出國報告（出國類別：其他國際會議）

出席2013年國際奈米科學計算與新能源材料研討會/2013年國際光電檢測與影像研討會

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出國期間：102 年 6 月 19 日~102 年 6 月 28 日
報告日期：102 年 9 月 16 日

摘要（200-300 字）

本次參與國際會議差旅費用於兩個大型國際會議，(I) 2013 年國際奈米科學計算與新能源材料研討會, 哈爾濱、(II) 2013 年國際光電檢測與影像研討會,北京。其中2013 年國際奈米科學計算與新能源材料研討會除了發表論文之外，亦參加會議組委會會議。另外，配合北京光電展，除了參加並發表論文於國際光學工程學會、美國光學學會、歐洲光學學會等與中國宇航學會合辦之2013 年國際光電檢測與影像研討會之外，並參觀北京光電展以瞭解目前光電市場之趨勢。

關鍵字：奈米計算、材料科技、光電材料

目次

一、 目的

(包括原定計畫目標、主題、緣起、預期效益或欲達成事項)

本次參與兩個國際會議，其目的將於這兩重要會議中發表目前相關研究之外，並與數個國外教授學者與專家進行交流。且藉由此機會交流，除了參與會議組織之運作之外，並可藉由此次會議多與國外學者專家進行研究相關討論與合作機會探討，並利用此次機會增加學校之能見度。

二、 過程

(執行經過，包括出國期間行程、參訪單位及訪問過程，會議議程、議場主題、與會參與各項研討或聽取報告議題之內容重點摘述、見聞或新知；如發表研究或報告，個人所發表內容摘要、現場報告或討論交流情形等。)

本次參與國際會議差旅費用於兩個大型國際會議，(I) 2013 年國際奈米科學計算與新能源材料研討會, 哈爾濱、(II) 2013 年國際光電檢測與影像研討會,北京。一年一度國際奈米科學計算與新能源材料研討會(CNNEM2013)今年在哈爾濱舉行且為大陸哈爾濱師範大學主辦(6 月18 日～6 月23 日)，此次研討會共有數百篇論文參與盛會，其主題皆為奈米科技相關技術，內容相當豐富；與會人士相當多，來自各個國家的奈米科技學者與業界先進，彼此分享自己的研究成果，及經驗的交換，相當有意義。此次會議很榮幸本人於會議中發表論文，且與中山大學機電系師生、南區高速電腦中心、明新科大機械系與本校機械系老師一同前往發表論文，而所發表的題目為『Investigations into the mechanical properties of a graphene with a pentagonal-heptagonal defect』被大會安排口頭發表。其報告內容為石墨稀缺陷機械性質相關模擬與性質之研究。由於大會語言為英文，在報告的過程中和與會學者及業界先進彼此交換心得與經驗，也吸取了其他學者重要的寶貴研究結果。此外，由於是該會議籌備委員之一，故也參與組織會議討論相關議程。

另一方面，順道利用時間也前往北京參加每兩年一次之2013 年國際光電檢測與影像研討會，2013 國際光電檢測與影像研討會在北京舉行且為國際光學工程學會、美國光學學會、歐洲光學學會等與中國宇航學會合辦(6 月25 日～6月27 日)，此次研討會名稱為(ISPDI 2013)，其中此次會議包含了有11 種大主題，其主題包含光電相關科技，內容相當豐富，共有口頭與海報發表的論文近一千篇；與會人士相當多，來自各個國家的

光電技術學者與業界先進，彼此分享自己的研究成果，及經驗的交換，相當有意義。大會亦有安排光電相關產品的廠商做產品展覽，展覽的產品有相關光電元組件、檢測儀器及相關之研發產品等，因此，從這展覽中帶回了上述相關型錄及名片，及尋問各種曾遇到的問題，對於將來再採購相關產品或維修時，可以有更多的了解及選擇性。

此次會議與中山大學機電系師生、南區高速電腦中心、明新科大機械系與本校機械系老師一同前往發表論文，而本人所發表的題目爲『Synthesis and Characterization of ZnTe Thin Films on Silicon by Thermal-Furnace Evaporation』被大會安排爲Poster Session 之海報發表，於6 月25 日到6 月27 日下午的時段，其報告內容爲利用熱蒸鍍法製作碲化鋅薄膜之研究，且透過不同製程參數以瞭解其半導性質。由於大會語言爲英文，在報告的過程中和與會學者及業界先進彼此交換心得與經驗，也吸取了其他學者重要的寶貴研究結果。

三、 心得

參與國際性的研討會，使本人可多方吸收新的觀念，藉由會議與來自各國的學者討論，更可增廣見聞，所以除了在國內做研究外，更應該多多參與國際性的會議，吸收新知，汲取他人優點，促使自己在研究上有更上一層的突破。

1. 此次會議雖然規模不是很大，但大會會場的悉心的安排及接待人員和藹的接待，可以看出大陸各重點大學對向上提升學術研究水準與參與(舉辦)國際學術會議的企圖心。
2. 國際光電元件大廠與相關學者，對於光電元組件的技術提昇，可從此次會議中看出其重要性。
3. 國際奈米科技大廠與相關學者，對於技術提昇，可從此次會議中看出其重要性。
4. 此研討會學術層次較高，藉由參與此研討會有助於學校能見度的提升，尤其對知名度欠缺的本校而言，更是十分重要。

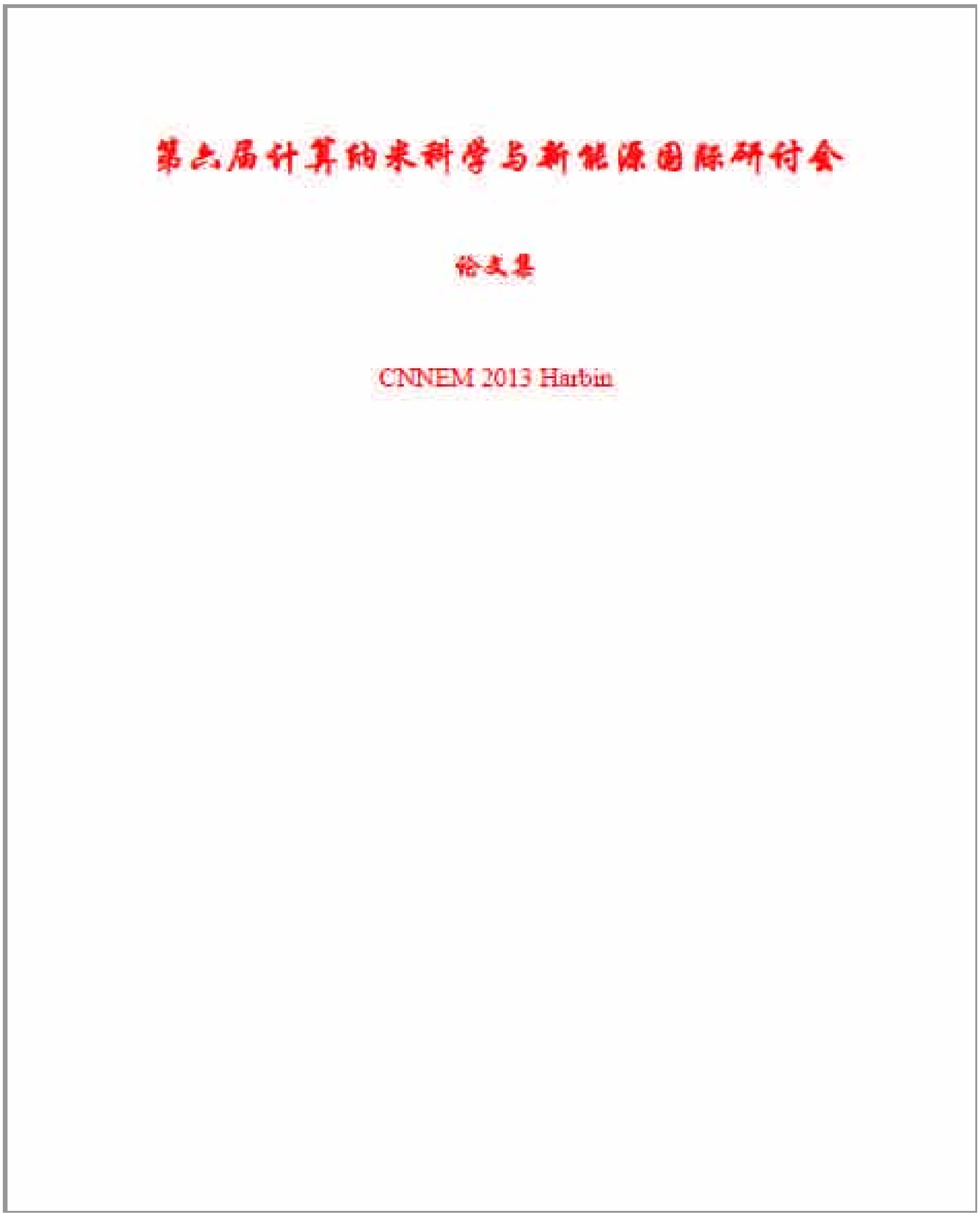
四、 建議事項

此次國際會議之行，要在這邊感謝學校提供補助，使這趟行程能夠順利成行；但補助金額與實際支出相去甚遠，似乎無法實際鼓勵教師出席國際研討會。

若能適當提高補助參與一些有歷史性的國際研討會，藉此和與會層次相仿的學校或研究機構尋求合作機會，將有助於提昇教師或學校之研究能量。

五、 攜回資料名稱

1. **<u>2013年國際奈米科學計算與新能源材料研討會</u>(CNNEM 2013)**


第六届计算纳米科学与新能源国际研讨会

论文集

CNNEM 2013 Harbin

Investigations into the mechanical properties of a graphene with a pentagonal-heptagonal defect

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Abstract: Fracture mechanisms, mechanical behaviors, and the Young's modulus of a zigzag-graphene with a pentagonal-heptagonal defect are performed by classical molecular dynamics simulation method with Tersoff potential. The zigzag-graphene with a pentagonal-heptagonal defect is loaded by two-sided vertical tension, and then tensile fracture undergoes defects initiation, bonds breaking and defects growth, crack propagation, and fracture catastrophically. However, the buckling behavior of a zigzag-graphene with a pentagonal-heptagonal defect is also found while it is loaded by two-sided vertical compression, and then the bump located at the pentagonal-heptagonal defect turns catastrophically into the dent while a sheet of a zigzag-graphene is bent into one-sided. In this paper, the Young's modulus of a zigzag-graphene with a pentagonal-heptagonal defect is related to the system temperature, but not to length-to-width ratio. The Young's modulus of a

2. 2013年國際光電檢測與影像研討會(ISPDI2013)

Contents

1

results match well with the results via michelson interferometery. This method does not require beam splitting elements, so the changes of polarization induced by beam splitter (BS) are avoided. This method is suitable for the evaluation of modulation characterization of both transmissive and reflective spatial light modulators. Secondly, a phase pattern of thin lens written on the LCOS is demonstrated. Because of the pixel structure of LCOS, the discretization of lenses which fulfills the Nyquist sampling law is considered. The experimental results show that the plane wave becomes a light point at its focal length, while the plane wave becomes a big spot at other distances. In the experiment, the actual focal length is in good agreement to the theoretical deduction, and an acceptable relative error (RE) of the experimental results is achieved below 1%. The maximum and minimum of the focal length of the lens based on LCOS are also measured, which means users can modify the focal length of simulated lenses among the range via LCOS. Both simulation and experimental results show that LCOS can converge the plane wave, and replace the optical lens successfully.

Keywords: LCOS, phase modulation characterization, lens

Biography: Sijin MA(1989-) ,female, Beijing, China. She is studying for M. S. degree in College of Applied Science, Beijing University of Technology. Her technical research is mainly about optical information processing.

10-027

Synthesis and characterization of ZnTe thin Films on Silicon by Thermal-Furnace Evaporation

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Abstract: Zinc telluride (ZnTe) compound is one of the attractive elements of the II–VI group also having wide range of applications such as switching devices, light-emitting diode, solar cells and photodetectors. In this paper, the microstructure and electrical properties of znic telluride thin films were studied by using thermal-furnace evaporation with emphasis on the effects of argon pressure and deposition temperature. Crystallinity, mobility, carrier concentration and sheet resistance are shown to be dependent on the argon pressure and deposition temperature. The grain size was increased with increasing the annealing temperature and decreasing the argon pressure. The highest carrier concentration of 1.9×10^{16} cm^{-3}, the lowest sheet resistance of 3180 Ω/□ and the largest mobility of 5.1×10^{3} $cm^{2}V^{-1}S^{-1}$ are presented at an argon pressure of 100 sccm and a deposition temperature of 580°C, respectively.

Keywords: ZnTe films,thermal-furnace evaporation,electrical properties,microstructure.

Biography: Ph.D. HSU Cheng-hsing (1974-), male, Taipei, Taiwan, He received his B.S. degree in electronic engineering from Fu Jen Catholic University, Taipei, Taiwan, in 1997 and the M.S. and Ph.D. degrees in electrical engineering from National Cheng Kung University, Tainan, Taiwan, in 1999 and 2003, respectively. His research interests include dielectric ceramics, thin film technology, planar antenna design, microwave passive components, nonvolatile memory devices and optoelectronic materials.

10-028

Research of data retention in EEPROM cells

Cheng WEI,Canglu HU,Gangcheng JIAO,Zhuang MIAO,Ni ZHANG

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2.North Night-Vision Science &Technology Group Corp. , Ltd. Xi'an 710065, China

Abstract: This paper investigates date retention ability of EEPROM cells for a given voltage or temperature by theory and experiment. The expression of EEPROM date retention is derived. In the temperature acceleration experiment, the logarithm of device inactivation time have linear ratio with temperature according to Arrhenius formula and the device life retention was acquired in the various temperature. According to Arrhenius equation, lifetime curve is deduced. In the electric acceleration experiment, because of the charge leaking on the floating-gate, the threshold voltage would decrease gradually. In the log-log plot, the decrease efficiency of threshold voltage have linear ratio with time. Under the assumption that the charge loss mechanism is Fowler-Nordheim tunneling through the thin oxide, date retention time of EEPROM cells is derived and the experience formula is derived by experiment.

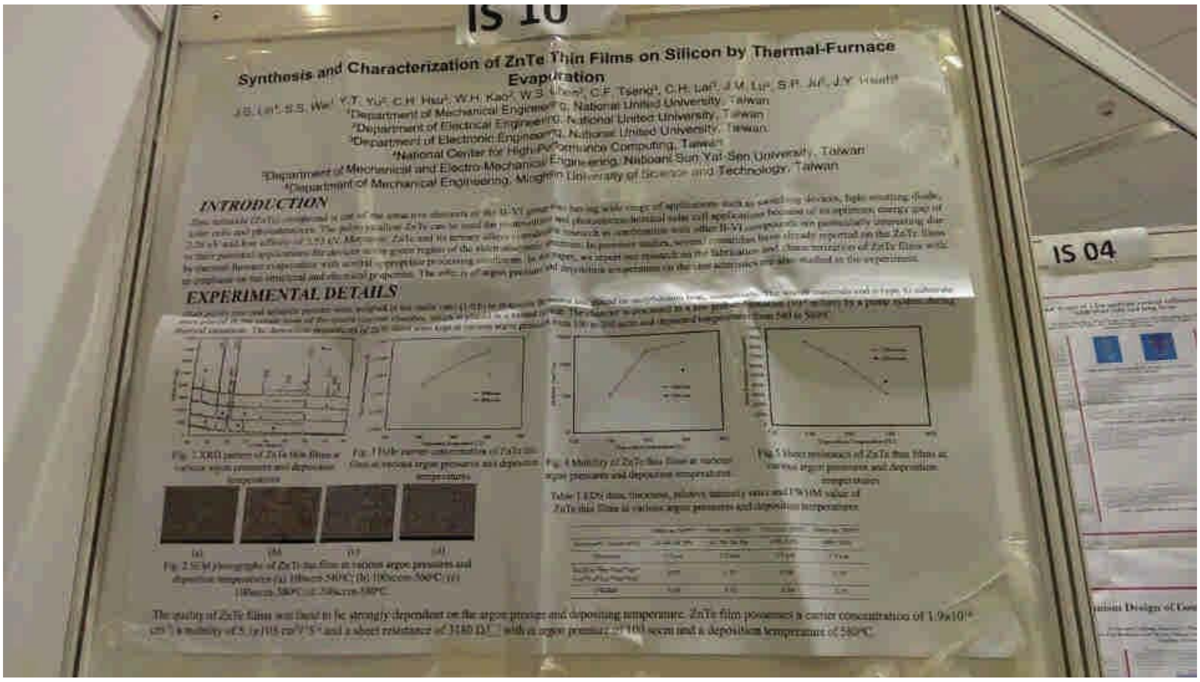
Keywords:optical card,EEPROM,charge retention,threshold voltage,Fowler-Nordheim.

Biography: Cheng WEI(1977-), male, master. His current research interests include III-V semiconductor testing and analysis.

10-029

New image fusion algorithm for auto-stereoscopic display

Chunyan PAN[1,2], Qing YANG[1,2],Jianjun LI[1,2]


IS 10
Synthesis and Characterization of ZnTe Thin Films on Silicon by Thermal-Furnace Evaporation
INTRODUCTION
EXPERIMENTAL DETAILS
IS 04

六、　論文全文或摘要

Synthesis and Characterization of ZnTe Thin Films on Silicon by Thermal-Furnace Evaporation

Jenn-Sen Lin[1], Shih-Syun Wei[1], Yi-Ting Yu[2], Cheng-Hsing Hsu[2,*], Wen-Hua Kao[2], Wen-Shiush Chen[2], Ching-Fang Tseng[3], Chun-Hung Lai[3], Jian-Ming Lu[4], Shin-Pon Ju[5], and Jin-Yuan Hsieh[6]

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ABSTRACT

Zinc telluride (ZnTe) compound is one of the attractive elements of the II–VI group also having wide range of applications such as switching devices, light-emitting diode, solar cells and photodetectors. In this paper, the microstructure and electrical properties of znic telluride thin films were studied by using thermal-furnace evaporation with emphasis on the effects of argon pressure and deposition temperature. Crystallinity, mobility, carrier concentration and sheet resistance are shown to be dependent on the argon pressure and deposition temperature. The grain size was increased with increasing the annealing temperature and decreasing the argon pressure. The highest carrier concentration of 1.9×10^{16} cm^{-3}, the lowest sheet resistance of 3180 ohm/square and the largest mobility of 5.1×10^{3} $cm^2V^{-1}S^{-1}$ are presented at an argon pressure of 100 sccm and a deposition temperature of 580^{o}C, respectively.

Keywords: ZnTe films, thermal-furnace evaporation, electrical properties, microstructure.

1. INTRIDUCTION

Recently, several II–VI compound semiconductors such as CdS, CdTe, ZnS, ZnSe, and ZnTe have been researched because of they are of interest as high refractive-index materials in optical coatings since transparent over a broad wavelength range [1]. Zinc telluride (ZnTe) compound is one of the attractive elements of the II–VI group also having wide range of applications such as switching devices, light-emitting diode, solar cells and photodetectors [2-5]. The polycrystalline ZnTe can be used for photovoltaics and photoelectrochemical solar cell applications because of its optimum energy gap of 2.26 eV and low affinity of 3.53 eV [6]. Moreover, ZnTe and its ternary alloys considerable research in combination with other II-VI compounds are particularly interesting due to their potential applications for devices in the green region of the electromagnetic spectrum [6].

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Vacuum thermal-furnace evaporated deposition has several advantages which the physical and electrical properties of the films can easily be controlled by the various processing conditions such as deposition temperature, annealing temperature and deposition pressure. Moreover, the thermal evaporation is also considered to be a standard and reproducible method for the preparation of ZnTe thin films [7]. In previous studies, several researches have already reported on the ZnTe films by thermal-furnace evaporation with several appropriate processing conditions. In this paper, we report our research on the fabrication and characterization of ZnTe fims with an emphasis on the structural and electrical properties. The effects of argon pressure and deposition temperature on the characteristics are also studied in the experiment.

2. EXPERIMENTAL PROCEDURES

High purity zinc and telluride powder were weighed in the molar ratio (1:0.6) to evaporate the source and placed on molybdenum boat, respectively. The source materials and n-type Si substrate were placed in the center zone of the quartz reaction chamber, which is placed in a heated furnace. The chamber is evacuated to a low pressure situation (10^{-2} mTorr) by a pump system during thermal treatment. The deposition procedures of ZnTe films were kept at various argon pressures from 100 to 200 sccm and deposited temperatures from 540 to 580^{o}C. Films which varied in thickness from 7.5 nm to 3.3 nm, which were determined using scanning electron microscopy (SEM) were deposited with increasing argon pressure and deposition temperature. The film structure was analyzed by X-ray diffraction (XRD) with Cu Kα radiation. The microstructural observations of deposited surface were performed using a scanning electron microscopy (SEM) and an energy-dispersive X-ray spectrometer (EDS). Electrical sheet resistance of ZnTe films were measured with using four-point measurement. The carrier concentration and carrier mobility of the films were determined by Hall-effect analysis with a Van der Pauw contact geometry carried out in a home-made system.

3. RESULTS AND DISCUSSION

Figure 1 shows the XRD patterns of the ZnTe thin films deposited at various argon pressures and deposition temperatures. From the X-ray diffraction pattern results, the peaks of ZnTe (101), (003), (102), (103), (110), (112), (113), (022) and (015) were very distinct with a hexagonal structure (JCPDS card 83-0967). To compare the X-ray diffraction patterns, the relative intensity ratio [$I_{101} / (I_{101} + I_{003}+I_{102}+I_{103}+I_{110}+I_{112}+I_{113}+I_{022}+I_{015})$] value increased from 0.27 to 0.39 with increasing deposition temperature at an argon pressure of 100 sccm. With decreasing suitable argon pressure at the growing film surface, the finer and uniform grain development in the films. On the other hand, the relative intensity ratio value also increased from 0.38 to 0.39 with decreasing argon pressure at a deposition temperature of 580^{o}C. In addition, the full-width-half-maximum (FWHM) intensity value of the XRD peak is estimated in Table 1. The FWHM intensity values of the ZnTe become narrower from 0.06 to 0.04 as the deposition temperature decreases and argon pressure increases, which imply that a lower argon pressure and higher deposition temperature might enhance their grain sizes according to Scherr's formula [8]. With increasing deposition temperature at the growing film surface, the kinetic energies and mobilities of the atoms also increase, and the thermal energy contributed to uniform grain development in the films [9]. Moreover, the peaks of Te were decreased with increasing deposition temperature.

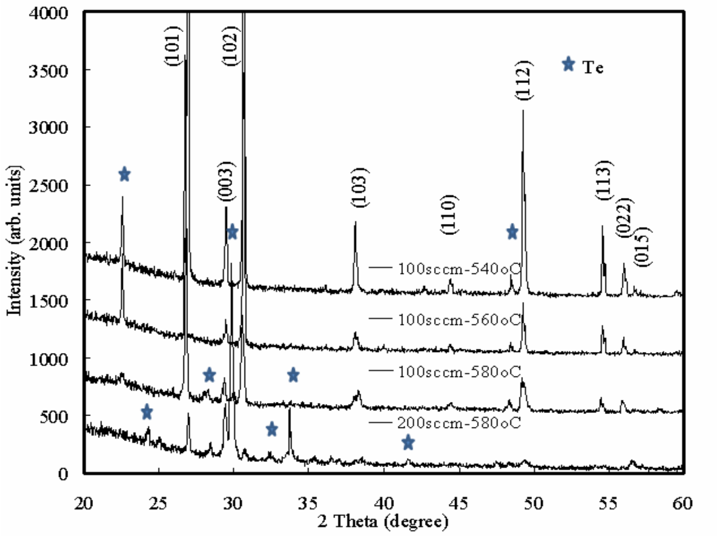
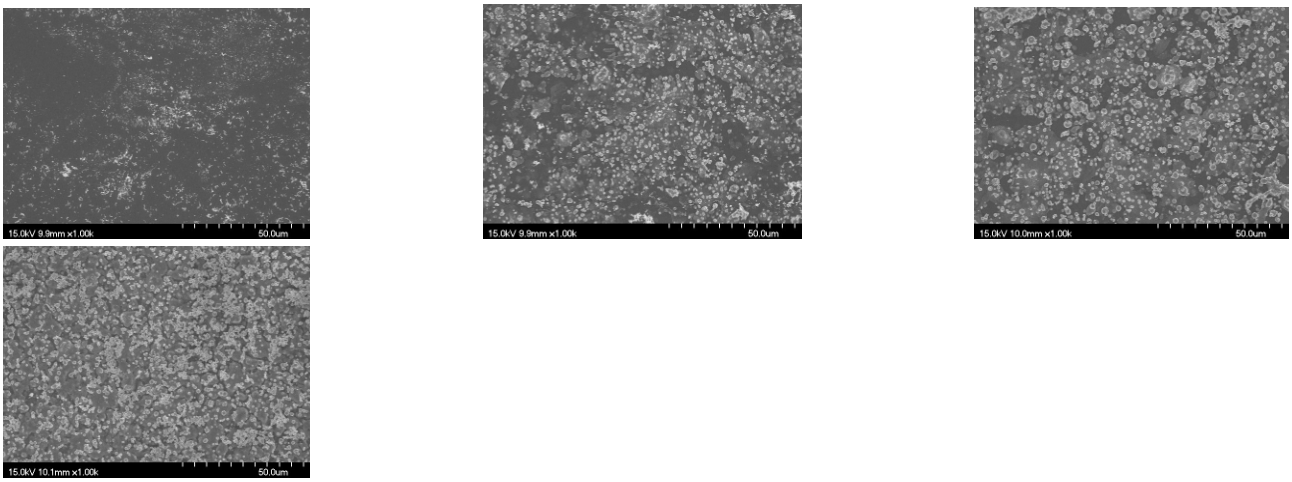


Fig. 1 XRD pattern of ZnTe thin films at various argon pressures and deposition temperatures

Figure 2 shows the SEM micrographs of the ZnTe thin films with various argon pressures and deposition temperatures. It was observed that the grains of the ZnTe ceramic films were dense and uniform at an argon pressure of 100 sccm and a deposition temperature of 580^{o}C. Table 1 also presents the EDS data of the surfaces of ZnTe ceramics with various argon pressures and deposition temperatures. The surfaces of the ZnTe ceramics with various deposition temperatures have the same Zn and Te ion contents, and the ratios of the atom percentage of Zn:Te were became near 1:1 with the higher deposition temperature.



(a) (b) (c) (d)

Fig. 2 SEM photographs of ZnTe thin films at various argon pressures and deposition temperatures (a) 100sccm-540^{o}C; (b) 100sccm-560^{o}C; (c) 100sccm-580^{o}C; (d) 200sccm-580^{o}C.

Table 1 EDS data, thickness, relative intensity ratio and FWHM value of ZnTe thin films at various argon pressures and deposition temperatures

	100sccm-540°C	100sccm-560°C	100sccm-580°C	200sccm-580°C
Zn(atom%):Te(atom%)	33.4%:66.6%	41.7%:58.3%	47%:53%	48%:52%
Thickness	7.5 μm	5.2 μm	3.9 μm	3.3 μm
$I_{101}/(I_{101}+I_{003}+I_{102}+I_{103}+I_{110}+I_{112}+I_{113}+I_{002}+I_{015})$	0.27	0.37	0.39	0.38
FWHM	0.06	0.05	0.04	0.05

Hall-effect measurements were performed the majority carrier type, carrier concentration and carrier mobility in the ZnTe films which deposited at various argon pressures and deposition temperatures. The carrier concentration and mobility of the ZnTe films are given in Fig. 3. The carrier concentration of the ZnTe films relative increased with decreasing argon pressure and increasing deposition temperature. This may be due to that the crystallinity and surface morphology were influenced with the lower argon pressure and higher deposition temperature. A maximum carrier concentration of 1.9×10^{16} cm^{-3} was measured with an argon pressure of 100 sccm and a deposition temperature of 580^{o}C. In addition, the results of the measurement in the ZnTe films were found that all the films were of p-type. This may due to the tellurium is responsible for the films to become p-type.

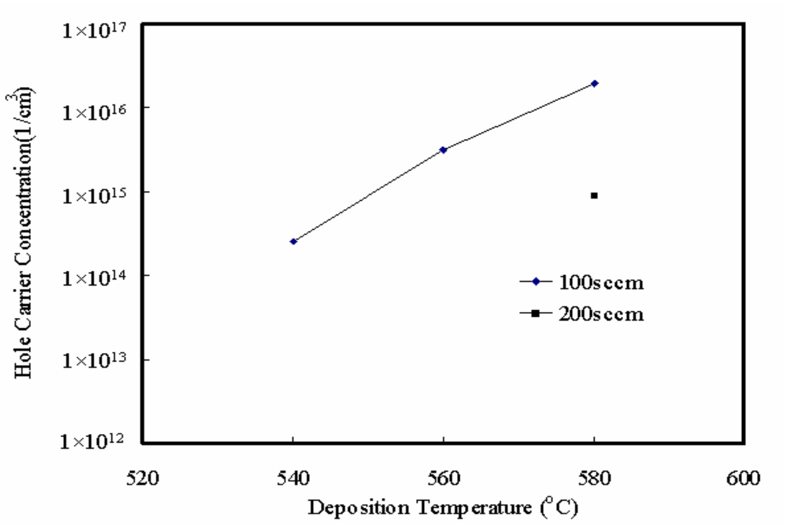


Fig. 3 Hole carrier concentration of ZnTe thin films at various argon pressures and deposition temperatures.

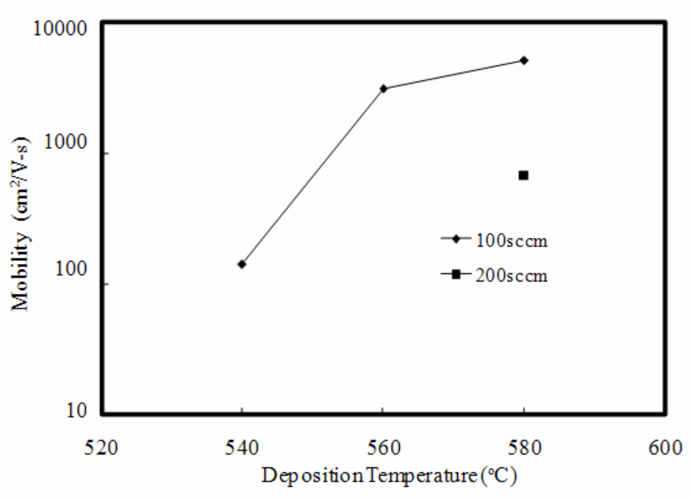


Fig. 4 Mobility of ZnTe thin films at various argon pressures and deposition temperatures.

The carrier mobility of the ZnTe thin films with various argon pressures and deposition temperatures is also shown in Fig. 4. The carrier mobility also increased with decreasing argon pressures from 200 to 100 sccm and increasing deposition temperature from 540 to 580^{o}C. Large grain boundary region and non-uniform surface microstructure are highly disordered, and having large number of defect states due to incomplete atomic bonding with higher argon pressure and lower deposition temperature. These situations are known as trap states act as effective carrier traps, impeding the flow of majority charge carriers between the grains [10].

The sheet resistance of the ZnTe films with various argon pressure and deposited temperature has been measured by using four-probe system is shown on Fig. 5. The sheet resistance is strongly depended on the microstructure, grain size and crystallinity. From the XRD patterns, intensities of the ZnTe peaks were enhanced with decreasing argon pressure and increasing deposition temperature. In addition, the FWHM intensity values of the ZnTe films become narrower at lower argon pressure and higher deposition temperature. Those results show an improvement in the crystallinity of the films. With an argon pressure of 100 sccm and a deposition temperature of 580^{o}C, a sheet resistance of 3180 ohm/square was obtained.

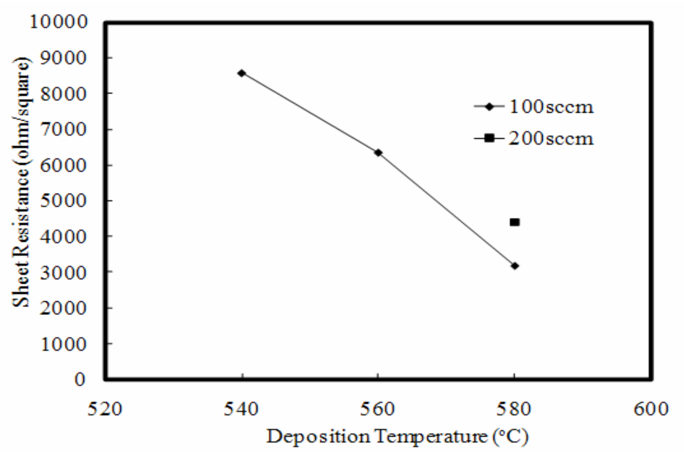


Fig.5 Sheet resistance of ZnTe thin films at various argon pressures and deposition temperatures

4. CONCULSIONS

The quality of ZnTe films with using the thermal-furnace evaporation method was found to be strongly dependent on the argon pressure and depositing temperature. Hall-effect measurements at room temperature were performed the majority carrier type in the ZnTe films, and it was found that all the films were of p-type. Moreover, the ZnTe film possesses a carrier concentration of 1.9×1016 cm^{-3}, a mobility of 5.1×103 $cm^2V^{-1}S^{-1}$ and a sheet resistance of 3180 ohm/square with an argon pressure of 100 sccm and a deposition temperature of 580^{o}C.

ACKNOWLEDGEMENTS

This work was sponsored by the National Science Council of the Republic of China under grant NSC 100-2221-E-492-010-MY3.

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