2020 年奈尺尺度技術與材料研討會

Nanometer-Scale Technology and Materials Symposium 2020

會議手冊

2020 年 12 月 18 日

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為促進奈尺尺度技術與奈尺尺度材料相關領域之研究與學術交流，並協助人才之培育，自 2005 年起大葉大學每年舉辦本研討會，藉由相關研究之發表與討論分享，更加充實與增進彼此的知識。

舉辦時間：**2020 年 12 月 18 日（周五）**
舉辦地點：大葉大學工學大樓六樓會議廳 H613 室
主辦單位：大葉大學電機工程學系、材料科學與工程學系
指導單位：行政院教育部
議程主席：李得勝
籌備委員：李得勝、宋皇輝、陳昭翰、范榮權、姚品全、李世鴻、黃俊杰、吳宛玉、王偉凱、歐信良

大會邀請演講：

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工作團隊：吳郁琦、鄭楷錚、陳克墜、陳家杰
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邀請演講摘要

L1

多元氮化鋁鈦系列硬質薄膜之鍍膜設計與機械性質

張銀祐

國立虎尾科技大學 機械與電腦輔助工程系

摘要

近年來真空電漿鍍膜技術大量應用在高科技產業，並大幅提升機械領域產業的材料製程技術水準。科技日新月異，加工技術困難度倍增，如何延長模具或者刀具的使用壽命是現今各大產業的一大難題。在眾多材料製程技術中，真空電漿鍍膜技術製備各式硬質薄膜在模具、刀具運用於電路板加工與機械加工產業中已占有一席之地。另如沖壓模具在現代工業生產中已不可或缺，且由於沖壓模具的磨損和摩擦是造成模具壽命減少的關鍵。為了提高模具使用壽命，可在表面鍍製硬質薄膜，使之具有優越的機械性質，如:高硬度、高強度，高韌性、抗腐蝕之能力、抗磨耗甚至是抗沖壓磨損與疲勞特性，同時在尺寸上亦兼具高精準度之水準，如此可有效延長工具的壽命，提昇產品品質，獲得最佳之生產力與附加價值。

鍍膜沉積法以使用物理氣相沉積法(Physical Vapor Deposition, PVD)最為廣泛，以物理氣相沉積法所鍍製之硬質薄膜具有高硬度、低摩擦係數、高耐磨性以及高附著性，適用於刀具、金屬加工業以及模具業。目前常鍍製 TiN、CrN、CrAlN、TiCN 與 TiAlCN 硬質薄膜以利增加模具壽命。再者，如氮化鋁鈦硬質薄膜等可應用在各式機械零組件、刀具和模具的表面鍍膜，以增加機械零組件、刀具和模具的表面硬度與耐磨耗而延長刀工具壽命與加工品質。本研究嘗試以個人之研究與產學合作設計開發製造經驗，從應用端需求進行氮化鋁鈦系列機械硬質薄膜之鍍膜設計與優化，探討其製備技術、分析與機械加工應用。例如在典型的工業用氮化鋁鈦薄膜中添加鉻(Cr)、硼(B)及矽(Si)所形成的氮化鋁鈦鉻(AlTiCrN)、氮化鋁鈦鉻(AlTiBN)與氮化鋁鈦矽(AlTiSiN)薄膜以至高熵合金(HEA)氮化物具有高硬度及耐磨耗之機械性質而作為模具與機械加工刀具之保護性硬質薄膜。透過介層設計藉以控制殘留應力，進而提高薄膜之機械性質同時增加模具之使用壽命。此類薄膜可透過工業級真空陰極電弧蒸鍍(Cathodic Arc Evaporation，CAE)鍍製設計奈米多層與多元固溶薄膜，再進行薄膜微結構及機械性質特性，針對實際應用將薄膜鍍製在機械刀具和模具上，探討薄膜對於降低刀具和模具磨耗量及提升使用壽命之效益。

關鍵字:硬質鍍膜；機械性質；氮化鋁鈦；機械加工

L2

紅外線光偵測器及熱影像應用

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國立雲林科技大學 電子工程系

摘要

紅外線熱影像感測技術在日常生活方面的應用越來越廣泛，包含了國防，天文，環保以及醫療等等。因熱像儀具有非破壞性、非接觸式、快速檢測…等等優勢，故在可廣泛應用在乳房、血管、皮膚溫度檢測…等等臨床檢測及監控。而近來讓全球大恐慌的CoVid-19，因其潛伏期即具有發燒症狀，故能遠距且即時檢測的紅外線熱影像系統更顯得重要。

醫療等級的熱像儀都仰賴進口且非常昂貴，且因需要極高的溫度解析度，其關鍵核心為紅外線光偵測器的效能,量子結構偵測器如:量子井及超晶格結構均具有不錯的偵測效能而量子點結構具有高溫操作的特點，以此三種結構為基礎取各結構的優點但適度降低各結構之先天缺陷，發展出特殊性及改良型的元件設計及光電子吸收增強之模擬及實驗設計，並對其物理機制做深入之探討為首要重點，目標為研製出在高溫下(>77K)仍擁有高偵測率、低雜訊、製程簡單且具有快速光響應的偵測器為首要重點。

我們設計雙能障超晶格及量子井紅外線偵測器，並完成後續偵測器最佳化目標，利用模擬軟體計算出最佳的微結構形狀及深度，利用微奈米製程技術實作出光柵結構作出更高吸收效率的表面結構，光可以被多次吸收而有效提升偵測器的效能。最後，我們期望完成此偵測器與讀出電路的整合晶片的雛形並產生準確溫度偵測，為未來台灣生產自有醫療用等級國產熱像儀埋下基石，為台灣的醫療檢測品質盡心力

L3

Enhanced Perpendicular Magnetic Anisotropy of Pr-Fe-B Thin Film by Spontaneously Precipitated Fe-Si Underlayer

以自發析出的 FeSi 底層強化 PrFeB 薄膜的垂直磁異向性

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Abstrate

High perpendicular magnetic anisotropy (PMA) Pr-Fe-B thin film was deposited on Si_3N_4 underlayer on glass substrate by RF magnetron sputtering technique and in-situ annealed in a high vacuum chamber. The effects of Pr-Fe-B thickness and in-situ annealing treatment on the microstructure and magnetic properties of the Pr-Fe-B films were investigated. The results showed that the PMA and coercivity were better at the magnetic layer thickness of 125 nm and in the annealing temperature of 650 °C. With this compatible thickness and in-situ heat treatment, the formation of Fe_3Si layer by effective inter-diffusion of the main magnetic layer and underlayer supported significantly the $Pr_2Fe_{14}B$ phase as well as the PMA strength. The higher coercivity was achieved at 7.5 kOe. The surface morphology was more blossom like. XPS analysis exhibited the distribution of the main magnetic elements that strongly affected by the heat energy at the same thickness through the elemental depth profile.

Keywords: *Thin Film; $Pr_2Fe_{14}B$; Annealing; Si_3N_4; Perpendicular Magnetic Anisotropy; Magnetic Properties*

L4

大氣電漿噴射束用於製備金屬氧化物奈米材料於固態氧化物燃料電池之應用

郭俞麟 特聘教授

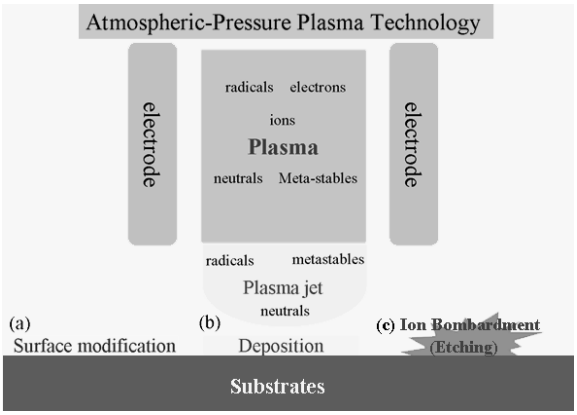
國立臺灣科技大學機械工程學系 (材料組)

摘要

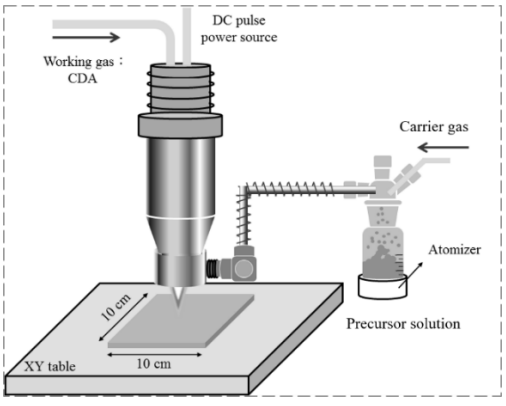
大氣電漿技術現已應用於許多製程技術上，例如材料表面處理、薄膜沉積、奈米顆粒製備等。本研究團隊歷經十年研究，透過大氣電漿噴射束設備並以空氣作為電漿氣體來源，進行功能性金屬氧化物奈米材料於能源上的應用。大氣電漿噴射束用於製備氧化物顆粒主要機制為在常壓環境下，透過電漿區內之高溫反應區域結合噴霧熱裂解和電漿輔助化學氣象沈積的製程技術。前期成果以大氣電漿噴射束製備具有立方晶系穩定化之氧化鋯陶瓷粉末，其穩定化方式為氧空缺穩定系統，藉由光放射光譜(Optical Emission Spectroscopy; OES)檢測之活性氧物種認為是大氣電漿過程中的主要氧化劑，並確立了此快速氧化顆粒製備製程。

本研究團隊主要以大氣電漿噴射束系統製備固態氧化物燃料電池材料，其中包括固態電解質、陰極觸媒層等。由於固態氧化物燃料電池所追求的為中低溫型操作條件(400-600 ºC)，因此研究選擇上固態電解質材料主要以氧化鈰、氧化釓摻雜氧化鈰電解質材料為研究方向，以硝酸鈰與硝酸釓混合溶液作為前驅物製備來源，並探討不同Gd摻雜濃度對於GDC奈米顆粒其結晶性質、表面型態、微觀結構及電性能之影響。結果顯示經由常壓電漿噴射束能於短時間內製備出GDC立方相螢石結構之奈米粉體，而透過第一原理密度泛函理論（DFT）研究能提供詳細的原子級結構分析，模擬CeO_2、$Ce_{0.9}Gd_{0.1}O_2$的電荷分佈顯示以Gd作為摻雜物有助於增加$Ce_{0.9}Gd_{0.1}O_2$奈米結構之電荷，提升$Ce_{0.9}Gd_{0.1}O_2$之導電性能。

後續為追求中低溫型固態氧化物燃料電池之發展，則持續進行探討多元金屬氧化物之製備製程評估，其中包括鑭鍶錳氧化物、鑭鍶鈷鐵氧化物、銀-氧化鈰等複合材料應用於固態氧化物燃料電池之陰極觸媒電極層。其中銀-氧化鈰陰極觸媒電極層在中低溫(400-500ºC)環境下具有優異之交換電流密度及電功率密度，其值分別為550.23 mA/cm^{2}及256.77 mW/cm^2。而在中溫(550-600ºC)環境下以AC28有最高之交換電流密度及電功率密度，其值分別為907.18 mA/cm^{2}及703.28 mW/cm^2。此發電效能數據成果顯示大氣電漿噴射束系統製備固態氧化物燃料電池陰極觸媒電極層具備快速且連續生產製程之優勢且無續後續燒結製程，預期將可應用於固態氧化物燃料電池之組件組合。



大氣電漿技術應用機制圖



大氣電漿噴射束設備圖

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壁報論文摘要

P1

水熱製程對矽溶膠製備二氧化矽奈米粉末形貌影響之研究

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摘要

實驗之原始物料為切割矽晶圓片所衍生之矽污泥，將其經初步固液分離所取得之固體矽泥，行鹼化反應製成矽溶膠，即為研究之初始物料。而本研究目標是希望能藉由簡易之水熱製程的施作，由矽溶膠中製備出奈米尺度之二氧化矽晶質粉末。

實驗結果顯示，於固定pH值之矽溶膠液，行水熱溫度與持溫時間的改變，皆是影響產物特性之重要因素。無論是片狀或顆粒狀產物，皆屬標準α-石英晶體；同時產物之晶構強度，皆隨著持溫時間增長、呈現持續增強的趨勢。且知，對業界常用之矽溶膠液，施以此簡易水熱製程，皆可順利獲得奈米級α-石英之晶質產物。

關鍵詞：矽溶膠、水熱製程、奈米級α-石英晶質粉末

To Study the Hydrothermal Processes to Fabricate the Nano-grade crystalline Silica Power from Silica Sol

Fang-Chun Liao[1], Ya-Ping Wu[2], and Jun-Lin Lu[2]

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Abstract

This experiment original material is silicon slurry, which obtains by cutting the wafer. The solid particles of slurry acquired by preliminary solid-liquid separation and alkalized to form the silica sol, which is the initial material for experimental study. The main goal of this study is to prepare a nano-scale crystalline silica powder from silica sol by simple hydrothermal processes.

From pre-experimental results shown that, besides the pH value of the silica sol will obviously affect the appearance and crystalline intensity of the product. At the same time, changing hydrothermal temperature and holding time are also important factors to influence the characteristics of products. Regardless of the flake-like or granular-shape product, it is a standard α-quartz crystal. Furthermore, the crystalline intensity of the product tends to increase continuously with increasing the holding time. From results also knowing that applying a simple hydrothermal process treating industrial silica sol, the nano-scale of α-quartz crystalline product can obtain successfully.

Key words: Silica Sol、Hydrothermal Processes、Nano-scale Crystalline Silica Powder.

P2

廢玻璃製備微奈米晶質石英粉末之研究

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摘要

首先將回收之廢玻璃瓶予以機械粉碎，再施以粒徑分篩、磁選、熱鹼洗、濕法酸洗、清洗及烘乾等前處理步驟，即成為實驗研究之初始物料。接續施行水熱處理，藉高溫高壓之強鹼液使玻璃粉重新溶解及再結晶析出。實驗將對各參數水熱產物進行FE-SEM形貌觀察、EDS成份分析、XRD晶構分析及回收率的測量。

實驗結果得知，經水熱處理之玻璃粉表面皆有結晶產物的沉積析出。經XRD分析顯示，產物在0.5及1.0 M礦化劑濃度下主要為方沸石($NaAlSi_2O_6 \cdot H_2O$)；當濃度大於1.0 M後，產物將轉變成為針鈉鈣石($NaCa_2Si_3O_8(OH)$)。且隨著持溫時間的增長，方沸石產物的回收率及晶構強度也將隨之提升；然而水熱時間的增加，似乎對針鈉鈣石產物並無太大的影響。

關鍵詞：廢玻璃、水熱製程、形貌觀察、晶構分析

To Study the Preparation Technique of Micro-Nano Crystalline Quartz Powder from Waste Glass

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Abstract

First, the recycled waste glass bottle was mechanical smash, and then subjected to the pre-treatment steps such as particle size sieving, magnetic separation, hot alkaline washing, wet pickling, cleaning and drying, etc., becoming the initial material for experimental research. Then proceed with hydrothermal treatments, under high temperature and high pressure status, the glass powder is dissolved and recrystallized by strong alkali liquor. The experiment will conduct FE-SEM morphology observation, EDS component analysis, XRD crystalline structure analysis and recovery measurement of the hydrothermal products with various parameters.

From experimental results show that there is precipitation of crystalline products on the surface of the glass powder after hydrothermal treatment. From XRD analysis revealed the product was mainly analcite ($NaAlSi_2O_6 \cdot H_2O$) at 0.5 and 1.0 M mineralizer concentrations; when concentration greater than 1.0 M, product would be converted into pectolite ($NaCa_2Si_3O_8(OH)$). Also, with increasing the holding time, the recovery rate and intensity of crystalline structure of analcite product will increase accordingly. However, increasing the hydrothermal time does not seem to have much effect on the pectolite product.

Key words: Waste Glass、Hydrothermal Processes、Morphology Observation、Crystalline Structure Analysis.

P3

pH 值與持溫時間對矽溶膠水熱產物形貌影響之研究

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摘要

一般矽溶膠($Na_2O \cdot n\ SiO_2$)物料，是一種由二氧化矽微粒所組成的水溶液，俗稱矽酸膠或矽溶膠，具獨特之物理及化學特性；如：極大比表面積、極細粒徑、粒子帶負電性、粘結性、耐高溫膠化性等，目前廣泛應用於精密鑄造業、造紙工業等。

本實驗嘗試將矽溶膠，藉由水熱法製程製作出奈米級二氧化矽晶質粉末之研究。初始乃固定 200℃溫度，以不同 pH 值之矽溶膠液與改變水熱持溫時間為試驗參數，探討對水熱產物形貌影響之研究。實驗結果顯示，溶膠液 pH 值的調整的確會對水熱產物之形貌產生影響；至於水熱持溫時間的增長，將使反應產物之粒徑與晶構強度隨之變大與增強，同時亦觀察到形貌會由結球狀之奈米薄片，逐步轉換成為多面體之奈米晶質顆粒。

關鍵字：矽溶膠、pH 值、水熱法、奈米級二氧化矽晶質粉末。

Study the Influence of pH Value and Holding Time on the Morphology of Silica Sol Hydrothermal Products

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Abstract

In general, the material of silica sol ($Na_2O \cdot n\ SiO_2$) is an aqueous solution which composed of very fine silica particles, common name as silica gel or silica sol, with unique physical and chemical properties; such as: large specific surface area, extremely fine particle size, particle carried with negative charge, adhesiveness, high temperature gelation resistance, etc. At present, it is widely used in precision casting and paper industry.

This experiment attempts to use silica sol to prepare a nano-scale crystalline silica powder by hydrothermal processes. First, the hydrothermal temperature was fixed at 200°C, selecting different pH values of silica sol and holding time as the major experimental parameters to investigate their influence on the morphology of hydrothermal products. From experimental results show that adjusting pH value of sol solution will indeed affect the morphology of hydrothermal product. As for increasing hydrothermal holding time, the particle size and the intensity of crystalline structure of products will get bigger and increase. At the same time, observing the morphology of product will gradually transform from spherical nano-flake to polyhedral nano-grade crystalline particles.

Key Words：Silica Sol、pH Value、 Hydrothermal Method、Nano-grade Crystalline Silica Powder.

P4

半導體坩堝氮化矽塗層燒結技術研發

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摘要

本研究使用拉製單晶矽之半導體坩堝為燒結試驗基材，同時選擇氮化矽(Si_3N_4)陶瓷粉為漿體物料，噴塗於基材上進行燒結製程(燒結溫度、降溫速率)的研發。期間藉 FE-SEM 檢視燒結層之表面、斷面形態及量測燒結層之膜厚，亦檢視燒結層與基材間之熔著結合情形。

綜合實驗結果建議，以 1200℃、0.4℃/min 降溫速率燒結之橫斷面，孔隙尺寸雖較大，但相互串連的現象可大幅減少，且侷限在上表層部位，相信已具阻隔雜質滲透效果。若對燒結層厚度有所要求，則可選擇以 1300℃、持溫 1 小時及 1℃/min 之降溫速率，因此製程時間適中，且膜厚成長率頗佳，燒結層之孔洞數和孔隙數皆少，且亦分布在上表層附近，惟裂縫受收縮殘留內應力所影響，將明顯較深寬些。

關鍵詞：半導體坩堝、氮化矽、燒結製程、燒結層厚度、裂縫、阻絕雜質滲透

To Investigate the Sintering Technology of Si_3N_4 Coating on Semiconductor Crucible

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Abstract

In this research, semiconductor crucible fragments obtained from single crystal silicon rod manufacturing industrial, were used as the experimental substrate for sintering study. Also, Si_3N_4 powder was selected as the coating material to study the sintering processes, which included sintering temperature and cooling rate. Applying FE-SEM to examine the morphology of upper surface and cross section of sintered layer, and measure the average thickness of sintered layer. At the same time, will also examine the fused bonding interface between sintered layer and substrate.

The overall experimental results suggested that although the pore size at the cross section sintered at 1200℃ and 0.4℃/min cooling rate is larger, the connection situation can be greatly reduced, and it is limited at the upper surface, which believed to have the effect of blocking impurity penetration. If the thickness of sintered layer is required, we can choose sintering at 1300°C with one hour holding, then select 1°C/min cooling rate to cool down. Under this process parameters, the proceeding time is adequate for fabrication, and the growth rate of sintered layer is good, both the quantity of hole and pore in sintered layer is less and distribute at the upper surface area. However, the crack will be significantly deeper and wider, which is caused by the internal residual stress.

Key words: Semiconductor Crucible, Si_3N_4, Sintering Processes, Thickness of Sintered Layer, Cracking, Prevent Impurities Penetration

P5

藉微波製程製備氫氧基磷灰石(HA)及二氧化矽(SiO_2)奈米粉之研究

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摘要

本研究選擇業界常見之微波製程，進行氫氟基磷灰石(HA)及二氧化矽(SiO_2)奈米粉末之製備研究，實驗物料分別為拉製半導體單晶矽柱所廢棄之坩堝碎片及早餐店丟棄之蛋殼。期間藉由對微波輸出功率與微波時間調整進行試驗，並對相關產物藉由 FE-SEM 及 XRD 進行外觀形貌、晶體結構及粒徑尺寸的檢視、檢測與分析。

由實驗結果顯示，經此法製得之氫氧基磷灰石及二氧化矽粉末，將隨微波時間的增長或輸出功率的增強，產物之粒徑與晶構強度皆有增長變強的趨勢，且皆可順利製備出奈米尺度之粉末產物。

關鍵詞：微波製程、蛋殼、坩堝碎片、氫氧基磷灰石奈米粉、二氧化矽奈米粉

To Study the Preparation Technology of the HA and SiO_2 Nano-Powder by Microwave Processes

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Abstract

In this study, the microwave processes, which commonly used in industry, was selected for the hydroxyapatite (HA) and silica (SiO_2) nano powders prerarations. The experimental materials are crucible fragment discarded from pulling semiconductor single crystal silicon pillars and egg shell from breakfast shop. During the experiment, the microwave output power and holding time were the testing parameters. Following will conduct FE-SEM and XRD for morphology observation、crystalline structure analysis and particle size measurement for various parameter products.

From experimental results shown that both hydroxyapatite and silica powder made by this method, the average particle size and intensity of crystalline structure trend to grow and become stronger, with increasing the test time or power input. Also, we can prepare the nano-scale powder products successfully.

Key words：Microwave Processes、Eggshell、crucible fragment、Hydroxyapatite Nano Powder、Silica Nano Powder

P6

微奈米二氧化矽粉末製程參數研究

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摘要

本實驗使用拉製半導體矽單晶之廢坩堝片為物料，由於坩堝純度非常高，故希望經簡易製程處理後予以回收，並製成微奈米尺度之高純粉末。其概略步驟是將坩堝片先加以粉碎、分篩、磁選、濕法酸洗、清潔、烘乾等處理，始為研究之初始二氧化矽物料。再藉水熱製程，將物料重溶和再析出，進而轉換成粉末產物。並藉 FE-SEM、XRD 與粒徑分析儀，對各參數產物行形貌觀察、晶構分析及粒徑分布的量測。

實驗結果顯示，於固定水熱溫度下，改變礦化劑濃度與冷卻方式，將使產物的生成形貌有明顯差異。若以低濃度礦化劑或水熱溫度偏低及行空冷方式，將無法使實驗物料完全溶融及晶質析出，此時產物將呈奈米非晶質薄片狀為主；若將溫度和濃度提高，產物將轉換成次微米多面晶柱狀晶質顆粒，且粒徑分布與形貌亦將隨之改變。最後以超純水徹底清洗、微奈米濾管過濾及烘乾，藉以量測不同參數粉末之回收率和平均粒徑。

關鍵詞：半導體坩堝、水熱製程、奈米非晶質薄片、次微米多面晶柱狀晶質顆粒

To Study the Preparation Process Parameters of Submicron Silica Powder

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Abstract

This research selected crucible fragment discarded from pulling semiconductor single crystal silicon pillars as the raw material. According to its high purity, thus, hope can recycle it by simple process processing into high purity micro/nano-scale powder. The pre-treated steps are mechanical smashing、sieving、magnetic separation、wet pickling、cleaning and drying, to be the initial powder for research. Then applying hydrothermal processes, dissolve and reprecipitate it, converted into powder product. After that, using FE-SEM、XRD and particle size analyzer carefully examine the morphology, analyze the crystal structure and measure the particle size distribution of products.

Experimental results show that under fixed hydrothermal temperature, changing the concentration of mineralizer and the cooling method, will influence the product morphology apparently. If under low mineralizer concentration or lower hydrothermal temperature with air cooling method, the experimental powder can not completely dissolved and reprecipitate, the obtained product will be mainly noncrystalline nano-scale flakes. If increased the temperature and concentration, product will transform into sub-micron polyhedral columnar crystalline particles, and

the particle size distribution and morphology will also change accordingly. At the end, carefully cleaned the products with ultra-pure water, filtered it with a micro/nano filter tube and dried, to measure the recovery rate and average particle size of powder with different processing parameters.

Keywords: Semiconductor Crucible, Hydrothermal Processes, Noncrystalline Nano-scale Flakes, Sub-micron Polyhedral Columnar Crystalline Particle

P7

「AgCuTi+石墨烯」對 Al_2O_3 -Ti6Al4V 之異材瞬時液相接合性質研究

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摘要

本研究係採用AgCuTiSn填料金屬對Al_2O_3陶瓷與Ti-6Al-4V合金使用瞬時液相接合(TLP)來進行異材間的真空硬銲技術開發。由於，異材接合後的冷卻階段會因兩種材料之熱膨脹係數(CTE)有所差異，金屬冷卻速率會較陶瓷快，會誘使接合強度降低。而且，受到CTE差異所造成的內部應力擠壓會在試片上的陶瓷端面形成弧形破壞。為改善此現象，依以往本團隊的經驗，將嚐試在銲片間添加石墨烯來進行改善。實驗結果顯示，870 ℃/持溫30分鐘的銲件壓剪強度20 MPa，若添加石墨烯試片的壓剪強度會提高至52 MPa，達到原銲件強度的2.6倍。巨觀觀察可發現，從原先的弧形破壞轉變為殘存少量陶瓷的破壞方式；顯微觀察發現。添加石墨烯試片的銲縫寬度皆有縮減現象，且能提升整體強度。

關鍵字：AgCuTiSn、瞬時液相接合、異材接合、石墨烯、熱膨脹係數

Research on Transient Liquid Phase Bonding Properties of "AgCuTi+Graphene" to Al_2O_3 -Ti6Al4V Heterojunction

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Abstract

This research is based on the development of vacuum brazing technology between Al_2O_3 ceramics and Ti-6Al-4V alloy dissimilar materials using AgCuTiSn filler metal. Various industries are flooded with ceramic and metal components, such as military, aerospace engineering and so on. However, due to the difference in the coefficient of thermal expansion (CTE) improvement between the two materials in the cooling stage after the dissimilar materials are joined, the cooling rate of the metal will be faster than that of the ceramic, which will induce a decrease in the joint strength. Moreover, the internal stress extrusion caused by the difference in CTE will try to improve this phenomenon. Based on the previous experience of our team, we will try to add graphene between the solder sheets to improve it. The experimental results show that the compressive shear strength of the weldment at 870℃/temperature for 30 minutes is 20 MPa. If the graphene test piece is added, the

compressive shear strength will increase to 52 MPa, which is 2.6 times the strength of the original weldment. Macroscopic observation shows that the original arc-shaped damage has changed to a mode of damage where a small amount of ceramic remains; microscopic observation reveals. The weld width of the graphene test piece has the expected phenomenon, and the overall strength can be improved.

Keywords: AgCuTiSn, TLP, Heterojunction, graphene, CTE

P8

CZTSe 太陽電池表面 Sn-Se 二次相蝕刻研究

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摘要

製備單相CZTSe-based薄膜比CIGS-based薄膜困難，CZTSe-based薄膜在結晶過程中容易生成 Cu-Se、Zn-Se、Sn-Se及Cu-Sn-Se等二次相，會影響電池的光電轉換效率，其中以Sn-Se二次相影響最為嚴重。本研究主要在利用化學蝕刻方式來除去Sn-Se二次相。研究中先調變不同硒化製程Ar氣體流量，觀察對薄膜表面二次相的影響，隨後進行CZTSe表面二次相的化學蝕刻製程，最後再探討二次相對元件光電特性的影響。實驗結果得知，CZTSe薄膜在較低硒化製程Ar流量(100cc/min)，表面出現棒狀結構的Sn-Se二次相(type Ⅰ)；在較高硒化製程Ar流量(150cc/min)，表面出現圓形或半圓形結構的Sn-Se二次相(type Ⅱ)，Sn/Se比愈低越容易形成type Ⅰ，Sn/Se比愈高會形成type Ⅱ。(HNO3+ 3 HCl)溶液可有效去除type Ⅱ Sn-Se二次相，其化學反應可能為SnSe＋HNO3+ 3 HCl→SnCl3＋H2Se＋H2O＋NO2。由C-AFM分析得知Sn-Se二次相為電流流經通道，可能會造成元件漏電流。太陽電池元件在去除type Ⅱ Sn-Se二次相後，其Voc、Jsc、FF皆提升，光電轉換效率可增加37%。

關鍵字：CZTSe、化學蝕刻、Sn−Se二次相、C−AFM

Removing of the Sn-Se secondary phases from the surface of CZTSe absorber

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Abstract

Preparing of single-phase kesterite structure of CZTS-based film is more challenging than that of chalcopyrite structure CIGS-based film, due to Cu-Se, Zn-Se, Sn-Se, and Cu-Sn-Se secondary phases are easily existing during the CZTS-based film the grain growth process. Moreover, these secondary phases may cause the detriment of device efficiency, Sn-Se phase is the most one of all. In the study, the different flow rate of Ar gas in selenization processes was firstly changed, and the influence of the Sn-Se secondary phase on the surface of the film was observed. Then, the chemical etching process of the Sn-Se secondary phase on the surface of CZTSe was carried out, Finally, the influence of Sn-Se secondary phase removal on the device performances was discussed. The experimental results show that at the lower (100 cc / min) and higher (150 cc / min) Ar flow rate, the rod-like (type I) and round / semi-circular (type II) Sn-Se second phase appears on the surface of the CZTSe film during the selenization process. The lower the Sn/Se ratio, the easier it is to form type I, and the higher the Sn/Se ratio, the more type II is formed. Type Ⅱ Sn-Se phase can be etched effectively by HNO_3 and HCl chemical solution, the possible reaction is $SnSe + HNO_3 + 3\ HCl \rightarrow SnCl_3 + H_2Se + H_2O + NO_2$. In addition, via conductive atomic force microscopy(C-AFM) analysis, it can be confirmed that the Sn-Se phase might act as a path of current which causes leakage current of device. The device efficiency can be increased by 37% after removing the type II Sn-Se secondary

phase.

Key words: CZTSe、chemical etching、Sn-Se secondary phase、C-AFM

P9

常壓製程類石墨烯 PN 接面之光電特性量測

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摘要

石墨烯擁有高載子遷移率、低電阻率、高透光等優點，適合用來當作半導體材料，進而製作元件或電晶體。本實驗利用熱爐管裂解大豆油之油源，在大氣壓的環境下製作出類石墨烯材料，並檢測類石墨烯之電阻率、載子濃度、載子遷移率等數據。最後，對樣品進行磷摻雜後製作出 PN 接面元件之結構，當 PN 接面照光時會產生電子-電洞對，進而產生明顯之光電流。

關鍵字:熱爐管，類石墨烯，PN 接面，光電流

Optical and electrical characteristics of graphene-like PN junction made under atmospheric pressure process

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Abstract

Graphene has the advantages of high carrier mobility, low resistivity, high light transmission, etc., and is suitable for use as a semiconductor material to make device or transistors. This experiment uses a thermal furnace tube to produce graphene-like materials from the soybean oil under atmospheric pressure, and to measure the resistivity, carrier concentration, and carrier mobility of graphene-like materials. Finally, the sample is doped with phosphor to fabricate the structure of the PN junction device. When the PN junction is illuminated, electron-hole pairs are generated, which in turn generates a significant photocurrent.

Key word: furnace tube, graphene-like, PN junction, photocurrent

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以 3D 列印技術製作多層電路之研究

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摘要

現今的一般電路板的製作過程複雜且產生的廢料以及汙染較高，因此我利用 3D 列印機來改良電路板生產方式以達到快速生產，降低汙染以及減少製作成本為訴求，而 3D 列印技術快速生產的特性以及列印線材的環保性，可製作出客製化電路和電路板，不但可以縮短產品製造時間, 減化製程以及減輕對環境的傷害，一但熟練運用可能取代傳統的電路板生產方式，故本文將探討此製作方式可行之處。

本文以熔融沉積型(Fused Deposition Modelling, FDM)作為列印的硬體設備，並以玉米澱粉樹酯(Polylactic Acid, PLA)作為列印線材，再以導電銀膠(Silver paste)取代電路銅箔(Copper Clad)製作出電路板。故本選用 ATOM3 列印機台來製作電路板並選用了三種不同的導電銀膠進行試驗，由於列印中會因為溫度、擠出速度、列印速度等影響到列印尺寸和精度，也直接影響了銀膠固化後的電阻組值，再加上以 PLA 材質時的參數數據進行研究，並在途中更換線材並研究分層分色的影響，再以 ATOM3 的內部軟體進行參數更改，以驗證 3D 列印機印製電路板於玻璃平台上的影響。

本文最後製作一塊三層電路板並在內部設計一份並聯電路作為試驗，並選用其中之一的導電銀膠作為銅箔的替代品，試驗內容為在不同的盲孔(blind via)中裝上 5 個 10Ω電阻後是否導通，以及測量電路電阻是否為預設的電阻阻值。試驗結果確認成品的電阻為 16Ω與預設的電阻阻值相同，以此證實使用 3D 列印製作電路及電路板的可行性。

關鍵字:3D 列印機，電路板，多層電路，導電銀膠，銅箔

The study of 3D printing technique for multi-layers printed circuit board

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Abstract

The current production procedure of regular circuit board is more complicated and also have to scrap a lot of materials which will cause environment pollutions. I plan to utilize 3D printer technique to improve circuit board production method to speed up production, reduce environment pollutions, and reduce cost. Also, the features of 3D printer technique are not only able to speed up production, but also the printer filament is eco-friendly which could customed make the electric circuit and circuit board easily. This way, it will cut off lots of production time and less harmful to our environment. Once the 3D printer operation is trained well which will be able to replace the

traditional circuit board production method. Let me illustrate the possibility of this new production method in my essay.

The purpose of this study is to utilize FDM (Fused deposition modeling) as 3D printing hardware device, and use PLA (Polylactic Acid) as printer filament. Also, take Silver Paste to substitute Copper Clad to print circuit board. Choose ATOM3 3D printer to print circuit board and use 3 kinds of Conductive Silver Paste to do experiments. The temperature, speed of squeeze out & speed of print during the printing will impact the print out size, precision and tolerance which will also affect the value of resistance after Silver Paste is solidified. Besides, use different parameters of PLA filament to conduct research, and change different filaments during printing to find out the impact for the different colors on different layers. Then, also modify parameter on the internal software of ATOM3 printer, to verify if any impacts to print circuit board on the glass platform.

At the end, I print a 3 layers circuit board and also design a circuit in parallel to do an experiment, and choose one out of three Conductive Silver Paste to replace Copper Clad to test the resistance conduction for 5 pcs of 10Ω resistance on the different blind via on the circuit board, then measure the resistance is the preset resistance value. Test result confirm the resistance on the circuit board reaches 16 Ω which has the same value as preset resistance. This test proves that uses 3D printing technique for electric circuit and multi-layers PCB would work.

Key words: 3D printer, electric circuit board, multi-layers electric circuit, Conductive Silver Paste,Copper Clad

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金奈米粒子固定於基材之穩定性和應用

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摘要

貴金屬奈米粒子因本身會吸收特定波長的光源產生吸收光譜[1]，此特性對所存在的環境下很敏感[2]，環境折射率改變會造成電漿子共振的情況改變，所以可以使用此種特性來感測所在環境的折射率，此元件使用化學自組裝的方式將金奈米粒子固定在基材上作為感測元件，並利用可見光譜儀來探討此元件之穩定性，將此元件保存於純水溶液中經過4週的觀察時間可發現其吸收度平均變化量小於5%。目標微小化光源與擷取光訊號設備，期許可作為容易攜帶、簡單製作的感測設備。

關鍵詞：奈米粒子，電漿子共振，自組裝

The stability and application of gold nanoparticles fixed on the substrate

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Abstract

The noble metal nanoparticles could absorb specific light and then produce the spectra[1]. This characteristic is sensitive to the environment[2]. Changes in the refractive index of the environment will cause changes in the plasmonic resonance, so we can use the features to sense the environment. This element uses chemical self-assembly to modify gold nanoparticles on the substrate as a sensing element and uses a visible spectrometer to check the stability of this element. The element is stored in a pure aqueous solution for 4 weeks, and the change in absorbance is less than 5%. We hope to fabricate easy and simple sensing equipment.

Keywords: nanoparticle, plasmonic resonance, self-assembly

Reference

1. Willets, K.A., Van Duyne, R.P. (2007) Localized surface plasmon resonance spectroscopy and sensing. *Annu. Rev. Phys. Chem*, 58, 267-297.
2. Nath, N., Chilkoti, A. (2002) A colorimetric gold nanoparticle sensor to interrogate biomolecular interactions in real time on a surface. *Analytical Chemistry*, 74, 504-509.

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錐形光纖定域化表面電漿共振折射率感測器之開發

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摘要

近年來，光纖感測器已在許多領域中使用[1-2]。這類型的感測器優點是簡單結構、易於操作、即時檢測等。而貴金屬奈米材料因其奈米粒子具有獨特吸收峰，且對外在環境的折射率變化相當靈敏，當外在環境折射率變化時，藉由量測共振波長飄移或光強度的變化進行檢測[3-6]。在本研究中展示了一種新型的由錐形光纖與金奈米粒子開發出光纖定域化表面電漿共振(TFO-LSPR)折射率感測器。錐形光纖的總長度為 23 毫米，並在腰部表面修飾金奈米粒子進行改性來製做定域化表面電漿共振感測器。利用蔗糖溶液其折射率為 1.343-1.403 RIU 來評估 TFO-LSPR 感測器是否可進行分析。從實驗結果得到 TFO-LSPR 傳感器檢測折射率樣品其線性回歸分析顯示出良好的相關係數（0.9962）。可以肯定的是，在不久的將來，基於 TFO-LSPR 感測器和奈米技術的檢測方法將取代目前在農業，食品，環境和臨床診斷中的方法。

關鍵詞：定域化表面電漿共振、金奈米粒子、折射率、光纖感測器

Development of Tapered Fiber Optic Localized Surface Plasmon Resonance Refractive Index Sensor

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Abstract

In recent years, fiber-optic sensors have been used in many fields [1-2]. The advantage of the type of sensor is simple of composition and ease of operation, real-time detection and excellence sensitivity to the local refractive index of the surrounding environment [3-6]. A novel fiber optic localized surface plasmon resonance refractive index sensor composed of a tapered optical fiber was demonstrated in the present study. The total length of the tapered fiber was 23 mm were fabricated and modified with gold nanoparticles on the waist surface to produce the nano-plasmonics sensor. The TFO-LSPR sensor was examined for analysis of sucrose solutions with various refractive indexes (1.343 - 1.403 RIU). Experimental results obtained from the TFO-LSPR sensor showed a good

correlation coefficient (0.9962) from the linear regression analysis. It is certain that in the near future, TFO-LSPR sensor and nanotechnology based detection methods will take the place of current methods in agricultural, food, environmental and clinical diagnosis.

Key Words: localized surface plasmon resonance, gold nanoparticles, refractive index, fiber optic

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平衡層流式濕法蝕刻清洗機去離子水水洗淨槽體設計研究

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摘要

本研究關於一種半導體濕法工藝清洗機，尤指一種批次式濕法蝕刻清洗裝置及批次式濕法蝕刻清洗方法。該批次式濕法蝕刻清洗裝置具有向下層流流場以及向上溢流層流流場，在清洗程序前期先以向下層流流場快速的將殘酸均勻的流動，用以清洗晶圓上一向難以清洗的結構死角，且清洗程序後期以向上均勻溢流的向上溢流層流流場，將水面附著的顆粒汙染藉由溢流方式排出，確保洗淨後的晶圓的潔淨度。上述批次式濕法蝕刻清洗裝置及批次式濕法蝕刻清洗方法可避免重複實施清洗流程而耗費過大量去離子水以及花費過多清洗時間，促使廢水排放量比較傳統QDR技術減量1.8倍~2.5倍，用水量大幅度降低、減少DI造水系統的loading，均勻的層流技術可有效提高蝕刻後的清洗能力以及可使Tank內的wafer穩定不晃動，化學洗淨的效率也會提高，尤其對於薄片製程更佳。

Batch Wet Etching Rinsing Device (Downflow Overflow Rinse, DOR technology)

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Abstract

A batch wet etching rinsing device has a rinsing trough, two upper water supplying troughs, an external pipe and a discharge pump. A main trough chamber is formed in the rinsing trough. A laminar flow plate is mounted in the main trough chamber and divides the main through chamber into an upper chamber and a lower chamber. A lower overflow pipe is disposed through the rinsing trough and communicates with the lower chamber. The upper water supplying troughs are disposed outside the rinsing trough. A water supplying chamber is formed in each upper water supplying trough and communicates with main trough chamber. An upper water supplying pipe is disposed through each upper water supplying trough. The external pipe is disposed through the rising trough and communicates with the lower chamber. The discharge pump is disposed on the external pipe. The rinsing device saves deionized water to be used such that cost for rinsing wafers is lowered.

以溶膠-凝膠法製備 $BaAl_2O_4$:Eu 及其特性之研究

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摘要

本實驗製備樣品粉末之方法為溶膠-凝膠法，以三嵌段兩性共聚物F-127做為螯合劑製備鋁酸鋇($BaAl_2O_4$)與摻雜Eu之$BaAl_2O_4$之螢光粉體，最後經由X-Ray繞射分析(XRD)、掃描式電子顯微鏡(SEM)、穿透式電子顯微鏡(TEM)等材料分析及螢光光譜分析(PL)光學特性分析來探討其結構及性質。

由XRD分析結果得知利用溶膠-凝膠法於750℃以上即可合成出$BaAl_2O_4$粉末，其屬於六方晶結構，Eu摻雜之$BaAl_2O_4$均有少許雜相出現。TEM亦證實$BaAl_2O_4$為六方晶結構。PL分析中可以發現未摻雜之$BaAl_2O_4$於408 nm處有一放射波長，其激發波長約位在248 nm處，摻雜Eu之$BaAl_2O_4$在激發波長395 nm，有579、593、618、655和704 nm即Eu離子所造成之放射峰。$BaAl_2O_4$以248 nm之波長做激發可以發散出藍色之光波，但摻雜Eu之$BaAl_2O_4$以395 nm之波長做激發可以發粉紅和淡橘光。

關鍵詞：鋁酸鋇、溶膠-凝膠法、光致發光

Preparation and Characterization of $BaAl_2O_4$:Eu Phosphors by Sol-Gel Method

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Abstract

The method of preparing the samples in this experiment is the sol-gel method, using the triblock amphiphilic copolymer F-127 as chelating agent to prepare barium aluminate ($BaAl_2O_4$) and Eu-doped $BaAl_2O_4$. X-Ray diffraction analysis (XRD), scanning electron microscope (SEM), transmission electron microscope (TEM) and optical characteristic analysis such as photoluminescence spectroscopy (PL) to explore its structure and properties.

According to the XRD results, all the samples obtained are characterized with hexagonal structure and calcined at above 750℃. But with a little impurity in Eu-doped $BaAl_2O_4$. TEM analysis also confirmed that the structure of undoped and doped $BaAl_2O_4$ is hexagonal. Eu-doped $BaAl_2O_4$ of PL analysis shows that excitation at 395nm, the emission peaks at 579, 593, 618, 655 and 704nm were attributed to the transitions of Eu ion. From the CIE results, it is know that $BaAl_2O_4$ emits blue color light and Eu-doped $BaAl_2O_4$ emits pink and orange light colors.

KeyWords: $BaAl_2O_4$, sol-gel method, photoluminescence

以溶膠-凝膠法製備 $CaAl_2O_4$:Eu 及其特性之研究

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摘要

$CaAl_2O_4$之晶體結構為單斜晶，其具有高強度及高韌性等優點，可藉由摻雜稀土或過渡金屬離子擁有持久性的發光。本實驗利用溶膠-凝膠法製備$CaAl_2O_4$，研究摻雜不同濃度Eu離子與不同的煅燒溫度對粉體之特性影響。最後經由X-ray繞射分析(XRD)、掃描式電子顯微鏡(SEM)、場發射穿透式電子顯微鏡(FEG-TEM)及螢光光譜特性分析(PL)等探討其結構及光學特性。

實驗結果說明經XRD分析顯示隨著摻雜濃度愈高，會有$CaEuAl_3O_7$。由TEM分析搭配XRD分析比對，確認結構為$CaAl_2O_4$。由PL分析結果可以得知摻雜Eu之$CaAl_2O_4$以394 nm激發，在618 nm有放射波段，且經900℃煅燒、摻雜濃度10 mol%為峰值最強之條件。由CIE分析結果得知摻雜Eu之$CaAl_2O_4$在紅色及橘紅色區域發光。

關鍵詞：鋁酸鈣，溶膠-凝膠法，銪摻雜

Preparation and Characterization of $CaAl_2O_4$:Eu Phosphors by Sol-Gel Method

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Abstract

The crystal structure of $CaAl_2O_4$ is a monoclinic phase, which has the advantages of high strength and high toughness, etc. It can get persistent light emission by doped rare earth or transition metal ions. In this experiment, $CaAl_2O_4$ was prepared by sol-gel method. The effects of different concentrations of Eu ions and calcination temperature on the properties of the powder were investigated. Finally, exploring the structure and optical properties by X-Ray diffraction analysis (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM) and photoluminescence spectroscopy (PL) analysis.

The XRD results show that the peaks of $CaEuAl_3O_7$ appear with the higher doping concentration. The TEM analysis shows that it can be also confirmed is $CaAl_2O_4$ structure. Eu-doped $CaAl_2O_4$ of PL results showed that ultraviolet emission at 394 nm, and excitation at 618 nm. The best condition is 10 mol% Eu-doped $CaAl_2O_4$ at 900℃ calcination. Their peaks are in the red and orange regions.

KeyWords: $CaAl_2O_4$, sol-gel method, Eu-doped

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以溶膠-凝膠法製備 $MgAl_2O_4$: Eu 及其特性之研究

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摘要

本研究是以檸檬酸做為螯合劑，並摻雜 Eu 做為活化劑，利用溶膠-凝膠法製備 $MgAl_2O_4$ 之螢光粉體，研究了摻雜不同濃度對粉體之特性影響。研究重點包括：材料的成份設計與合成，晶粒形貌、表面型態、晶體結構及發光特性測定等。研究結果顯示，XRD 分析以 900℃ 煅燒及持溫 2 小時後，確認為 $MgAl_2O_4$ 立方尖晶石結構，摻雜 Eu 時隨著濃度提高會使繞射峰變寬，皆無雜相出現。SEM 結果顯示，粉末形態為塊狀推疊，TEM 結果顯示，晶粒緊密連接在一起，繞射圖比對後確定為 $MgAl_2O_4$ 之晶體結構。PL 結果顯示，摻雜 7.5mol% Eu 時在激發波長 395 nm 條件下，有 508、593、617、655、705 nm 等 Eu^{3+}離子所造成之放射峰，其中 617 nm($^5D_0 \rightarrow {}^7F_2$)處之放射峰值最強，而經 CIE 色度座標圖確認發紅光。

關鍵詞：$MgAl_2O_4$，溶膠-凝膠法，銪摻雜

Preparation and Characterization of $MgAl_2O_4$: Eu Phosphors by Sol-Gel Method

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Abstract

In this study, undoped and doped $MgAl_2O_4$ were prepared by sol-gel process with citric acid as chelating agent, and Eu as activator. The effects of different doping concentration on the crystal structure, morphology and photoluminescence properties were investigated. XRD analysis showed that $MgAl_2O_4$ with cubic spinel structure was obtained. There were no impurities found in Mn-doped and Eu-doped $MgAl_2O_4$ with increasing concentration. SEM results revealed that the samples have different morphology. TEM images showed that grains agglomerated with citric acid as chelating agent, and the diffraction pattern also confirmed $MgAl_2O_4$ structure. The emission peaks at 580 nm, 593 nm, 617 nm, 655 nm and 705 nm were attributed to the ($^5D_0 \rightarrow {}^7F_0$) ($^5D_0 \rightarrow {}^7F_1$), ($^5D_0 \rightarrow {}^7F_2$), ($^5D_0 \rightarrow {}^7F_3$) and ($^5D_0 \rightarrow {}^7F_4$) transitions of Eu^{3+} ion, and excitation at 395nm. The Commission Internationale de l'Eclairage (CIE) coordinates results showed that the emission color shift can be tuned from bluish to reddish by doped Eu^{3+} ion.

Key Words: $MgAl_2O_4$, sol-gel method, Eu-doped

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以溶膠-凝膠法製備 $LaAlO_3$: Eu 及其特性之研究

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摘要

發光材料大部分是藉由內部原子占據主體晶格之位置導致能量放射進而產生光，故螢光粉於材料的選擇上非常重要，而鋁酸鑭($LaAlO_3$)為一較新穎之材料，其具有良好的化學穩定性、機械耐久性及光學活性等特性，在近幾年來成為了發光材料研究重點之一。本實驗製備樣品粉末之方法為溶膠-凝膠法，以三嵌段兩性共聚物F-127做為螯合劑，再分別以硝酸鋁、硝酸鑭及硝酸銪做為$LaAlO_3$及摻雜元素Eu離子之前驅物，經製程溫度850℃、900℃煅燒後獲得$LaAlO_3$樣品粉末。最後經由X-Ray繞射分析(XRD)、掃描式電子顯微鏡(SEM)、穿透式電子顯微鏡(TEM)和發光性質量測(PL)等材料分析來探討其結構及性質。由XRD分析結果得知利用溶膠-凝膠法搭配F127為螯合劑可以合成出$LaAlO_3$。TEM之繞射圖亦證實顆粒為$LaAlO_3$之結構。CIE色度座標圖顯示摻雜Eu之樣本皆發出紅光。

關鍵詞：鋁酸鑭，溶膠-凝膠法，銪摻雜

Preparation and Characterization of $LaAlO_3$: Eu Phosphors by Sol-Gel Method

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Abstract

Most of the luminescent materials are caused by the internal atoms occupying the position of the host lattice to cause energy emission to generate light. Therefore, the selection of phosphors is very important. $LaAlO_3$ is a relatively new material. Good chemical stability, mechanical durability, optical activity and other characteristics have become one of the research focus of light-emitting materials in recent years. $LaAlO_3$ and Eu-doped $LaAlO_3$ were prepared by sol-gol process with a triblock copolymer F-127 as a chelating agent, and aluminum nitrate, lanthanum nitrate, and europium nitrate as precursors. The as-synthesized products then calcined at 850℃ and 900℃. X-Ray diffraction analysis (XRD), scanning electron microscopy (SEM), and transmission electron microscopy (TEM) and photoluminescence spectroscopy (PL) were used to characterize the microstructure and properties of the samples. According to the XRD analysis results, it is known that the crystal structure of $LaAlO_3$ which belongs to the rhombohedron in the trigonal system are obtained. The diffraction pattern of TEM also confirmed $LaAlO_3$ structure. From the CIE analysis results, it is know that Eu-doped $LaAlO_3$ emits light in the red region.

KeyWords: $LaAlO_3$, sol-gel method, Eu-doped

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添加奈米晶紅石相二氧化鈦作為有機膨脹型阻燃塗料著色劑之評估

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摘要

本實驗為有機膨脹型塗料研究之一，其實驗材料為季戊四醇(Pentaerythritol)、氰尿酸三聚氰胺(Melamine Cyanurate)、聚磷酸銨(ammonium polyphosphate)、乙酸乙脂(Ethyl acetate)、熱塑性壓克力樹脂(polymethyl methacrylate AC1119)與晶紅石相二氧化鈦(TiO_2，R-900)；在嘗試調整二氧化鈦與樹脂的比例後，以未添加二氧化鈦實驗組為例，離開火源之後會殘留餘焰，雖有燃燒剩餘之炭層保護，但仍有機率造成復燃；反之二氧化鈦比例越高，重量損失率會越高，膨脹面積也會越大。而實驗數據最為漂亮者二氧化鈦只占總體 2%，其重量損失率較低、無餘焰時間、膨脹面積較小。

Evaluation of nano Rutile-phase titania as pigments for organic intumescent fire retardant coatings

In the present study, the nano Rutile-phase titania are employed as pigments for organic intumescent fire retardant coatings (FRC). The fire-resistant effects of the coatings were evaluated accordingly. The content of the intumescent coatings comprises pentaerythritol as the carbon source, melamine cyanurate as the blowing agent, ammonium polyphosphate as catalysts where thermos-setting acrylic acid resins in ethyl acetate were used as binder. By adding nano-rutile titania as pigment and additive, the synergistic effects for the above-mentioned FRC recipe is prominent as the thickness of char-layers increased by the addition of nano Rutile-phase titania. It reveals that by adding 2 wt.% of nano Rutile-phase titania, an remarkable fire resistant effects could be reached as compared to others titania-adding recipes.

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不同樹脂/溶劑配比之膨脹型阻燃塗料的阻燃特性評估

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摘要

本研究開發高效膨脹型阻燃劑(intumenscent flame retardant, IFR)，調配適合的配方，使其兼具古蹟保護與建築防火的功能。此膨脹型阻燃塗料(intumescent flame retardant coatings)之組成包括以聚磷酸鹽(例如聚磷酸銨, ammonium polyphosphate)簡稱 APP-L 為酸源(acid donor)或催化劑(catalyst) 、以季戊四醇(pentaerythritol)簡稱 PE200S 為碳源(carbon donor or char-forming agent) 、以環保無毒的氰尿酸三聚氰胺(Melamine cyanurate)簡稱 MCA 取代傳統的三聚氰胺(Melamine)毒化物為氣源(blowing agent)、以鈦白粉(Titanium dioxide,R-900)為無機添加物(inorganic additive)與有機熱塑性壓克力樹脂(thermal plastic acryl resin)為高分子接著劑(binder)以及乙酸乙酯(Ethyl acetate)為溶劑(solvent)。

本研究將分為兩個階段，A 階段為改變樹脂重量固定酸源、碳源、氣源、無機添加物及溶劑重量。B 階段為固定樹脂比例(10%)，改變溶劑重量，固定酸源、碳源、氣源、無機添加物重量，去探討樹脂及溶劑比例對於膨脹型阻燃塗料燃燒特性之影響，結果發現樹脂的重量占整體重量 10%及溶劑重量占整體重量的 40-42.5%，有著好的阻燃特性及黏度。

關鍵詞:膨脹型阻燃塗料(intumescent flame retardant coatings)、聚磷酸銨(ammonium polyphosphate)、酸源(acid donor)、以季戊四醇(pentaerythritol)、碳源(carbon donor or char former)、氰尿酸三聚氰胺(Melamine cyanurate)、氣源(blowing agent)、鈦白粉(Titumani dioxide)、無機添加物(inorganic additive)、有機熱塑性壓克力樹脂(thermal plastic acryl resin)、高分子接著劑(binder)、乙酸乙酯(Ethyl acetate)、溶劑(solvent)

Evaluation of the flame retardant performance of intumescent flame retardant coatings with different resin/solvent ratios

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Abstract

Development of high-efficiency intumescent flame retardant in the research, formulate suitable formula to make it have both the functions of historic site protection and building fire protection. This intumescent flame retardant coatings of the composition includes 1 polyphosphate (such as ammonium polyphosphate) referred to as APP-L, it is acid donor or catalyst, used pentaerythritol (PE200S) as a carbon donor or char−forming agent, the environmentally friendly and non-toxic

melamine cyanurate referred to as MCA replaces the traditional melamine poison as the blowing agent, used titanium dioxide (R-900) to be an inorganic additive, used thermal plastic acryl resin to be a binder, used ethyl acetate to be a solvent.

This research will be divided into two stages, the A stage is to change the resin weight to fix the weight of acid donor, carbon donor, blowing agent, inorganic additives and solvent. Stage B is to fix the resin ratio (10%), change the weight of the solvent and fix the weight of acid donor, carbon donor, blowing agent and inorganic additives to explore the influence of resin and solvent ratio on the combustion characteristics of intumescent flame retardant coatings. Result was found the weight of the resin accounted for 10% of the total weight and the weight of the solvent account for 40–42.5% of the total weight, which has good flame retardant properties and viscosity.

KeyWord: Intumescent flame retardant coatings, Ammonium polyphosphate, Acid donor, Pentaerythritol, Carbon donor or Char former, Titumani dioxide, Inorganic additive, Thermal plastic acryl resin Binder, Ethyl acetate, Solvent

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三頻段摺疊天線

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摘要

本論文提出一支三頻的 MIMO 摺疊天線，在微帶線的末端增加了兩個彎曲的曲折輻射元件，以提供多個表面電流路徑並產生三重諧振，並使用 AltairFEKO 軟體進行結構分析及模擬。基板尺寸為 $36\times72\times1mm^3$ 的三頻摺疊天線。應用頻段 2.33~2.65 GHz、3.79~4.21 GHz 和 5.67~6.45 GHz。

關鍵詞：MIMO 天線、不對稱天線

Triple-Band Folded Antenna For MIMO

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Abstract

This paper proposes a triple-band folded antenna for MIMO. The triple resonant modes are created by two bent meander radiating elements added to the end of the microstrip line to provide several surface current paths. Altair FEKO software is used for structural analysis and simulation. The proposed antenna has a substrate size of $36\times72\times1mm^3$. Application frequency bands are 2.33-2.65 GHz, 3.79-4.21 GHz and 5.67-6.45 GHz.

Key words：MIMO antenna , asymmetric antenna.

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具電感性耦合元件增加增益之圓極化微帶天線

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摘要

本論文提出一支應用於RFID之圓極化天線天線，使用圓極化（circular polarization）天線作為發射(接收)時，若是用線極化作為接收(發射) ，則線極化(圓極化)的天線可以在任意方向都收到訊號，使用 Ansys HFSS軟體進行結構分析及模擬。基板尺寸為150x150x2〖 mm〗^3的圓極化天線。並利用偶極子天線正交並且項為相差90度圓極化效果。應用頻段為2.45GHz的遠距離RFID。。

關鍵詞：圓極化天線，高增益，HFSS

Circularly polarized microstrip antenna, increase gain through inductive coupling element

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Abstract

This paper proposes a circular polarization antenna for radio frequency identification (RFID). When a circular polarization antenna is used for transmitting (receiving), if linear polarization antenna is used for receiving (transmitting), then linear polarization (circular polarization) antenna can receive signals in any direction. We use Ansys HFSS software for analysis and simulations. The sizes of the proposed circularly polarized antenna are $150\times150\times2mm^3$. Two orthogonal dipole antennas are used to create 90 degrees phase difference. The application frequency band of this antenna is 2.45 GHz, and it can be used as long-distance RFID.

Key words: RFID, circular polarization antenna, High gain, HFSS

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應用於基站之雙極化狹縫陣列天線

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摘要

本研究提出一支應用於基站之陣列天線，操作頻段包含GSM(1.71~1.99GHz)、PCS(1.85~1.98GHz)、UMTS(1.71~2.17GHz)、WLAN(2.412~2.484GHz)並使用FEKO電磁模擬軟體進行結構分析及模擬，基板材質為FR4，尺寸為69x69x1mm^3的雙極化狹縫天線。天線共振的條件取決於三段式Slot-Line的總長度。基於上述內容，所提出的天線為基站應用，所以設計了雙極化的陣列天線，應用頻段為1.7GHz至2.4GHz，並利用T型接面功率分配器(T-junction power divider)將兩個相同的訊號利用50Ω的傳輸線饋入至天線。該天線在兩個極化方向上具有良好的指向性，構成陣列天線之後具有高增益且良好的效率。

關鍵詞：天線陣列，雙極化縫隙天線，基站天線

Dual-Polarization Slot Antenna Array for Base Station Application

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Abstract

This paper proposes an antenna array for base station. The operating frequency bands include GSM (1.71~1.99GHz), PCS (1.85~1.98GHz), UMTS (1.71~2.17GHz), WLAN (2.412~2.484GHz). The simulation FEKO software is used for structural analysis and simulation. The substrate of this antenna is FR4 and its size is 69×69×1mm^3 with dual-polarization slots. The resonant frequency depends on the total length of the three-stage Slot-Line. Based on the above content, in order to use this antenna for base station application, a dual-polarized array antenna is designed. The application frequency band is from 1.7GHz to 2.4GHz, and a T-junction power divider is used to divide two signals with almost equal amplitudes to feed into two antenna elements by using 50Ω transmission lines. The proposed antenna array has good directivity in two polarization directions, and has high gain and good efficiency.

Key words: antenna array, dual-polarized slot antenna, base station antenna

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具正交極化的超寬頻 MIMO 天線

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摘要

本論文使用一支應用於超寬頻的多輸入多輸出(MIMO)天線，超寬帶(UWB)天線本身有著體積小、攜帶方便、成本低等諸多優點。此天線使用了 FEKO 軟體進行研究分析，基板應用 32×32×0.8mm^{3}為大小的 FR4 板，利用正面的天線與背面的 L 形挖槽達到超寬頻應用，以正交的形式擺放而達到高隔離度的效果，並在 3.1GHz~10.6GHz 為頻段模擬應用。

關鍵詞:多輸入多輸出、超寬帶、FEKO

Ultra-wideband MIMO antenna with orthogonal polarization

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Abstract

This paper proposes a multiple-input multiple-output (MIMO) antenna applied to ultra-wideband (UWB). UWB antenna has many advantages such as small size, convenient portability, and low cost. This antenna uses FEKO software for research and analysis. The substrate uses an FR4_epoxy with a size of 32×32×0.8mm^3. The L-shaped groove on the back and antenna on the front are used to achieve ultra-wideband applications. The antennas are set with orthogonal directions to achieve high isolation results. They can be used for analog applications in the frequency range of 3.1 GHz ~ 10.6 GHz.

Key words: multiple-input multiple-output, ultra-wideband, FEKO

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應用於 WIMAX/WLAN 三頻單極天線

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摘 要

天線應用於2.4 GHz至7 GHz頻段，同時符合了WIMAX和WLAN三個工作應用頻段，單極天線具有以下優點成本低，外形小巧且易於使用製造，使用了ansys Hfss軟體做分析和模擬，主要以改變矩形環和叉條形來做研究，基板尺寸為34×18×1.6mm^3 介電係數為4.4的緊湊型三頻單極天線

關鍵詞 ： 單極天線,,WLAN/WiMAX

A Triple-Band Monopole Antenna for WLAN/WiMAX Applications

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Abstract

This paper propose an antenna used in the 2.4GHz to 7GHz frequency band. It has three frequency bands to cover WIMAX and WLAN. The monopole antenna has the advantages: low cost, small size, and easy to use and manufacture. Ansys HFSS software are used for analysis and simulation. Changing the sizes of rectangular ring and the shape of the cross bars to match the specification. The sizes of the substrate is 34×18×1.6 mm^3. The relative permittivity of the substrate is 4.4.

Keyword: Monopole Antenna ,WLAN/WiM

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半月型 GPS 圓極化微帶線單極天線

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摘要

本論文提出一種利用微帶線還有半月型天線與三角形背板接地面的 90° 的相位差，製作的 GPS 圓極化天線。並使用 FEKO 模擬軟體來進行結構分析及模擬。所使用的基板尺寸為 88×88×1.6mm^3 的 FR4 圓極化天線。應用頻段為 1.1GHz 至 1.7GHz。

關鍵詞: 圓極化、單極天線

A Half-Moon GPS Circularly Polarized Microstripline Monopole Antenna

Abstract

This paper proposes a half-moon GPS antenna by using triangular background to create 90 degrees phase difference for circular polarization. FEKO is used for structural analysis and simulation. The substrate is FR4 with sizes of 88mm×88mm×1.6mm.

Keywords: circular polarization, monopole antenna

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緊湊型寬頻共平面圓極化天線

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摘　要

本論文提出一支應用於WLAN-5GHz之圓極化天線天線，圓極化（circular polarization）天線具有對線性極化天線收發時不需考慮天線極化方向的優點，使用FEKO軟體進行結構分析及模擬。基板尺寸為20×21.8×1.6mm^3的圓極化天線。使用正交擺放的四分之一波長和二分之一波長輻射元件並且由開槽傳輸線饋入其中一隻輻射元件達成相位相差90度製造出圓極化效果。

關鍵詞：圓極化天線，共平面，FEKO

Broadband Compact CPW-Fed Circularly Polarized Square Slot Antenna for WLAN Application

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ABSTRACT

This paper proposes a circularly polarized antenna for WLAN-5GHz. The circularly polarized antenna has the advantage of not having to consider the polarization direction of the antenna when receiving and transmitting linearly polarized antennas. The FEKO software is used for structural analysis and simulation. A circularly polarized antenna has size of 20×21.8×1.6mm^3. The quarter-wave and half-wave radiating elements placed orthogonally are used and one of the radiating elements is fed by a slotted transmission line to achieve a phase difference of 90 degrees to create a circularly polarized effect.

KeyWords: circularly polarized antenna, coplanar waveguide, FEKO

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於 Si(100)基板之方向性 ZnO 奈米棒之成長條件研究

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摘要

本研究中，透過適當的腐蝕基板上的晶種層，以輔助奈米棒以方向性生長。實驗中首先在Si(100)基板上濺鍍一層ZnO薄膜作為晶種層，接著以HCl腐蝕晶種層後，再透過熱氧化CVD生長ZnO奈米棒。所成長樣品則以FE-SEM觀察其ZnO奈米棒成長表面型態。實驗結果發現經過調整腐蝕晶種層條件，成長時持溫溫度、持溫時間等參數，可以調控ZnO奈米棒垂直基板表面生長。

關鍵詞：垂直成長，氧化鋅，奈米棒，晶種層

Study of the Growth Conditions of Oriented ZnO Nanorods on Si(100) Substrate

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Abstract

In this study, the seed layer on the substrate was properly etched to assist the directional growth of ZnO nanorods. In the experiment, a layer of ZnO film was sputtered on the Si(100) substrate as the seed layer, and then the seed layer was etched by HCl, and then ZnO nanorods were grown by thermal oxidation CVD. The grown samples were investigated by FE-SEM to observe the surface morphology of ZnO nanorods. The experimental results found that after adjusting the conditions of the corrosion seed layer, the growth temperature and dwelling time during growth, the vertical growth of ZnO nanorods on the substrate surface can be controlled.

Keywords: vertical growth, ZnO, nanorod, seed layer

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$Co_XFe_{3-X}O_y$ 塊材磁性及結構性質的研究

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摘要

近年來，研究發現鈷鐵尖晶石型氧化物薄膜在短波長內有較大的磁光克爾效應，它在磁性超薄膜的磁有序、磁各向異性、層間耦合和磁性超薄膜的相變行為等方面的研究中都有重要應用。應用該系統可以自動掃描磁性樣品的磁滯曲線，從而獲得薄膜樣品矯頑力、磁各異性等方面的資料，再加上其較大的矯頑力使其成為極具競爭力的高密度磁光記錄材料。但如何在保持鈷鐵氧體飽和磁化強度適當高的同時近一步提高其矯頑力，以期獲得適合高密度資訊存儲水準的磁光讀寫特性，是目前的研究熱點。

本研究利用化學沉法製備不同比例的鈷鐵氧體粉末 $Co_xFe_{3-x}O_y$ (X =0.5～1.6)，利用 X 射線繞射實驗(XRD)、掃描電子顯微鏡(SEM)、震動樣品磁度儀(VSM)做研究分析，數據發現利用 SEM 觀測顯示，發現 $Co_{0.5}Fe_{2.5}O_y$ 呈現顆粒的結構，

但是其他樣品在高於 600℃的燒結溫度下，會呈現片狀的結構。將不同樣品做磁性分析顯示，在不同溫度燒結下 $Co_{0.5}Fe_{2.5}O_y$ 及 $Co_{0.79}Fe_{2.21}O_y$ 燒結溫度對磁性變化不大，但 $CoFe_2O_y$ 會呈現燒結溫度在 780℃與其他溫度有不一樣的磁滯曲線，具有較小的飽和磁化量，而 $Co_{1.6}Fe_{1.4}O_y$ 也呈現在 600℃有同樣的效應。

關鍵字：鈷鐵氧體，化學共沉法，磁性能，磁光克爾反應

Study on the Magnetic and Structural Properties of $Co_XFe_{3-X}O_y$Ferrite Bulks

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Abstract

In recent years, it has been found that spinel of cobalt ferrite oxide film has a large magnetic optic Kerr effect at short wavelengths, which has important uses in the study of magnetic order of magnetic super thin films, magnetic anisotropy, interlayer coupling and phase change behavior of magnetic super thin films. The application of the system can automatically scan the magnetic sample hysteresis curve, thus obtaining the coercivity of thin films, magnetic anisotropy and other information, coupled with its largest coercivity force to make it a highly competitive high-density magnetic recording material. However, how to keep the saturation magnetization intensity of the cobalt ferrite at the same time to further improve its coercivity, in order to obtain suitable for high-density information storage level of magnetic optical reading and writing characteristics, is currently a hot topic of research.

In this study, different proportions of cobalt ferrite powder were prepared by chemical sinking method. $Co_xFe_{3-x}O_y$ (x-o. 5 to 1. 6), using X-ray winding experiment (XRD), scanning electron microscope (SEM), vibration sample magnetometer (VSM) for research and analysis, data found. Using SEM observations, the structure of the particles presented by $Co_{0.5}Fe_{2.5}O_y$ was found. However, other samples will exhibit a flaky structure at sintered temperatures above six hundred degrees Centigrade. Magnetic analysis of different samples shows that under different temperature sintering. $Co_{0.5}Fe_{2.5}O_y$ and $Co_{0.79}Fe_{2.21}O_y$ sintering temperatures do not change under magnetic hysteresis curves. But $CoFe_2O_y$ will show sintering temperatures at seven hundred eight degrees Centigrade that are different from other temperatures. The hysteresis curve has a smaller amount of

saturation magnetization, while $Co_{1.6}Fe_{1.4}O_y$ is also present. The same effect is the same at six hundred degrees Centigrade.

Keywords: Cobalt ferrite, Chemical precipitation method, Magnetic energy, Magnetic optic Kerr effect