
LM.ESR.P.17	Natural Radioactivity Concentration of Macroalgeas, İskenderun ***Tamer Doğan***
LM.ESR.P.18	Design and Implementation of an optical Illumination Profilometer ***Tarek Elsebaei***
LM.ESR.P.19	Investigation of Dosimetric Properties of Autoclaved Aerated Concrete (AAC) by Electron Spin Resonance (ESR) Technique ***Ufuk Paksu***
LM.ESR.P.20	TL-OSL Correlation in $CaSO_4$:Mg Dosimetric Phosphor ***Veysi Güçkan***
LM.ESR.P.21	Annealing Effect on Deep Traps as PTTL Sources of $CaSO_4$:Mg ***Veysi Güçkan***
LM.ESR.P.22	*OSL characteristics of BeO:Al ceramics* ***Volkan Altunal***
LM.ESR.P.23	Investigation of Thermoluminescence Properties of Natural Calcite Minerals in Karaca Cave ***Volkan Daştan***
LM.ESR.P.24	Thermoluminescence Characteristics of KCl doped zinc borate (ZnB_2O_4) nano phosphors ***Vural Emir Kafadar***

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