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الصفحة	فهرس البحوث	ت
12 – 1	Impact of Vitamin D3 Deficiency on Liver and Adipose Tissue in Pregnant Mice Amenah Salman Mohammed	1
23 – 13	Diagnostic potential of salivary MMP-9 to differentiate between periodontal health and disease in smokers and non-smokers Tamarah Adil Mohammed Hussein Omar Husham Ali	2
35 – 24	Salivary IL-10 and TNF-α levels in Dental Caries Detection in Pediatric β-Thalassemia Major Patients Ban Hazem Hassan Zainab Abduljabbar Athab	3
46 - 36	Compare Robust Wilk's statistics Based on MM-estimator for the Multivariate Multiple Linear Regression Thamer Warda Hussein Abdullah A. Ameen	4
58 – 47	Curvature Inheritance Symmetry of C_9 –manifolds Mohammed Y. Abass Humam T. S. Al-Attwani	5
67 - 59	The issues of cultural expressions untranslatability from Iraqi Arabic into English language Ahmed Mohamed Fahid	6
80 - 68	Hematological and biochemical parameters changes associated with Coronavirus Disease (COVID-19) for some patients in Missan Province Anas, S. Abuali	7
89 - 81	Evaluation of the diagnostic efficacy of salivary malondialdehyde among smokers and nonsmokers with periodontal disease: A case-control study Haneen Fahim Abdulqader Maha Sh. Mahmood	8
104 - 90	Mapping the Slopes' Geomorphological Classification Using Geomatics Techniques: A Case Study of Zawita, Iraq Mohammed Abbas Jaber Al-humairi Elaf Amer Majeed Alyasiri	9
112 - 105	Enhancement methods of intrusion detection systems using artificial intelligence methods (TLBO)Algorithm. Mohammed Saeed Hashim Al-Hammash Haitham Maarouf	10
124 - 113	In Silico Interaction of Select Cardiovascular Drugs with the Developmental Signal Pathway Pax3 Sarah T. Al-Saray	11
135 - 125	Influence of gingivitis in preterm delivery on serum biomarkers COX-2 and PGE-2 Shaden Husham Maddah Ghada Ibrahim Taha	12
143 - 136	Detection and Identification of Chlamydia causing Ear infection by PCR. Rabab Saleh Al.sajedy Ghaida'a . J. AL.Ghizzawi	13
152 - 144	Metric areas and results of best periodic points Maytham zaki oudah Al Behadili	14
157 - 153	Structural and Optical Properties of Co doped CdS Nanoparticles Synthesised by Chemical Method Uday Ali Sabeeh Al-Jarah Hadeel Salih Mahdi	15
166 - 158	The occurrence of <i>Lactobacillus</i> and <i>Candida albicans</i> in patients with thyroid disorders Riam Hassoun Harbi Maha Adel Mahmood	16

173 - 167	An overview of the loquat's (Eriobotrya japonica) active components Shahad Basheer Bahedh Dina Yousif Mohammed	17
183 - 174	Study the mineralogy of Al-Faw soil in southern Iraq and determine swelling properties by indirect methods Haneen.N. Abdalamer Huda.A.Daham	18
192 - 184	The Role of pknF and fbpA as a virulence genes with Interleukin4-and 6, in the Pathogenesis of Tuberculosis Samih Riyadh Faisal	19
203 - 193	لغة الانفعال في النص الشعري التسعيني أحمد عبد الكريم ياسين العزاوي	20
218 - 204	الحماية الدستورية لحقوق الأطفال عديمي الجنسية في التعليم في التشريعات العراقية (دراسة مقارنة) الباحث كامل خالد فهد هند علي محمد	21
230 - 219	التنبؤ بالطلب على الخزين باستعمال الشبكات العصبية الاصطناعية مع تطبيق عملي أيمن خليل اسماعيل لمياء محمد علي حميد	22
240 - 231	بعض التقديرات المعلمية واللامعلمية لأنموذج الانحدار الدائري بالحاكاة رنا صادق نزر عمر عبد المحسن علي	23
258 - 241	القتل في القران والسنة (دراسة في الاسباب والاثار والوقاية) جاسب غازي رشك	24
271 - 259	الطريقة الصوفية البكتاشية دراسة تحليلية جبار ناصر يوسف	25
286 - 272	السياسات التعليمية في الفكر الإسلامي مدخل لتعزيز البناء الاجتماعي حامد هادي بدن	26
306 - 287	دراسة سنديّة لحديث: (أهل بيتي أمان لأمتي...) وفق المنهج الحديثي عند أهل السنّة حكمت جراح صبر	27
321 - 307	القياس والافصاح المحاسبي عن الانتاج المرئي وفق معايير المحاسبة الدولية رائد حازم جودة خوله حسين حمدان	28
332 - 322	اسس تطبيق فن الايكيبانا في دروس الإشغال الفنية بقسم التربية الفنية سهاد جواد فرج الساكني	29
353 - 333	تنبؤ العلاقات العامة بالآزمات عبر تطبيقات الذكاء الاصطناعي ليث صبار جابر	30
374 - 354	روايات أهل البيت (ع) في مدح وذم أهل الكوفة دراسة تحليلية محمد جبار جاسم	31
385 - 375	تجليات الصراع الوجودي في لامية اوس بن حجر مشتاق طالب منعم	32
392 - 386	ازدواجية الهوية الدينية وفهم الذات في رواية (عازف الغيوم) لعلي بدر أنموذجا نور خليل علي	33
402 - 393	مشروع الحلف الاسلامي السعودي وموقف الكيان الصهيوني (دراسة تحليلية في الوثائق الامريكية) سعد مهدي جعفر	34



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Structural and Optical Properties of Co doped CdS Nanoparticles Synthesised by Chemical Method

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Abstract:

Constructed using the sol gel technique, the CdS nanoparticles contain cobalt. Scientists used X-ray diffraction (XRD) analysis to determine the properties of the particles they collected. The structural characterization results demonstrate the synthesis of impurity-free, Co-doped CdS nanoparticles in a single phase. We have shown and discussed the UV-VIS spectrophotometer-recorded optical absorption spectra of the doped sample in the 350–800 nm wavelength range. According to the Tauc relationship, the energy band gap is 2.46 eV. Potentially useful uses for co-doped CdS include photocatalysis, sensors, and solar cells.

Introduction:

Nanoparticles of cadmium diselenide (CdS) exhibit a comparatively high nonlinear optical response and photocatalytic activity, making them an attractive candidate for use in nanoelectronics and other photocatalytic applications. Size, form, and dimension are key factors in determining their physical attributes because of the strong relationship between their qualities and structures. Semiconductors' optical and electrical characteristics may be fine-tuned by doping, which is crucial for semiconductors' possible uses in biotechnology, solar cells, and wavelength-controlled lasers. Magnetic ion doping of semiconductor nanoparticles may result in a novel material class called diluted magnetic semiconductors (DMSs) (Dietl, 2010). Bulk semiconductors containing Mn and Co ions have shown magnetic coupling in II-VI materials (Seong et al., 2001). There is a lot of interest in DMSs right now because of the many possible uses for them in domains like spin-based electronics, or "spintronics," as well as in the fields of magnetics, electronics, and biological labelling. Semiconducting alloys (Alsaad, 2014), semiconducting films (Santra et al., 2005), and nonmagnetic semiconductors (Ohno et al., 2000) are all examples of semiconductor devices that can benefit from spintronics, which aims to regulate electron spins for information transmission. Researchers are interested in learning more about the processes used to create nanocrystals doped with magnetic ions because of the materials' potential uses and the fact that they may exhibit new magneto-optical phenomena. The synthesizability and widespread use of CdS, an II-VI semiconductor material, make it a useful tool for both the display and teaching of new technologies (Ibid.). Additionally, by including a third element, CdS may transform into a doped semiconductor due to its high band gap of 2.42 eV. Doping CdS NCs with magnetic ions, such Mn, has been a major area of research (Ohno, 1998).

Keywords: Nanomaterials, CdS, X- Ray diffraction, Optical properties.

Experimental method:

We used the sol-gel method to synthesis CdS nanoparticles that were doped. There was no additional purification required for any of the compounds as they were all analytical grade and purchased from Sigma-Aldrich. The necessary quantity of cobalt nitrate [Co (NO₃)₂.6H₂O] and an aqueous solution of cadmium nitrate [Cd (NO₃)₂.4H₂O] were mixed using a magnetic stirrer for 2 hours at 80 °C. The solution (cadmium nitrate + cobalt nitrate) was heated for 6 hours before adding a water-based sodium sulphide (Na₂S) solution drop-wise. We got a green precipitate after adding sodium sulphide solution. Centrifugation was applied for 20 minutes at 5000 rpm after the solution had been rinsed with distilled water and ethanol to eliminate any contaminants. To achieve the final co-doped CdS nanoparticles, the product was removed and placed on a ceramic petri dish. Then, it was dried in a vacuum oven set at 100°C for 9 hours. We used a mortar and pestle to grind the dry material into a fine powder, which allowed for more accurate characterization.

Result and discussion

XRD Analysis:

The XRD analysis revealed the crystal structure of the sol-gel synthesized Co-doped Cds. Figure 1 shows the operation of a device with Cu Kα radiations (λ = 1.54 Å) operating at 30 kV and 15 mA current within the 2θ range of 15.0 to 65.0. We indexed the XRD patterns using Powder X software. The sample's XRD pattern, as seen by Bragg reflections at diffraction angles 2θ of (25.8 0), (43.20) and (51.2 0), corresponds to the (111), (220), and (311) peaks, respectively, and has a single cubic structure (JCPDS Card No.80-6019).

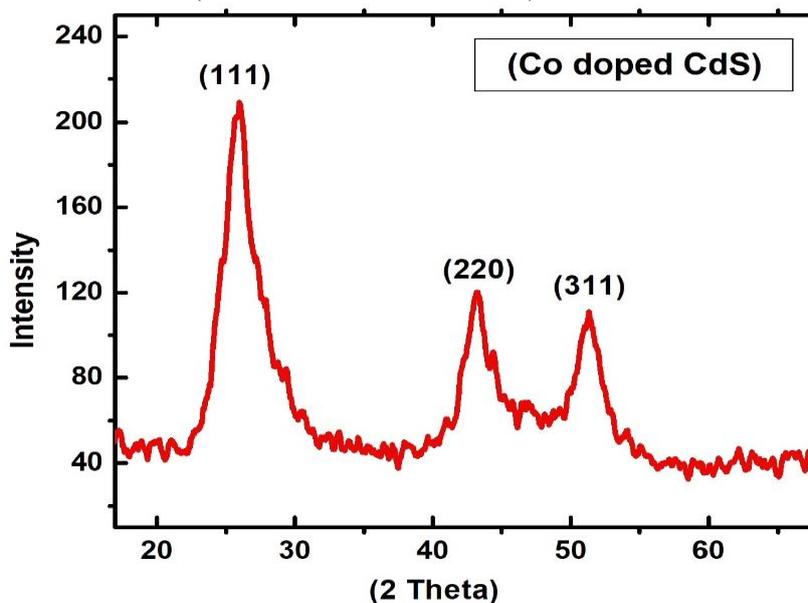


FIG.1. RXD OF Co doped CdS nanoparticles

The crystallite size calculated by using the Debye-Scherrer equation (Mahdi et al., 2018; and Mahdi et al., 2019), and found to be 25 nm by

$$D = k\lambda / \beta \cos \theta \tag{1}$$

"Where, D is the average crystallite size, k is constant = 0.9, λ is the wavelength of X-ray radiation (Cu Kα=1.5406 Å), β is the full width at half-maximum (FWHM), θ is the Bragg angle 2θ".

UV-Visible:

Figure (2) displays the absorption spectra of CdS nanoparticles doped with Co, measured between 300 and 800 nm. The blue shift, as seen in the absorption peaks, is due to the quantum confinement effect and is different from the bulk material.

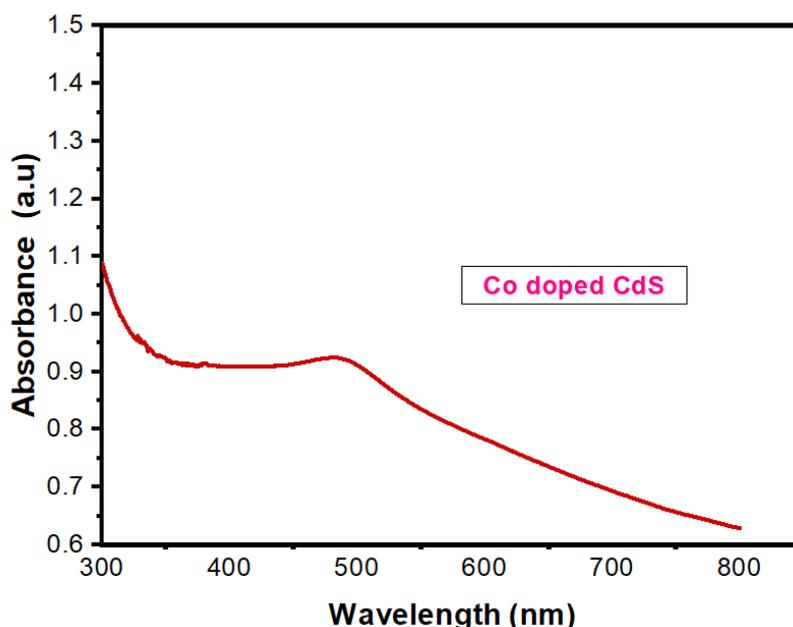


FIG. 2. Absorbance spectra as a function of wavelength for Co doped CdS

The optical band gap was determining by the Tauc relation (Mahdi et al, 2017):

$$\alpha h\nu = A(h\nu - E_g)^n \quad (2)$$

The equation (2), as shown in Figure 3, can take on various values (2, 3, etc.), and the result is 2.46 eV, “where α is the absorption coefficient, E_g is the optical energy gap, $h\nu$ is the photon energy, A is a constant, and n is the index”.

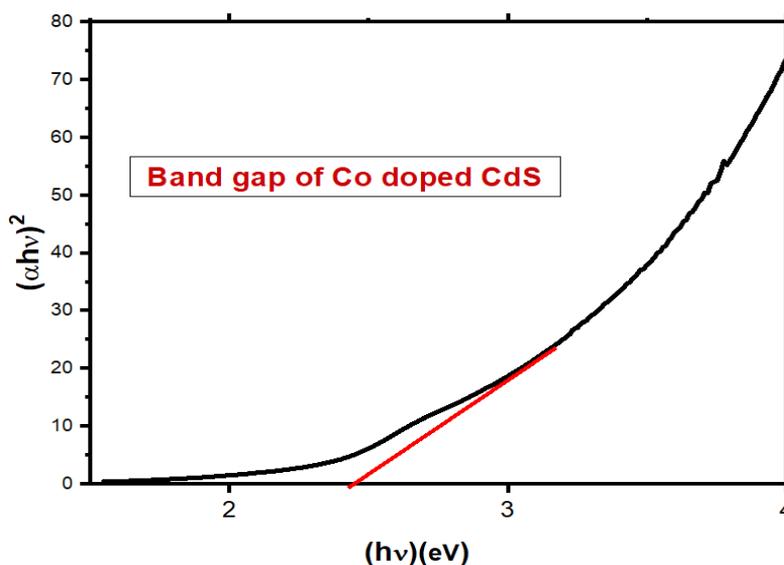


FIG.3. Band Gap of Co doped CdS

FTIR Spectroscopy:

We utilized a Perkin-Elmer Model of FTIR spectrophotometer from Iraq, which operates in the 4000 - 400 cm^{-1} range, to analyse the samples as shown in fig (4). We combined a 5 mg sample with 100 mg of KBr and compressed it into a pellet using a hydraulic press. All FT-IR spectra analysis required the KBr pellet procedures.

We may analyse the vibrational and functional groups in the CdS system by looking at the room temperature FTIR spectra of Co doped CdS NPs. Because the -OH group demonstrates the stretching vibration of the absorbed water on the CdS surface, a significant absorption peak at 3419 cm^{-1} is seen. The water molecule's OH bending vibration causes the absorption band at 1623 cm^{-1} . At 1105 cm^{-1} , the absorbed CO_2 's C-O stretching vibration generates a strong peak. (Giribabu

et al, 2013) The O-C=O asymmetric stretching vibrations are responsible for the absorption peak at 1391 cm^{-1} . Doped CdS particles have a stretching vibration peak at 630 cm^{-1} (Lazell et al, 1999).

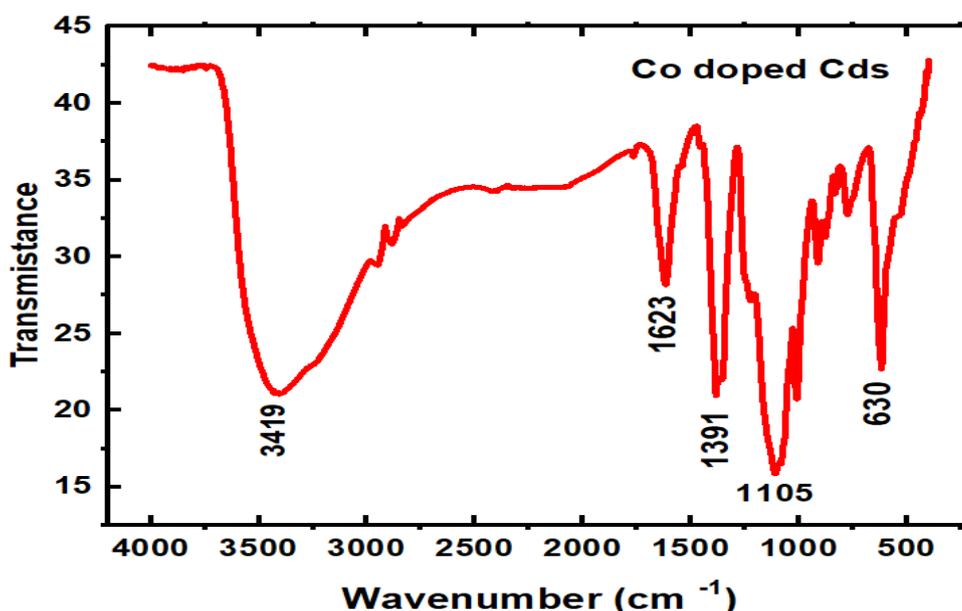


FIG 4. FTIR spectra of Co doped CdS

Conclusions:

We have successfully synthesized CdS nanoparticles that were doped by sol gel method. The confirmation of nanoparticle structure of Co doped CdS was completed through XRD data which shows the presence of all the main peaks. The optical band gap measures as 2.46 eV for Co doped CdS. The coordination of oxygen ions surrounding the CdS was confirmed by FTIR analysis.

References:

- Alsaad, A. (2014). Structural, Electronic and Magnetic Properties of Fe, Co, Mn-doped GaN and ZnO Diluted Magnetic Semiconductors. *Physica B: Condensed Matter*, (440), 1–9. <https://doi.org/10.1016/j.physb.2014.01.029>
- Dietl, T. (2010). A Ten-Year Perspective on Dilute Magnetic Semiconductors and Oxides. *Nature Materials*, 12(9), 965–974. DOI: [10.1038/nmat2898](https://doi.org/10.1038/nmat2898)
- Giribabu, G., Murali, G., Amaranath, G. R., Liu, Ch., Vijayalakshmi, R. P. (2013). Structural, Optical and Magnetic Properties of Co Doped CdS Nanoparticles. *Journal of Alloys and Compounds*, (581), 363-368. <https://doi.org/10.1016/j.jallcom.2013.07.082>.
- Lazell, M., & O'Brien, P., (1999). Synthesis of CdS Nanocrystals Using Cadmium Dichloride and Trioctylphosphine Sulfide. *Journal of Materials Chemistry*. 7, 1381-1382. DOI: [10.1039/A901901D](https://doi.org/10.1039/A901901D)
- Mahdi, H. S., Parveen, A., Agrawal, Sh., & Azam, A. (2017). Microstructural and Optical Properties of Sol Gel Synthesized CdS Nano Particles Using CTAB as a Surfactant. *AIP conference Proceedings*, 1(1832). DOI: [10.1063/1.4980245](https://doi.org/10.1063/1.4980245).
- Mahdi, H. S., Parveen, A., & Azam, A. (2018). Structural and Photoluminescence Properties of Ni Doped CdS Nanoparticles Synthesis by Sol Gel Method. *AIP conference Proceedings*, 1(1953). DOI: [10.1063/1.5032366](https://doi.org/10.1063/1.5032366)
- Mahdi, H. S., Parveen, A., Ali, M. M., & Azam, A. (2019). Microstructural and Optical Properties of Indium Oxide Nanoparticles. *Materials Today: Proceedings*, 3(18), 704-709. <https://doi.org/10.1016/j.matpr.2019.06.472>.
- Ohno, H. (1998). Making Nonmagnetic Semiconductors Ferromagnetic. *Science*, 281(5779), 951–956. DOI: [10.1126/science.281.5379.951](https://doi.org/10.1126/science.281.5379.951).

- Ohno, H., Chiba D., Matsukura, F. Omiya, T., Abe, E., Dietl, T., Ohno, Y. & Ohtani, K. (2000). Electric-Field Control of Ferromagnetism. *Nature*, 6815(408), 944–946. <https://doi.org/10.1038/35050040>.
- Santra, S., Yang, H., Holloway, P. H., Stanley, J. T., & Mericle, R. A., (2005). Synthesis of Water-Dispersible Fluorescent, Radio-Opaque, and Paramagnetic CdS:Mn/ZnS Quantum Dots: a Multifunctional Probe for Bioimaging. *Journal of the American Chemical Society*, 6(127), 656–1657. <https://doi.org/10.1021/ja0464140>.
- Seong, M. J., Alawadhi, H., Miotkowski, I., Ramdas, A. K., & Miotkowska, S. (2001). Raman Electron Paramagnetic Resonance in $Zn_{1-x}Co_xTe$ and $Cd_{1-x}Co_xTe$. *Physical Review B*, 12(63), Article ID 125208, 7 pages. DOI:[10.1103/PhysRevB.63.125208](https://doi.org/10.1103/PhysRevB.63.125208).