行政院所屬各機關因公出國人員出國報告書

（出國類別．考察）

赴日考察薄膜製鍍技術
暨參加國際研討會

服務機關：行政院國家科學委員會精密儀器發展中心

出國人　：吳美芳 助理研究員

出國地點　日本

出國日期．九十年十一月八日至十一月十六日

報告日期．九十年十二月二十八日

行政院研考會/省（市）研考會
編號欄
I0/C09100252

系統識別號 C09100252

公 務 出 國 報 告 提 要

頁數 26 含附件 是

報告名稱

赴日考察薄膜鍍製技術及參加國際研討會

主辦機關

行政院國家科學委員會精密儀器發展中心

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出國類別 考察

出國地區 日本

出國期間 民國90年11月08日-民國90年11月16日

報告日期 民國91年01月21日

分類號/目 I0／綜合（科學類） I0／綜合（科學類）

關鍵詞 真空儀器,DWDM TFT-LCD OLED,真空

內容摘要 此次訪察行程共計九天，主要目的爲訪察真空鍍膜及設備技術發展現況及參加國際奈米薄膜及元件會議以掌握最新奈米科技發展現況，造訪以製作DWDM鍍膜設備而聞名的Shimadzu/Norkido儀器製造商、以及在真空界已具相當歷史的日本真空(ULVAC)公司以訪查其專業的TFT-LCD和OLED鍍膜技術及所開發的儀器設備，與其研發人員探討相關鍍膜問題及技術合作討論，最後參加了 年 度的奈米級薄膜及元件會議，至今已是第十七屆，今年於AIST的研發中心舉行，此行收穫相當豐碩 精密儀器發展中心致力於真空鍍膜技術已有多年歷史，並且在奈米科技所需技術能量也近趨完備，以此爲基礎必可在此範疇 展長才，藉由與國際學者進行研討並加強技術交流，

本文電子檔已上傳至出國報告資訊網

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壹、前言

近幾年來國內光電產業突飛猛進，已成為我國最耀眼的明星產業，為國家帶來莫大的產值。而光電產業相關元件亦正快速地往輕、薄、短、小之方向發展，在此需求下，薄膜製鍍技術及真空系統技術即佔舉足輕重之地位，因此即時掌握世界先進鍍膜技術及真空系統發展現況將是帶動國內相關研究與技術發展之重要關鍵。

精密儀器發展中心以累積多年之真空及薄膜製鍍技術為基礎，配合中心光學遙測技術、微系統技術長期發展的需求而不斷精進鍍膜系統設備及鍍膜技術。目前光學遙測計畫中規劃長期目標為高解析度光電遙測酬載研製，此目標之達成，有賴光學計算、適合遙測酬載之光學薄膜製鍍技術及以光學元件之逐一檢測等等諸多技術經驗之累積，而光電產業之相關技術及設備的研製與開發已為世界各國競相發展的重要項目之一，其中即包含各種鍍膜技術及設備開發。

本中心為求長期目標之順利達成，同時為提昇真空鍍膜技術及真空系統水準，並掌握國際真空儀器發展趨勢，以作為中心計畫執行基礎及未來我國光電產業技術發展之依據，指派同

仁赴日本考察薄膜製鍍技術及真空設備發展現況並參加國際奈米表面研討會以利中心計畫之推行。

貳、目的

每年由國際科技及工業學會(National Institute of Advanced Industrial Science and Technology)所舉辦之學術研討會今年主題 Atomic-scale surface designing for functional low-dimensional materials，今年擇定於日本舉行，所有與會之論文將發刊登於 Surface Science 國際期刊中。而今年會議主題著重在於奈米尺寸之材料、薄膜表面特性分析以及奈米元件之設計。此範疇同時也是我國科技發展重點之一，故擬參加此國際研討會議以了解前該領域之最新發展現況並集思廣益，以為未來開發薄膜製程及元件設計應用之參考。

有機激發光二極體在光電產業中之光源應用已是炙手可熱，應用層面非常廣闊，目前仍有許多研發瓶頸待突破，精密儀器中心累積多年之真空及鍍膜技術，具有極大之技術優勢。位於日本橫濱之日本真空公司為 OLED in-line 設備專業研發製造廠商，目前市場佔有率高達 70%以上，擬訪察該公司之研發部門以及生產單位，以利未來中心開發更先進之製程技術及設備之借鏡。

TFT-LCD 為新生代的明星光電產業，其中之鍍膜技術及設

備已發展至 in-line 自動控制，擬拜訪以 TFT-LCD 之 in-line sputtering 機台聞名之日本真空公司，訪查其鍍膜技術及機台細部設計，此公司所生產之設備品質卓越，市場佔有率高達 80%以上。藉由其經驗分享，有助於未來中心開發相關技術之執行。

光電產業之另一技術重點為寬頻光通訊系統需求之 DWDM，其中鍍膜品質更是技術重點，影響產品良率極大。位於日本東京之 Shimadzu 公司與英商 NORKIDO 合作開發之 Nordiko 3400 gap broad ion beam deposition system 極適合用於 GMR 磁性記憶體儲存裝置及光通訊 DWDM 薄膜製鍍。探訪擬打入光電市場之 Shimadzu 公司，了解其薄膜製鍍技術及設備設計重點，有利於中心開發相關技術進行。

參、過程

行程表

九十年十一月八日 ~ 十一月十六日共計九天

日 期	行 程	工 作 內 容	天 次
11/8(四)	台北→東京 Taipei → Tokyo	啟程/安排住宿	1
11/9(五)	東京 Tokyo	考察 SHIMADZU Crop. DWDM 薄膜技術及設備	2
11/10(六)	東京	撰寫報告	3
11/11(日)	東京橫濱	搭車/資料準備	4
11/12(一)	橫濱	考察 ULVAC Crop. OLED 製程技術及設備	5
11/13(二)	橫濱→東京	考察 ULVAC Crop. TFT-LCD 製程技術及設備	6
11/14(三)	東京	奈米薄膜表面及元件會議	7
11/15(四)	東京	奈米薄膜表面及元件會議	8
11/16(五)	東京→台北	回　　程	9

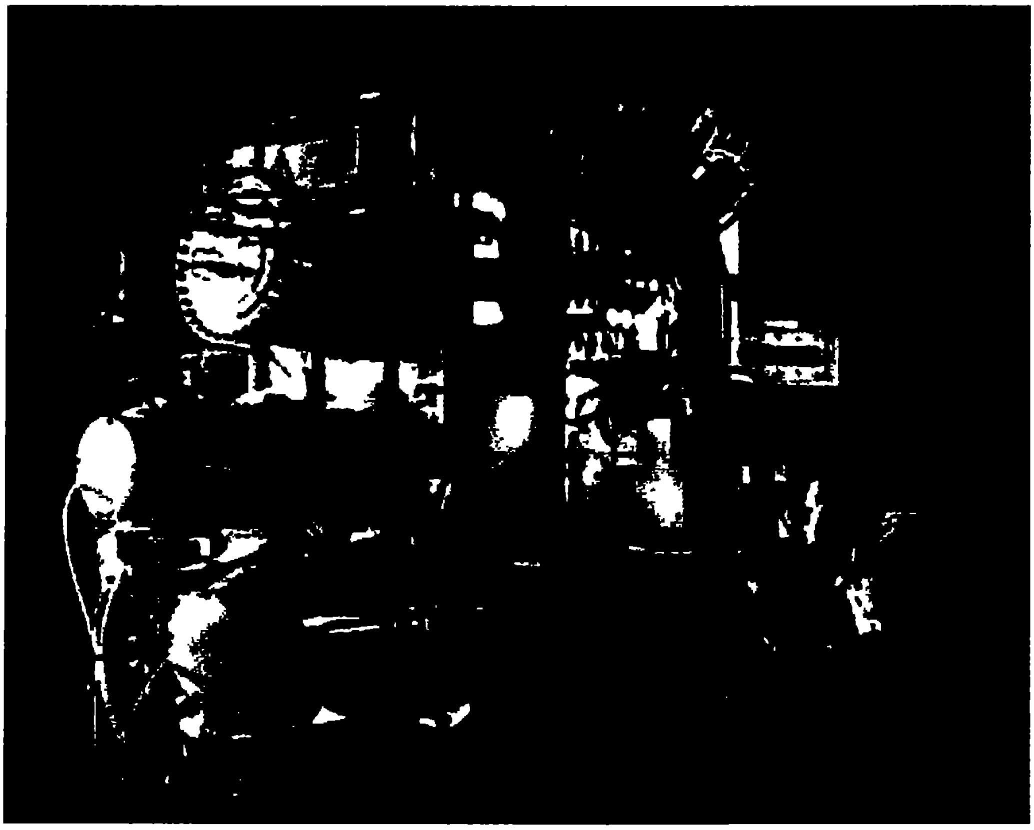
(一)　考察 Shimadzu 公司 DWDM 薄膜技術及設備

日期：九十年十一月九日（星期五）

首程前往位於東京的 Shimadzu 公司，該公司於去年併購英國之設備製造大廠 Nordiko 公司，並接手該公司之精密鍍膜儀器設備製造之業務。Nordiko 公司發展專業直流、交流濺鍍及離子鍍膜、蝕刻設備已達三十年之累積經驗(since 1972)，該公司之主力產品皆為工業用量產型鍍膜機台，包含有製程系統 3000、7000、9000 系列。其中 3000 系列鍍膜機型為離子束鍍膜系統，對於 GMR、TMR、自旋閥及介電材料有非常優異的製鍍能力，7000 系列之鍍膜機台為一具有五個 process 功能複合型機台(PVD、ion milling, sputter etch, annealing)，至於 9000 系列則是針對 8” 製程一系列之 in line 系統，可提供 ion beam etch, single species deposition, multiple target deposition & ion assisted PVD 等製程需求。目前該公司在國外市場佔有率正急速上升，國內亦由新竹科學園區廠商購買進行第一套系統組裝中。而該公司目前最彰顯的技術在於應用該公司之 3000 系列離子束鍍膜機台製鍍 DWDM (Dense Wavelength Division Multiplexing)薄膜元件。

此次參觀訪問之重點即在於參訪該公司之 3400 光學鍍膜

機台之 DWDM 製程鍍膜技術，並在 Sımadzu 公司之應用工程師帶領下與該公司技術團隊進行交流討論。



首先由 Keikı Fukumoto 博士簡述該公司之 3400 系列鍍膜設備之設計原理，該設備原先係針對製鍍高密度之 GMR 儲存裝置之用途進行設計，但自兩年前開始全球掀起一片 DWDM 光學鍍膜熱潮之際，3400 系列亦被看好能在此範疇一展長才。3400 精密光學鍍膜機台備如上圖所示，系統之心臟為兩隻 RF type 離子槍，其中以一隻 15cm 寬離子束用來鍍膜，而另一 25cm 寬離子束則用來作為基板之清潔及離子輔助鍍膜，藉由此廣角度之離

子輔助，鍍膜時之膜厚均勻性問題將可同時獲得改善。系統可容納的基板尺寸最大可到直徑 12”，並提供可傾斜任意角度及極高速旋轉以及極小之振動的基板夾具功能。此對於製鍍良率不高的 DWDM 薄膜而言，提供了關鍵性的大面積均勻性的一大優點，再加上基板角度可任意調整，可製鍍特殊需求之大面積光學薄膜，屬功能性極強的設計。該研究團隊在市場離子源大廠滿佈的情況下，自行研發出均勻性且穩定性極高的 RF type 離子源，創造出新的商業契機，此等研究精神著實令人感佩，而根據 Keiki Fukumoto 的敘述，原廠公司現有員工僅約三百人，在人力有限情況下協力完成設備研發工作。公司在研發此光學鍍膜系統過程中並且同時申請到六項研發專利，事實上也已成為公司的一大資產。職並利用機會與其討論 3400 系列機台的限制以及其用做他方面鍍膜的可能性，該公司產品的效能評估請參考附件資料。

（二） 考察ULVAC Crop. OLED製程技術及設備

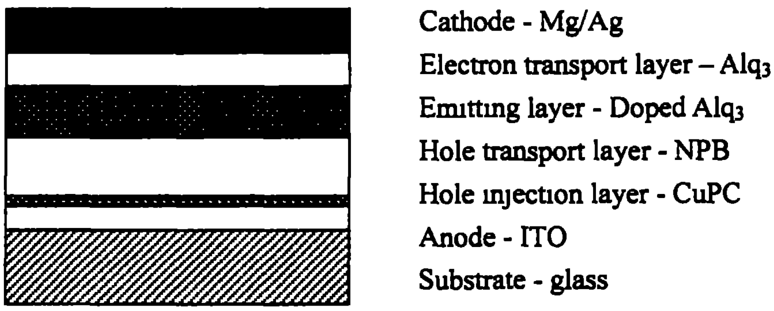
日期：九十年十一月十一日(星期一)

在真空界一向頗具盛名之日本真空(ULVAC)公司，成立於1952年，是由日本多家著名產業集團合資並結合當時真空學菁英所共同組成。是真空幫浦及真空鍍膜設備的專業製造商。日真公司累積多年的研發經驗，成立多元化的生產事業部，在真空幫浦方面，包括各式機械幫浦、渦輪分子幫浦、冷凍幫浦、抽氣平台、測漏儀以及各種相關的零組件皆由日真公司自行開發生產；在設備方面，舉凡各種半導體產業相關設備、平面顯示器鍍膜設備、以及各新興光電產業相關設備皆在該公司的研發生產範疇內，行銷全球，而該公司的產品市場佔有率擴展極為快速。

當日行程前往日真公司位於新橫濱工業區內的技術開發部門，主要參訪該公司所研發的有機光激發光二極體(OLED)連續鍍膜設備並進行鍍膜相關技術討論。首先由海外事業部門的Mr. Morikawa接待並簡單介紹該公司的產品項目以及在日本各地的生產、研發單位，除了真空鍍膜相關儀器之外，ULVAC 尚有自行生產高純鍍濺鍍靶材、Auger表面元素分析儀、XPS表面分析設備、SIMS以及橢圓偏光儀等分析儀器的研製，至此真是

見識到 ULVAC 產品的多元化。

接著在應用工程師 Uchida 博士的帶領下，現場參觀 OLED 製程相關設備，並解說各系統之設計、製造、組裝等生產流程。高亮度的 OLED 元件之基本膜層結構如下圖所示：



而目前 OLED 主要的困難在於發光壽命不夠持久以及材料的選擇以控制色彩及發光效率不易，尚屬具有相當研發價值及產業價值極高的領域，為此 ULVAC 針對各式不同需求設計了不同設備，包括有實驗室研發用之中小型蒸鍍機、產業用的 multi-chamber 組合式機台以及有機材料純化系統等設備，所有的配件皆由 ULVAC 自行生產。Uchida 博士提到，一般 OLED 的製作流程首先是基板前處理，接著送入 multichamber 進行電洞注入層、電洞傳輸層、發光層、電子傳輸層乃至電極的製作，最後送入手套箱進行封裝的工作，而其中 ULVAC 的主力產品正是 multichamber 鍍膜系統的製作，內部的機械結構設計要求非

常之高以達自動化控制的需要。大至而言，OLED 的鍍膜流程並不十分複雜，主要是有機材料以及金屬電極的蒸鍍，而膜層結構也看似簡單，但實際上的成品卻常常是良率不高。ULVAC 公司並且成立研究所進行 OLED 技術研發，腳踏實地的隨時在尋求新技術突破的可能，並且 ULVAC 提供大量的設備資源及經費予學校單位進行研究，以期望能培植出更多高科技人才並進行合作研究，值得台灣的產業界多多效法。

(三) 考察 ULVAC Crop. TFT-LCD 製程技術及設備

ULVAC 公司亦投注非常多的心力於薄膜液晶顯示器(TFT-LCD)技術研發且已展現相當不錯的成果，該公司並且成立”超材料研究所 ”專門進行 TFT-LCD、ITO 透明導電薄膜技術研發工作，顯見該公司雖然有廣泛的事業部門同時在開發中，但是對於每一部份都相當用心經營。在日本顯示器技術發展快速的同時，我國在 TFT-LCD 產業方面也已漸趨技術穩定，目前該公司的 TFT-LCD 連續濺鍍機台在日本及台灣的市場佔有率極高，幾乎 80%以上的顯示器廠家所使用鍍膜設備是由 ULVAC 所生產組裝提供，其設備之性能優異備受青睞程度由此可見一般。

此行前往千葉超材料研究所參訪該公司之工業用 InLine Sputterıng System SDP-850V TFT-LCD 專用濺鍍系統並討論鍍膜相關技術以及目前顯示器市場的發展動態。該公司國際銷售主管 Mr. Fukıdome 在簡報中提及目前日本的顯示器發展狀況，如何往更大面積、輕薄、低耗電率、視角廣、彩度不失真是開發次世代顯示器的目標，目前不少公司已有以塑膠作為基板的大尺寸顯示器誕生，這種螢幕輕薄如紙張，可以任意捲動隨身攜帶，兼具環保與便利性，在從前很難想像會實現

的科技現在已然展現在眼前，科技的進展著實令人心振奮，無怪乎研發工作如此令人執著。接著在 Fukidome 先生帶領下前往該研究所實驗室內參觀 inline sputtering 系統，系統的各部份機械設計圖請參考附件資料，此產業用 inline 濺鍍機台著實非常龐大，超大型玻璃基板以精密的輸送帶平穩低隨著鍍膜的流程運送，直至成品完成後才送出機台，是一套整合非常完整的系統。一般 LCD 的濺鍍流程中包括玻璃基板前處理、金屬導電層及閘極層(Al, Alloy, Mo, Cr, Ti, Mo Alloy 等材料)、像素(poly-ITO, amorphous-ITO, IDIXO 等材料)、透明導電層 ITO/CF、Black matrix film、PDP 及太陽能電池所需的保護層(SnO_2, ZnO 等材料)等膜層的製鍍，而這些都可在 ULVAC 的 inline sputtering 機台真空環境中連續完成而不會曝露在大氣中，大幅提昇產品的品質。該公司最特殊的設計在於運送機構，玻璃基板係直立運送，基板加熱器設計於運送機構軸承上隨基板一起移動，可達全程穩定的溫控，加熱器兩面皆可放上基板雙面鍍膜，也就是說同一個製程時間但可有兩倍的成品產出，真可謂事半功倍的設計，此項技術突破滿足了產業界對於大量量產的需求，而 ULVAC 公司於此亦獲得多國專利認證。職與 Fukidome 先生說明目前中心現有鍍膜設備以及進行中之光

學薄膜研製計劃，他則興沖沖的的說希望有機會能到中心來拜訪，職亦希望能有機會為其介紹中心實驗室。

(四)參加國際研討會：Atomic-scale surface designing for functional low-dimensional materials

日期：九十年十一月十四日(三)~九十年十一月十五日(四)

地點：National Institute of Advanced Industrial Science and Technology(AIST), Tsukuba Central, Japan

每年由國際科技工業學會（National Institute of Advanced Industrial Science and Technology，簡稱AIST）邀集國際產學界相關人士所舉辦之國際性學術研討會至今已是第十七屆，議程由十一月十四日(三)~十一月十六日(五)，今年研討會主題為Atomic-scale surface designing for functional low-dimensional materials，會議於日本東京近郊之AIST Tsukuba Central舉行，所有在會場中發表之論文將全文刊登於Surface Science國際期刊中，足見該國際會議具有相當不錯的水準。奈米科技儼然已成為21世紀科技發展指標之一，今年會議議程著重在於奈米尺寸之材料、薄膜表面特性分析以及奈米元件之設計，細分為八個子題同時進行口頭論文發表及壁報論文展示，八大子題區分為：a、表面奈米物理(surface nanophysics) b、奈米電子(nanoelectronics) c、奈米磁性(nanomagnetism) d、表面分子電性(surface molecular electronics) e、表面新材料特性及理論(surface new materials, synthesis and properties) f、催化及電化學(catalysis and electrochemistry) g、新穎科技(novel techniques)，職將重點放在與奈米表面檢測及奈米薄膜材料特性上，希望獲得最新資訊以供中心同仁參考，以下將就會議內容簡單節錄重點。

會議全程由奈米科技大師 Hiroshi Tochihara 博士擔任議程主持人，議程內容安排請參考附件資料，十一月十四日開場的大會演講邀請到表面分析專家 Wolf-DieterSchneider 博士作一場演說，講題為"Scanning tunneling microscopy and spectroscopy of nanostructures"，精闢低說明掃瞄穿遂式顯微鏡(STM)在奈米科技中的強大功用，藉由 STM 檢測可確實掌握奈米級薄膜之原子結構及元件內部結構，是奈米科技發展所不可或缺的檢測重要利器之一，而 TEM 機台亦正是中心未來發展奈米相關技術所規劃中欲添購設備之一。

緊接著由 AIST 機構內的 Masatake Haruta 博士所提出之低溫製程成長奈米粒子之機制，採用 CO 氧化製程方法成長奈米粒子於二氧化鈦基板上，非常富有科學創意。以及由 Zhong-Qun Tian 博士所發表之論文中，探討最先進的金屬奈米管技術

(nanotubes)及表面科學的一些爭議性問題，並對未來趨勢發展提出看法，這些科技進展尚有許多理論根據需要建立起來，再加上可實用性的爭議，確實需要理論、實驗專家以及產業界共同努力以求突破性進展，而絕非獨力所能夠完成之事。至於Flemming Besenbacher 博士則提出在銅表面製造出奈米結構的方法，是一篇相當值得參考的論文。另外，當天亦有近百篇針對表面檢測、奈米結構分析以及表面電性分析以及理論模擬的相關論文以 poster 的方式發表，會場中所有的學者對於感興趣的論文都紛紛提出意見交換，場面十分熱絡，足見各專家對於所學領域的熱衷及執著的精神。

十一月十五日(四)的開場由東京大學的 Masaru Tsukada 教授進行演說，提出該實驗室如何以原子力顯微鏡(Atomic Force Microscopy)檢測特殊奈米材料的表面特性並進一步加以控制其性質，論文內容非常有趣。AFM 表面檢測亦是奈米表面檢測的利器之一，與 TEM 相較之下，AFM 具有不需抽真空，週邊配備要求少的使用便利性，除可得到表面狀況之外，可搭配不同的探針設計而做為電性、磁性等物理特性的檢測之用，與巨觀觀點相較，當各種分析降至奈米尺度時，材料會展現出截然不同而令人感到驚奇的特性，也因此使得奈米科技有如此

大的魅力令人想一探究竟。中心目前已具有性能非常優秀的AFM 奈米表面檢測實驗室，建立在目前現有技術上，相信在奈米科技發展舞台上必可有相當多元化的成果。今日議程重點在於薄膜表面電性、磁性的相關理論及實驗進行探討，由理論學者 Han Woong Yeom 教授提出矽晶片之自我組織(self-organized) 現象形成原子鏈所產生的特殊電子結構理論模型，並以實際表面電性量測來加以驗證。隨後並有幾篇論文口頭發表皆是針對奈米薄膜表面行為作進一步探討，其中令職倍感印象深刻的是由Fumio Komori博士所發表的表面磁性行為，他的研究團隊在銅(Cu)的(001)晶格面上低溫成長奈米點矩陣進而量測該奈米結構的鐵磁性質特性，非常有趣的想法。而今日亦有近百篇相關領域論文以壁報形式發表。

參加此次國際會議後令職深感收獲許多，雖然最後一天的會議內容由於行程的關係而無法參加，但兩天參與會議內容並與各界學者接觸之下，最大的心得是新科技需要極具創意的思考再加上不怕嘗試失敗的決心以克服技術瓶頸，尤其是在未來尚有許多發展空間的奈米科技而言更是如此!科學發展日新月異，沒有任何事情是絕對不可能的。另外，中心之現有奈米科技相關技術能量已漸趨完備，且已有相當不錯的水準，相信建

構在現有技術上，投注心力在此長期發展且極具有研究及產業價值的研究領域上，相信很快便能有所成，技術層面將可直追國際上大廠所做之研究。

肆、達成之任務

此次赴日考察主要目的為訪察真空相關產業鍍膜技術及儀器設備發展現況並參加國際性 Atomic-scale surface designing for functional low-dimensional materials 研討會，藉由參訪知名廠商，實地瞭解儀器設備開發過程及鍍膜技術的改良，更能掌握相關光電產業之技術能量與發展趨勢；並透過與研究機構人員的相互討論，加強雙方技術交流。茲將此次考所達成的任概述如下：

一、瞭解著名 DWDM 儀器設備廠商之鍍膜設備及技術

此行參訪發現自行開發出大型設備實屬浩大工程，而開發鍍膜要求極高之 DWDM 鍍膜用設備，除要求大面積、膜厚均勻性高、應力小、膜厚度控制準確度低於 nm 等級，而 sumadzu 公司自行開發之鍍膜設備最大特點在於自行研發離子源的設計，性能優異的離子源搭配系統完美整合，展現出極佳的鍍膜品質。與其討論相關技術，了解系統開發的技術瓶頸及流程，以供中心開發大型設備之參考。

二、觀摩 OLED 設備製造商研發實驗室，討論相關鍍膜技術及設

備問題

有機激發光二極體在光電產業中之光源應用已是炙手可熱，應用層面非常廣闊，直至目前仍有許多研發瓶頸待突破，累積多年之真空及鍍膜技術，具有極大之技術優勢。參訪位於日本橫濱之日本真空公司之研發部門以考察其 OLED 鍍膜設備，與該公司研發人員討論蒸鍍技術及技術瓶頸，並收集相關資料，作為未來中心開發先進光電相關製程技術及設備之借鏡。

三、觀摩 TFT-LCD 設備製造商研發實驗室，討論相關鍍膜技術及設備問題

TFT-LCD 為新生代的明星光電產業，其中之鍍膜技術及設備已發展至 in-line 自動控制，擬拜訪以 TFT-LCD 之 in-line sputtering 機台聞名之日本真空公司，訪查其鍍膜技術及機台細部設計，此公司所生產之設備品質卓越，市場佔有率高達 80%以上。藉由其經驗分享，提昇未來中心開發相關產品之鍍膜及設備技術。

四、參加國際研討吸取最新技術動態、與他國研究人員進行學

術交流

本屆由 AIST 所舉辦之國際學術研討會，有來自世界各地的科學家及工程師與會針對奈米科技發表論文，所有的論文隨後將刊登於 Surface Science 國際期刊中。會議主題著重在於奈米尺寸之材料、薄膜表面特性分析以及奈米元件之設計。此範疇同時也是我國科技發展重點之一，職參加此國際研討會議與許多研究人員提出問題討論並分享研究成果，使職深感奈米科技領域之發展迅速，可謂千變萬化，而其中尚有許多可以深入研究探討之處，值得中心投入更多人力。

伍、心得與建議

一、 在參訪各鍍膜設備製造廠家過程中，發現他們對於所生產之產品非常專業化並且對於自家產品非常有信心，這份信心來自於長年投注心力於此範疇所累積的專業知識，而中心長期持續累積下來的各項專業正是最大資產，只要秉持鍥而不捨的執著精神，相信必有相當成果。

二、 鍍膜技術或是儀器設備開發是專業技術，而且進展非常的快速，因此中心所有研究人力需時時掌握最新技術動態並隨時與其他相關單位保持技術合作以達事半功倍之效;另外對於關鍵技術應積極進行專利的申請以建構出中心獨特的技術風格。

三、在參加奈米薄膜及元件國際會議中，職深深感受到中心在奈米相關科技發展技術能量已有相當水準，以此為基礎，再整合中心研究人員以發揮個自專長，並加強現職人員技術提昇，必可在此領域有卓然表現。

四、在造訪廠商中之研發實驗室，其工作人員對於設備之理論與特性十分熟悉，並且隨時研讀相關的技術性期刊論文及資料，抱持著相當謹慎的工作態度，用最少的人力發揮極高的水準。中心在人力有限情況下，同仁亦是積極努力，發揮極高的效能，而其中執著的精神應是最大支柱。

五、與廠商訪談中，得知此些設備廠商在積極開發新產品以尋求商機及利潤的同時，不忘回饋社會並全力贊助學校以栽培後進，為國家社會項獻一份心力，此等精神值得國內產業界多加參考。

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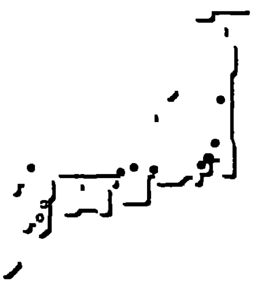

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Equipments for Multi-chamber Sputtering System

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SMD Series Product Line Up

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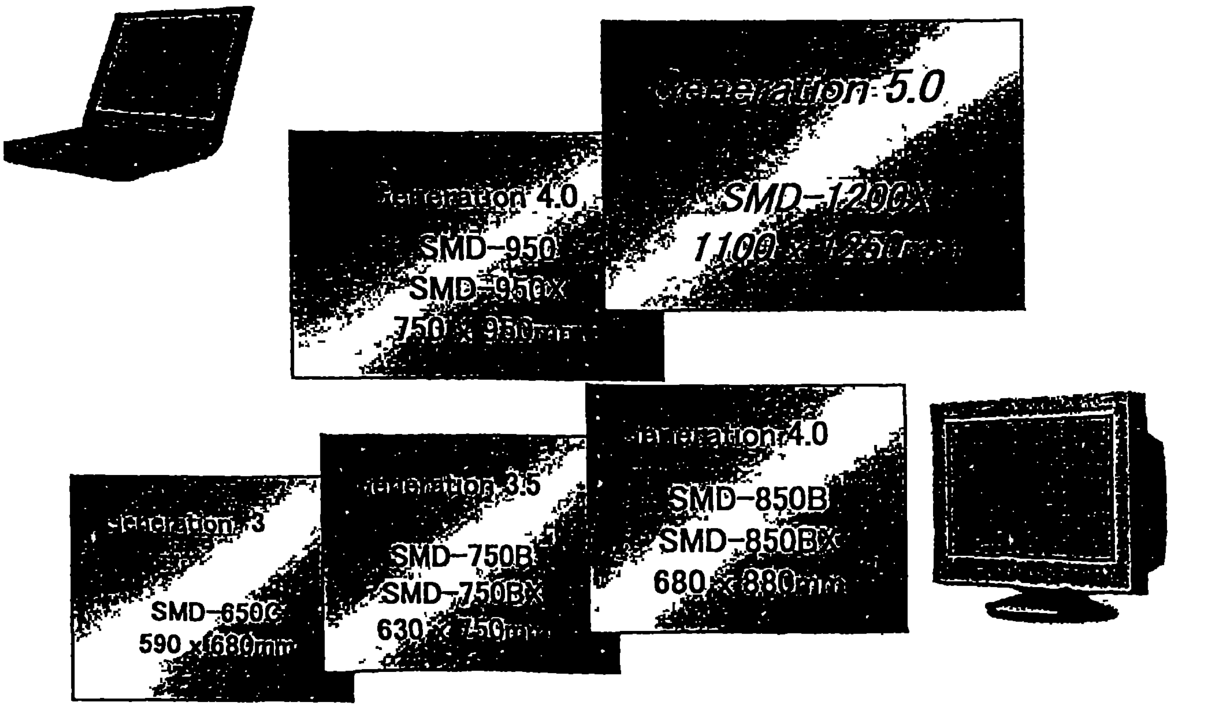

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Strategic Planning for New Sputtering System

Multi Chamber Sputtering System

SMD - 750B

Ulvac Japan Ltd.
Electronics Equipment Div.
Institute for Super Materials
99/7/29

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Experienced Process Data

"SMD" Cluster type sputtering for LCD application

1. Gate, S/D Metal
   Al, Al-Si, Al-Ta, Al-Cu, Al-Si-Cu, Al-Nd, Al-Zr
   Al-Ti-Ta, Cr, Ta, Ti, MoTa, MoW, Mo, Mo-Cr
   TaN, TiN
2. Pixel
   Poly ITO, Amorphous ITO, IDIXO
3. Other Application
   BM/CrOx, CF/ITO
   TaOx, Ni, Nb, Ag, (AgOx), Si
   SP Etching

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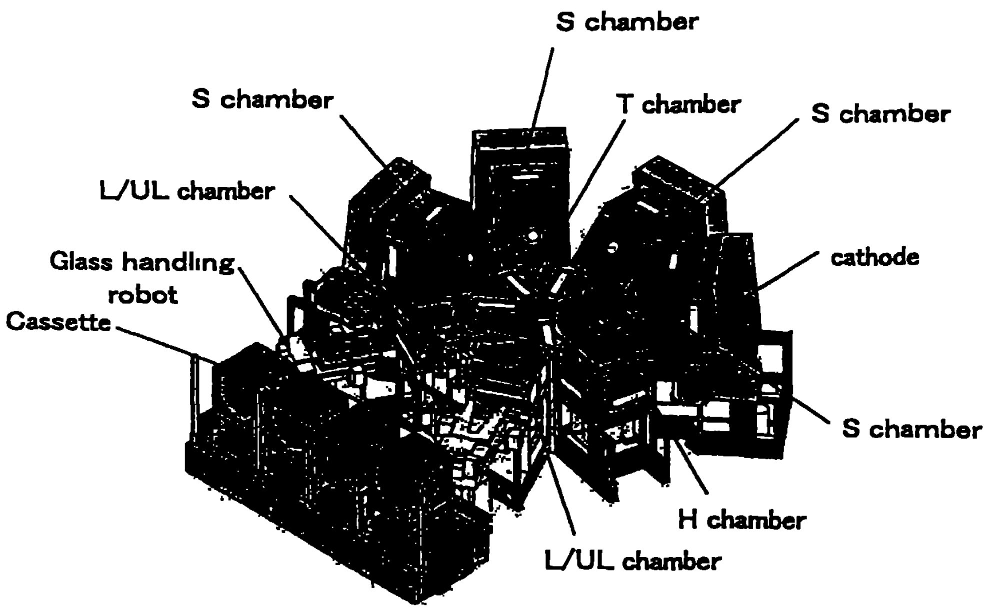
SMD-750B Side View



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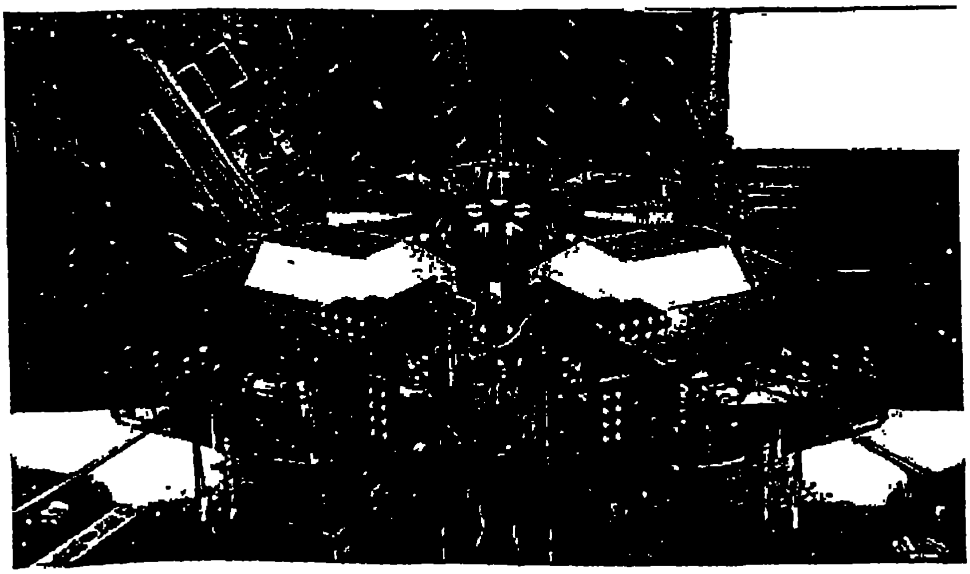
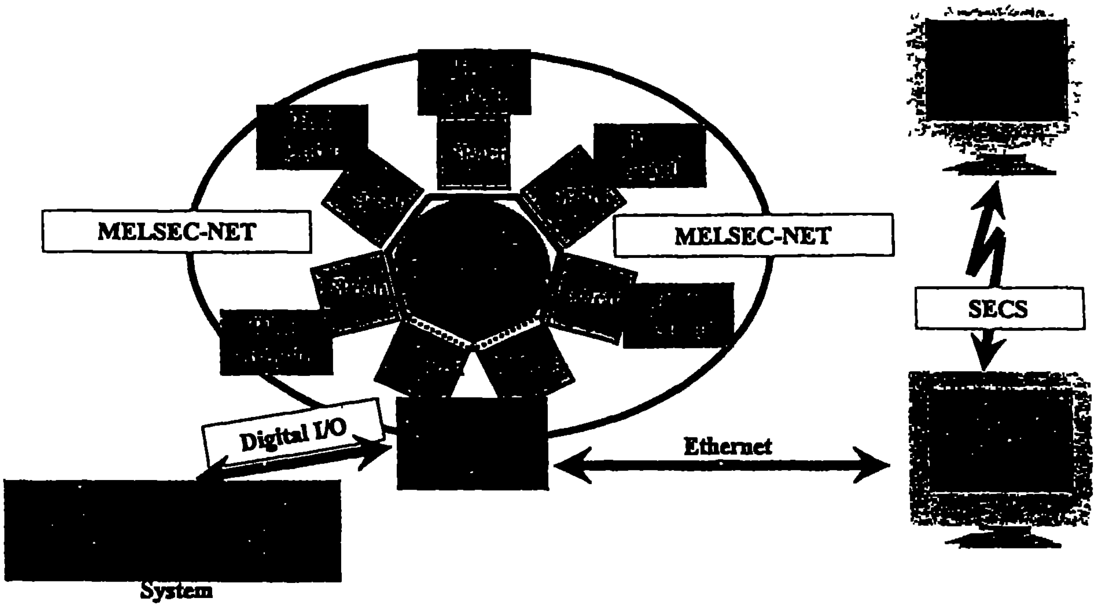
SMD-750B System Overview



Concept of SMD Control System

Cluster Based Control Architecture is applied



SMD-750B System Overview I

1. *Substrate Size*
   MAX .630×750×0.7t(mm)

2. *Throughput* *60 sec/pc*
   (ITO 100nm)
   3 Sputtering Chambers

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SMD-750B System Overview II

3. System Configuration

- *L/UL chamber × 2*
- *Heating Chamber × 1*
- *Sputtering Chamber × 3 (Max.4)*
- *Transfer Chamber × 1*
- *Cassette loader × 1*

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SMD-750B System Overview III

4. L/UL Chamber

1Stage

Small chamber size

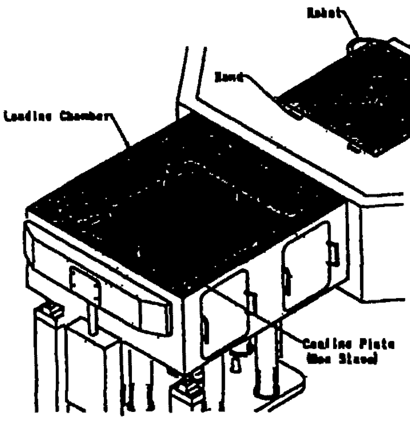
High Vacuum Pumping

Substrate Cooling Plate

5. Heating Chamber

4 stages multi-hot plate (Carbon made)

SMD-750B Loading/Unloading System



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SMD-750B System Overview III

6. Sputtering chamber

Substrate Clamping mechanism at Platen

heater

Special treatment for Depo Shields

Movable suscepter pin

By letting free suscepter pin when receiving substrate...

- *Minimize the interfare of suscepter pin and substrate*
- *Extend the life of suscepter pin*
- *Eliminate the slip of substrate on suscepter*

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SMD-750B System Overview III

7. Cathode

Side deposition

Thin Backing Plate : vacuum at back side

Active Arc Killer for ITO and Al

Magnetic circuit tilt scanning mechanism

Relieves the plasma collection on the both diagonal points on magnetic circuit, improves film thickness/ uniformity and minimize target being sputtered on one side.

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SMD-750B System Overview IV

8. Pumping System

L/UL chamber

Rough pumping line : Dry pump

High Vac pumping line :Cryo pump(Tandem Drive)

Cryo pump : Tandem Drive

SP/Transfer chamber

Cryo pump (Tr/Ch : Tandem Drive)

<<Turbo molecular pump as an option>>

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A Proposal of NEW CONCEPT Machine

SMD-X
Large Glass Substrate Sputtering System For Next Generation

ULVAC JAPAN, Ltd.
Electronics Equipment Div.1
Chiba Institute for Super Materials

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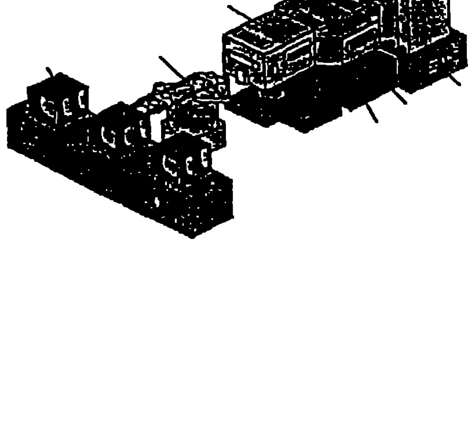
SMD-X Development Concept

In order to increase
Investment Productivity;
Low price
Small Footprint
High Throughput

New concept 3 S



Large size substrate applicable

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SMD-X Development Concept 3S

- ***SMALL***
  - *Smaller footprint*
  - *Division of investment unit / smaller unit*
  - *Simplified structure and transfer mechanism*
- ***SIMPLE***
  - *Optimization of system configuration by minimizing each process time*
  - *Multi function of chamber*
- ***SPEED***
  - *Throughput improvement*
  - *Shorter delivery, rapid set up*
  - *Shorter down time*
  - *Minimized development time*

TYPE SMD-X

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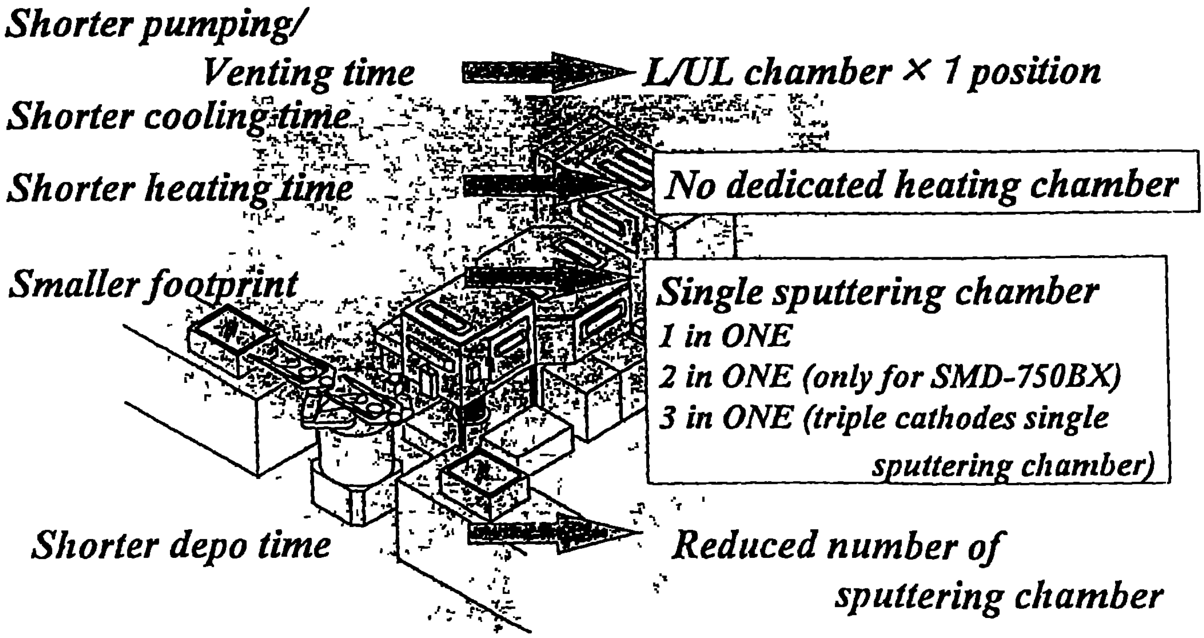
Ultimate in Vacuum since 1952

Features of SMD-X



SMD-X Line UP

SMD - 750BX
SMD - 750BX2

SMD - 850BX
SMD - 850BX3

SMD - 950X
SMD - 950X3

1. Load/Unload chamber (Heating, Cooling mechanism included)	x 1 set
2. Transfer Chamber (Vacuum transfer Robot included)	x 1 set
3. Sputter Chamber (multiple layer : Triple cathode type, Single film layer : Single cathode type)	x 1 set
4. ATM substrate transfer system (Option . Cassette or single loading)	x 1 set

Equipments for In-line Sputtering System

ULVAC SOLUTIONS

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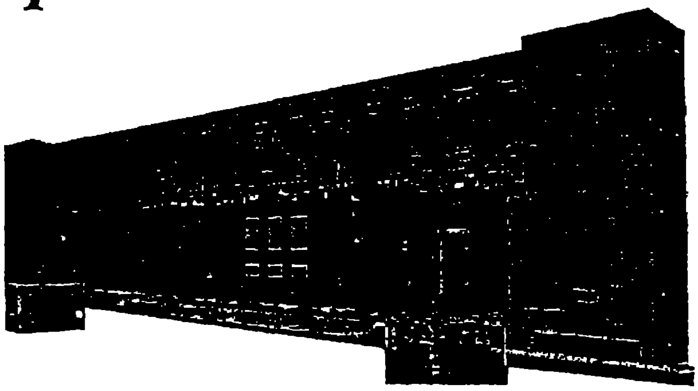
Ultimate in Vacuum since 1952

Inline Sputtering System

SDP-850VT



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Ultimate in Vacuum since 1952

SDP- Series装置特長(1)

・カラーフィルター業界　No.1の納入実績
⇒ LCD向けトータル納入実績：約131台

・信頼性の高い、搬送システム
⇒ラック＆ピニオンギヤを採用しているため、高い信頼性を実現

・メンテナンス性を考慮した装置構成
⇒メンテナンス時に真空槽内にキャリアが残らないため、清掃が容易である。

ULVAC SOLUTIONS

ULVAC
Ultimate in Vacuum since 1952

SDP- Series装置特長(2)

・容易なカソードメンテナンス機構
⇒カソード引出機構及びターゲットリフターの使用で
メンテナンス性を向上

・実績豊富な、マスク自動交換機構付き
基板移載システム
⇒アルバックでは、早くからマスクの自動交換を手がけており、
信頼性に富んだシステムを御提供出来ます。
マスク合わせ精度の向上のために、オプションにてビジョン
センサーを付けることも可能です。

ULVAC SOLUTIONS

ULVAC
Ultimate in Vacuum since 1952

SDP- Series装置特長(3)

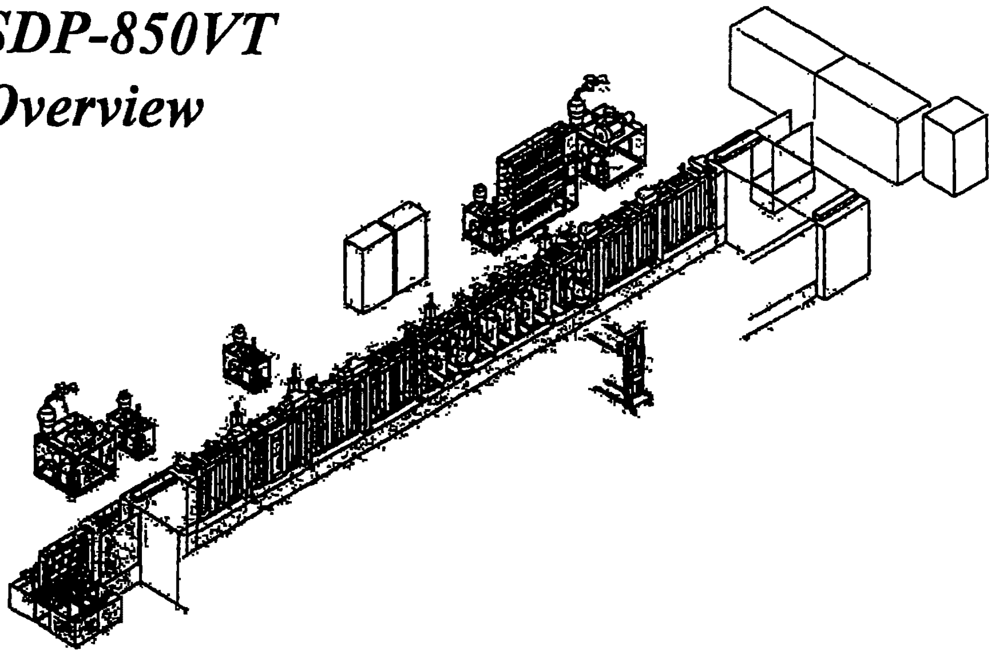
・豊富な、プロセスアプリケーション
⇒アルバックでは、プロセス開発のために、独自の開発部門を持って
おり(超材料研究所)納入前のプロセス確認から納入後のアフター
フォローまで十分な対応を行えます。

ULVAC SOLUTIONS

ULVAC
Ultimate in Vacuum since 1952

装置全体イメージ

SDP-850VT Overview



ULVAC SOLUTIONS

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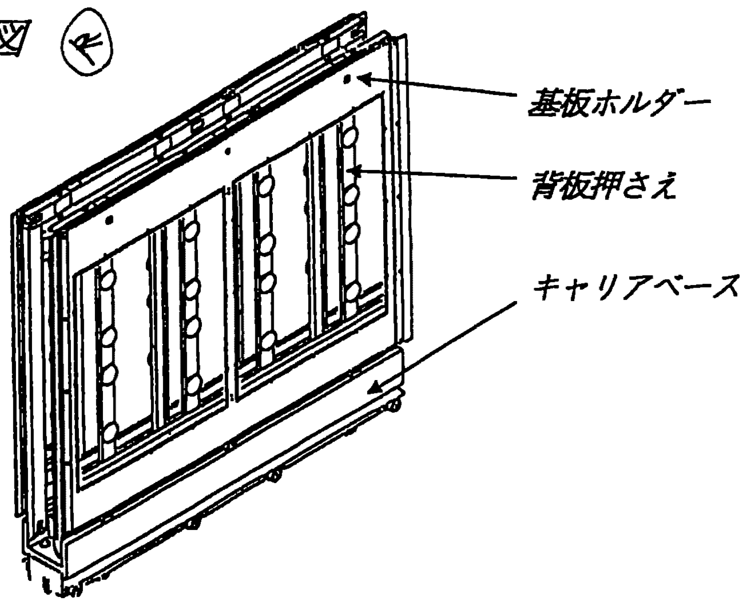
Ultimate in Vacuum since 1952

SDP- Series 搬送システム(1)

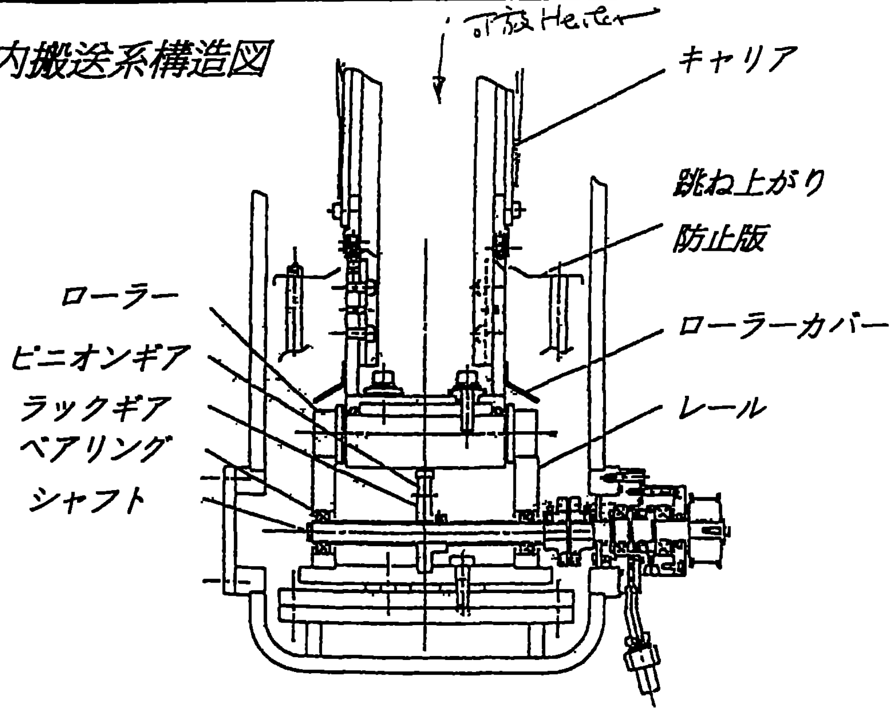
キャリア構造図



ULVAC SOLUTIONS　　ULVAC Ultimate in Vacuum since 1952

SDP- Series 搬送システム(2)

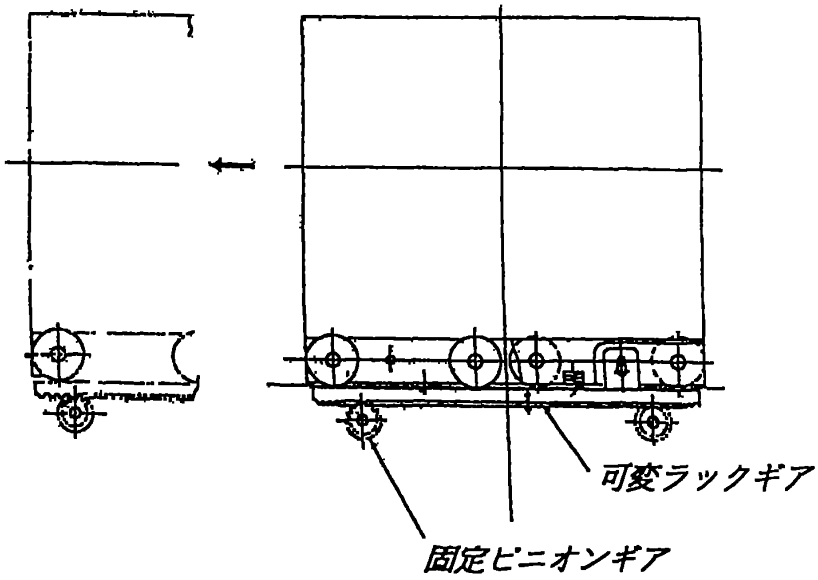
真空槽内搬送系構造図



ULVAC SOLUTIONS　　ULVAC Ultimate in Vacuum since 1952

SDP- Series 搬送システム(3)

キャリア駆動システム構造図



ULVAC SOLUTIONS

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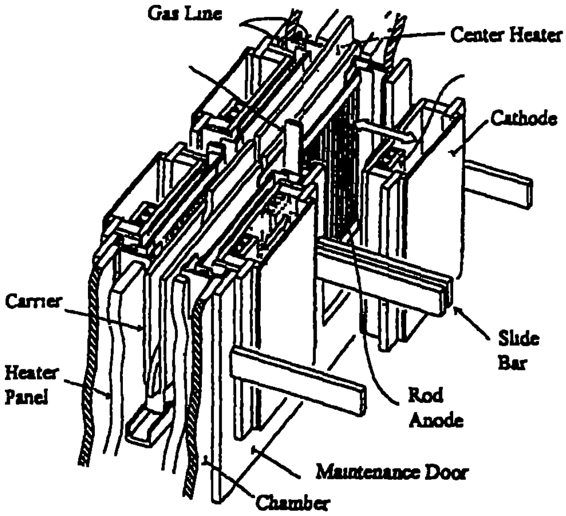
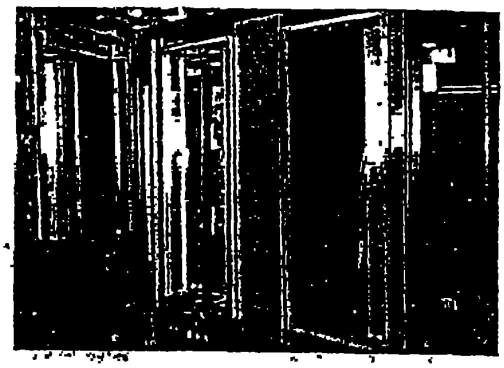
Ultimate in Vacuum since 1952

SDP- Series Cathode System





ULVAC SOLUTIONS

ULVAC
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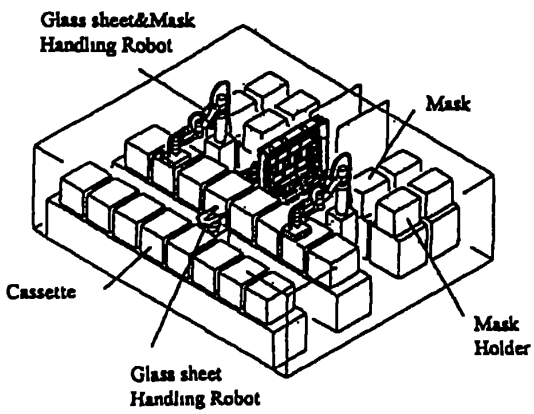
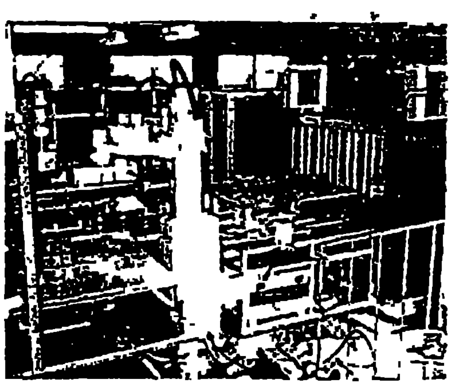
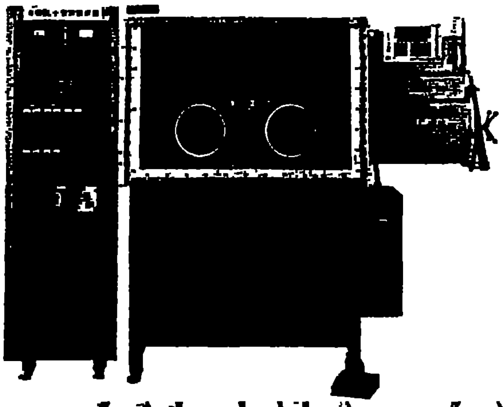
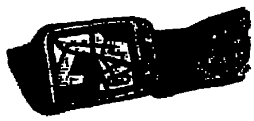
Glass sheet&Metal Mask Loading Unloading System



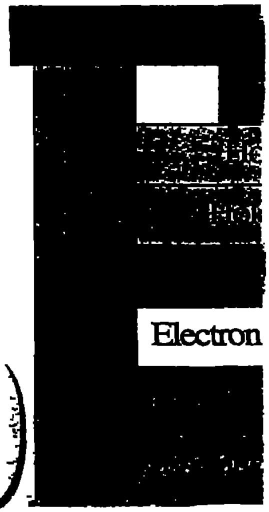


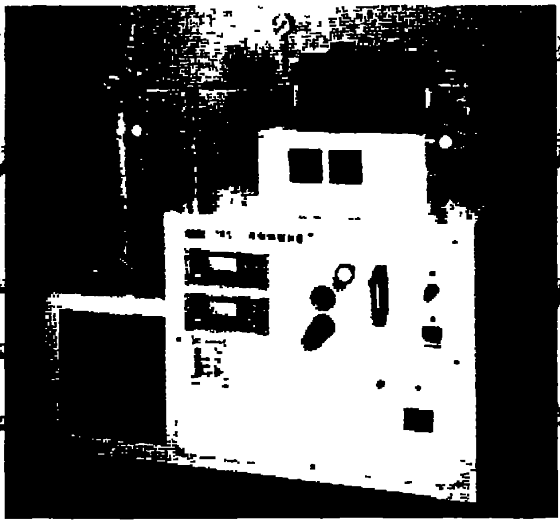


LUMINO
Small system for R&D

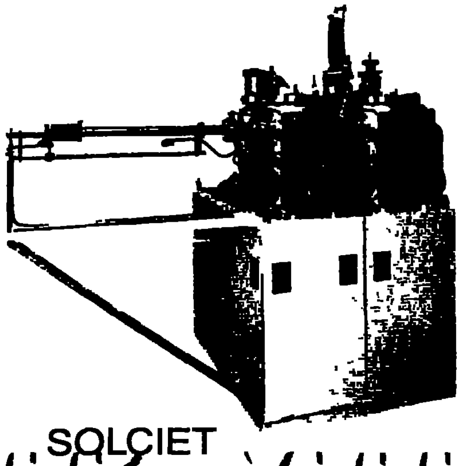


Hig

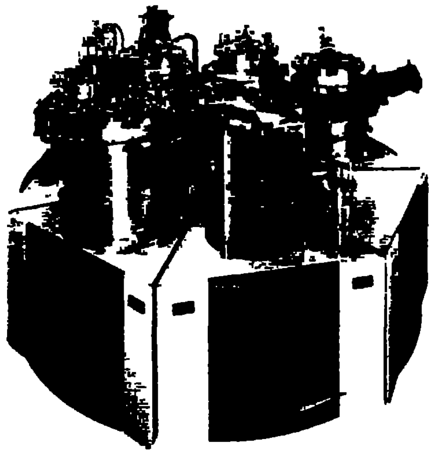




Organic Material Purifier system



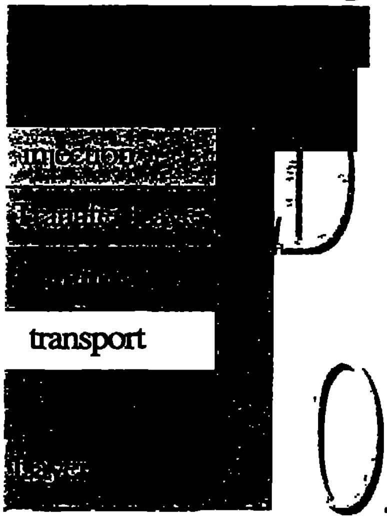
SOLCIET
Medium system for R&D

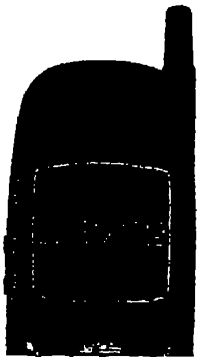


SATELLA

For Semi-production

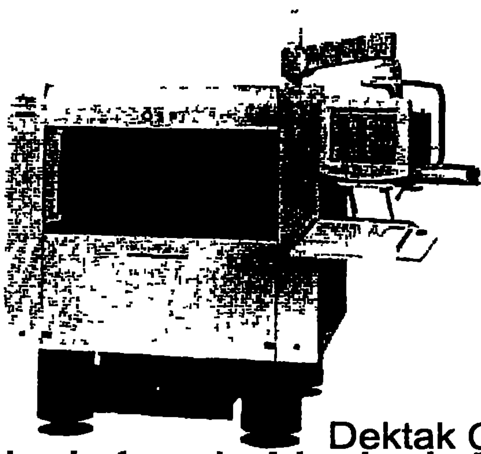
Brightness





SDP Series

For ITO in line sputtering system



Dektak OSP-1100

surface profile measuring system

Nordiko
SHIMADZU

Application Note
Application Note
Application Note
Application Note

NA99010

Dual Ion Beam Deposition of Dielectric GAP Films

[Key Benefits]

High rate, 12 nm min^{-1} deposition from a dielectric target — High breakdown Voltage >7 $MVcm^{2}$ for 20 nm Al_2O_3 — Excellent within wafer non-uniformity across 150 mm Ø wafer ±0 5% — Excellent reproducibility, ±0 5%

Nordiko have demonstrated the advantage of Dual Ion Beam Deposition in the fabrication of high break down strength, highly uniform and repeatable dielectric GAP film deposition Using a machine configuration designed for the application class leading thin film performance has been achieved.

Background

Increasing areal density of magnetic recording media demands improved performance from the read and write elements of the thin film magnetic heads Recent advances in head design calls for the GAP film to be reduced in thickness from 50 to 20 nm Traditionally magnetron sputtering has been used to deposit these dielectric films Decreasing film thickness and increasing demands upon within wafer non-uniformity across large substrates stretch the capability of this technique

Nordiko have applied the BIBD 3400 to the deposition of thin Al_2O_3 films These films may be deposited either from a dielectric compound target or alternatively reactively from an elemental target.

Process Need

The deposited films must display a suitable set of attributes These include, well controlled refractive index, good within wafer non-uniformity, high electrical breakdown strength, good step coverage and moderate stress

Machine Features

The 3400 is a purpose designed deposition tool, featuring dual ***Nordiko*** MKII rf excited ion sources The unique geometry permits simultaneous optimisation of the desired film properties The process module may be integrated with the Discovery wafer handling platform to provide single or multiple module manufacturing tools.

Application Note
Application Note
Application Note
Application Note

NA99011

Precision Thin Film Broad Ion Beam Milling
(Ultra low rate physical etching of magnetic sensor stacks)
[Key Benefits]

Ultra low rate, 0 6 nm min^{-1} for Al_2O_3, 4 nm min^{-1} for Cu — Excellent within wafer non-uniformity across 150 mm Ø wafer ±3% — Excellent reproducibility ±1%
Low divergence broad ion beam at 250 V

Nordiko have demonstrated an ultra low rate Broad Ion Beam Milling process, yielding class leading with wafer non-uniformity and repeatability

Background

Increasing areal density of magnetic recording media demands improved performance from the read and write elements of the thin film magnetic heads Recent advances in head design calls for multi-layer magnetic sense elements with diminishing film thicknesses Following sensor deposition these films must be patterned prior to the deposition of the hard bias and lead films This patterning step requires a high degree of precision

Often requirements for ion milling call for high material removal rates To achieve the necessary control and precision in defining the sensor very low milling rates are needed

Nordiko have applied the BIBM 7000 Fidelity to the ultra low rate milling of metal and dielectric films The performance reported here has been achieved using Argon ion beams

Process Need

The gmr spin-valve stacks used in current and emerging thin film magnetic heads comprise very thin film sandwiches When milling these films various process attributes are required, Ultra low rate, very good within wafer non-uniformity, good repeatability, good etched feature profile control, good thermal management.

Machine Features

The 7000 Fidelity is a purpose designed milling tool, featuring the 25 cm ***Nordiko*** MKII rf excited ion source The unique ion accelerator permits the propagation of low energy and low current ion beams with well controlled divergence The process module may be integrated with the Discovery wafer handling platform to provide single or multiple module manufacturing tools

Nordiko
SHIMADZU

NA99014

Dual Ion Beam Deposition of Low Loss Optical Films

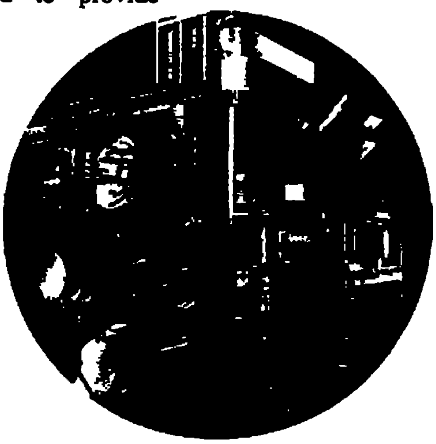
[Key Benefits]

High rate 12 nm min^{-1} deposition from dielectric and elemental targets — Premium performance for SiO_2, Ta_2O_5 — Excellent within wafer non-uniformity across 300 mm Ø fixture, ±0 8% — Excellent reproducibility ±0 5%

Nordiko have demonstrated the advantage of **Dual Ion Beam Deposition** in the fabrication of highly uniform optical multi-layer films Using a machine configuration designed for the application, class leading thin film performance has been achieved

Background

Broad ion beam deposition, BIBD, provides a means of depositing premium quality optical thin films This technique preserves the pre-polished optical surface to 0 05 nm, a feature germane to the preparation of low loss coatings In addition the geometry can be arranged to provide exceptional within fixture non-uniformity To achieve very good levels of uniformity of film thickness it is common to adopt compound rotation This technique while suited to the deposition onto many small parts, is inappropriate to the deposition onto a single large part The machine presented here provides excellent non-uniformity across a 300 mm fixture without the need to resort to compound rotation



Nordiko have applied the BIBD 3400 to the deposition of thin SiO_2 & Ta_2O_5 films These films may be deposited either from a dielectric compound target or alternatively reactively from an elemental target

Process Need

The deposited films must display a suitable set of attributes These include, well controlled refractive index, good within wafer non-uniformity, moderate stress and excellent reproducibility

Machine Features

The 3400 is a purpose designed deposition tool, featuring dual ***Nordiko*** MKII rf excited ion sources The unique geometry permits simultaneous optimisation of the desired film properties Special attention to the design ensures very low levels of contamination The process module may be integrated with either the Discovery wafer handling platform, or a heavy duty (multiple tray), load lock feature permitting the transport of 300 mm Ø fixtures up to 5 Kg, to provide additional productivity over a conventional atmospheric cycled coater

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Application Note
Application Note
Application Note
Application Note

NA99015

Artificial Antiferromagnet (AAF) biased spin-valves

[Key Benefits]

High Sensitivities >20%/Oe— High pinning field >5000 Oe— High MR ratios >7%

Artificial antiferromagnet spin-valves deposited in a ***Nordiko*** 9606 PVD deposition system have demonstrated improved sensitivities combined with high MR ratios and low interlayer coupling fields

Background

An artificial antiferromagnetic (AAF) structure substituted for the pinned ferromagnetic layer overcomes the limitations of sensitivity and dynamic range of a standard spin-valve The AAF consists of two ferromagnetic films (NiFe or CoFe) antiferromagnetically coupled across a thin non-magnetic layer (Ru)

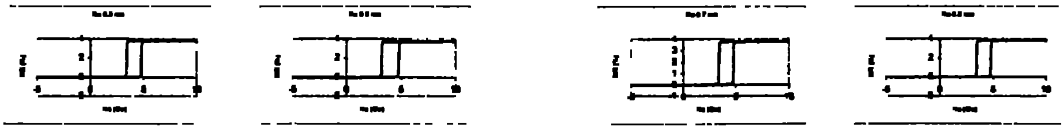
Since the magnetisations of the two F layers will have opposite directions, the two magnetostatic fields nearly cancel each other out, giving rise to an almost zero net magnetostatic field affecting the sense layer This results in improved sensitivity as well as low effective coupling field. Another advantage of AAF biased spin-valves is a large exchange pinning field, which results in magnetic stability of the sensors

Process Needs for AAF spin-valves

- Precise control of layer thickness
- Low deposition rate
- Excellent layer thickness uniformity over large substrate area
- Low latency between deposition of layers
- Flexibility in process parameters and system control
- High vacuum integrity

Magnetic and MR properties of AAF spin-valves versus Ru thickness

AAF spin-valves with IrMn as a biasing material have been developed at *Nordiko*'s applications department. A study of the variation of magnetic and magnetoresistive properties versus Ru thickness is presented.



AAF spin-valves with enhanced MR

To obtain spin-valves combining high sensitivity with high MR ratio AAF spin-valves with CoFe interlayers were developed. Figure 2 highlights the results of this study Spin-valve structures were as follows

'SV NiFe' - $Ta_5/NiFe_6/Cu_{2\ 6}/NiFe_3/n_7/Ta_5$

'SV single CoFe' - $Ta_5/NiFe_6/Cu_{2\ 6}/CoFe_{0\ 4}/NiFe_3/Ru_{0\ 9}/NiFe_3/IrMn_7/Ta_5$

'SV double CoFe' - $Ta_5/NiFe_6/CoFe_{0\ 3}/Cu_{2\ 6}/CoFe_{0.4}/NiFe_3/Ru_{0\ 9}/NiFe_3/IrMn$

The expected increase in MR ratio associated with the addition of CoFe interlayers was accompanied by an increase in *S* For 'SV single CoFe', an MR ratio of 5 6% and a *S* of 18%/Oe were achieved, while 'SV double CoFe' displayed an MR ratio of 7% and a *S* of 24%/Oe

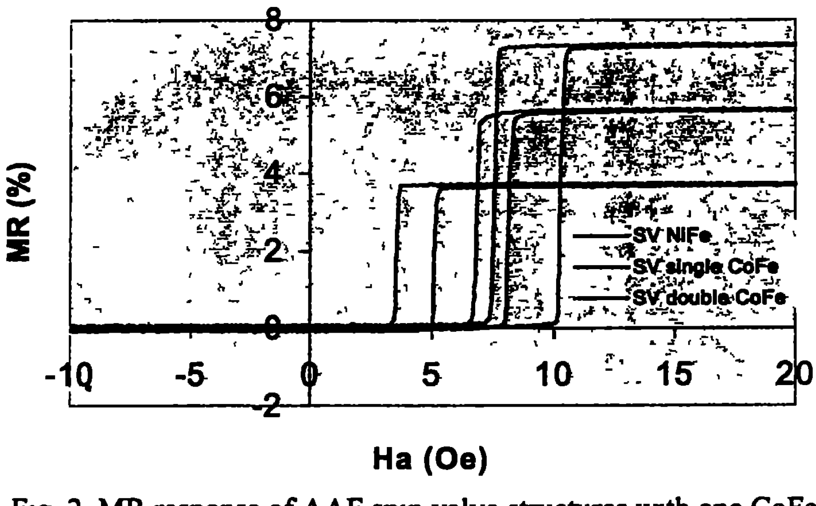


Fig 2 MR response of AAF spin valve structures with one CoFe interlayer, two CoFe interlayers and without interlayers

Application Note
Application Note
Application Note
Application Note

Nordiko
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Next Generation Spin-Valve Structures Incorporating Specular Nano-Oxide Layers (NOL) for Magnetic Storage Applications

[Key Benefits]

Enhanced MR ratio >13%
Preservation of high pinning fields >500 Oe
Controlled oxidation for the ultra thin nano-oxide layer

Nordiko have demonstrated magnetic structures utilising bottom spin-valve designs incorporating ultra-thin specular oxide layers which provide key advantages for high density HDD applications

Background

Current demand for high areal density data storage places significant pressure on the industry to develop new processes and material sets to achieve this goal Developments require the improvement of both the read and the write components within the heads

The transition from gmr to advanced gmr has seen substantial progress towards achieving greater MR ratios for the device structures One area of activity is the development of sensor designs which incorporate ultra-thin oxide layers used to enhance specular electron reflection at the boundaries of the ferromagnetic pinned/free layer sandwich

Nordiko have built structures using both Physical Vapour Deposition, pvd and Broad Ion Beam Deposition, bibd techniques For the pvd the deposition module used was the 9606, and for the bibd the 3600 module In each instance the oxidation was carried out in a discrete module attached to a common wafer handling platform

Results

Bottom spin-valve designs (Fig 1) have been prepared with thin oxide layers inserted within the pinned ferromagnetic layer and at the upper interface of the free layer These structures have been built by both pvd and bibd and the results compared

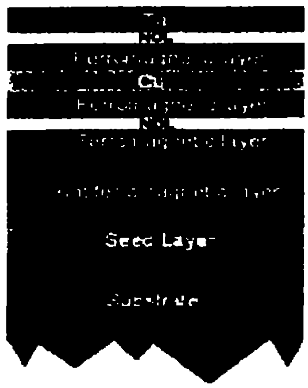

Figure 1

The incorporation of the NOL enhances the specular reflection of electrons within the conduction channels and increases the MR ratio For the structure deposited by pvd the MR value was enhanced from 7 1 to 13 3% (Fig 2) and from 6 to 11% for the bibd deposited structure (Fig 3)

The structures were characterised in a LakeShore VSM following annealing in an inert gas environment The proportional enhancement of the MR for both pvd and bibd structures are very similar

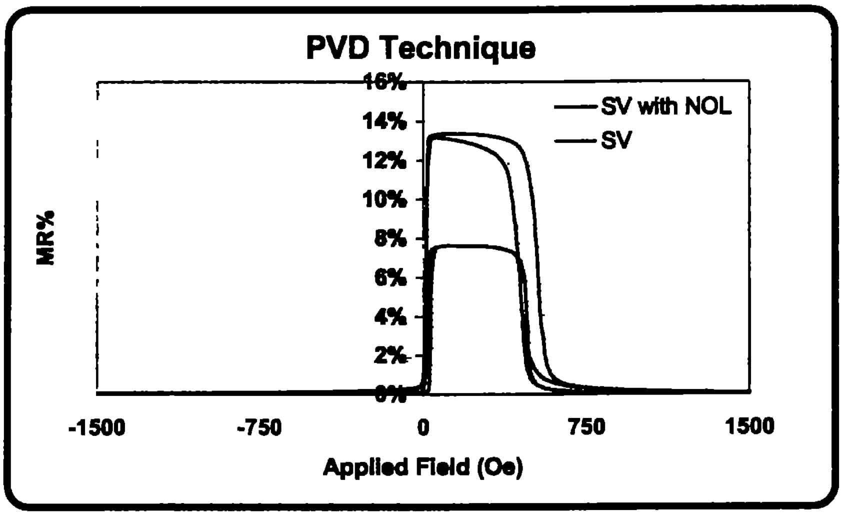

Figure 2 Spin-valve, with and without NOL enhancement, built by pvd

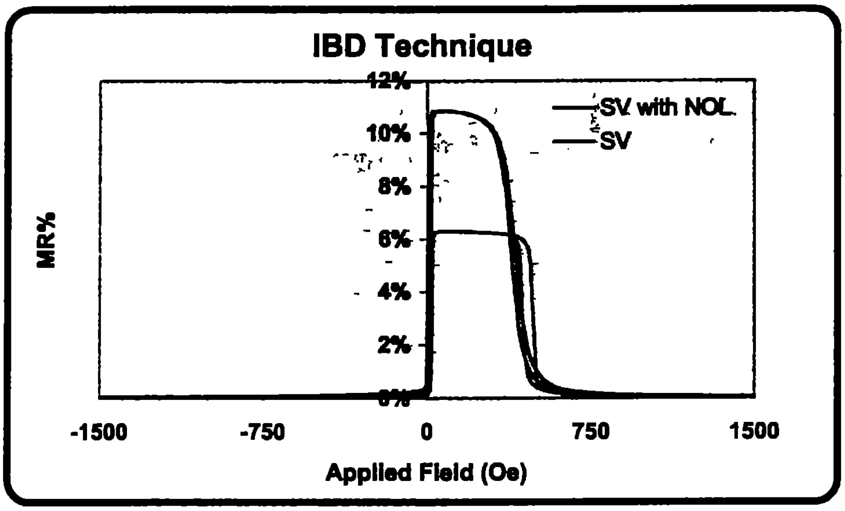

Figure 3 Spin-valve, with and without NOL enhancement, built by bibd

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SHIMADZU

Application Note
Application Note
Application Note
Application Note

Excellent Within Wafer Non-uniformity of Ultra-Thin Dielectric Films

[Key Benefits]

Choice between pvd or bibd film preparation
Large area capability
Class leading azimuthal homogeneity
0 1% pvd & 0 02% bibd

Nordiko have demonstrated deposition capabilities using both pvd and bibd capable of exceptional within wafer non-uniformity across large areas Ultra-thin dielectric films have applications in advanced storage devices and MRAM technologies

Background

Ultra-thin films find applications in advanced structures for storage, such as read/write heads in HDD The adoption of tunnelling barriers for the realisation of MRAM technologies also relies upon the homogenous growth of very thin films

For the NOL application within HDDs there is a need for an imperfect film, small imperfections play an active role in the application of the thin film For tunnelling applications, however, the integrity of the film is paramount Sputter deposition techniques can fulfil both of these requirements Deposition of dielectric materials directly from a ceramic target tends to produce films with micro-imperfections, whilst reactive sputtering produce denser films Generally the preferred route to producing the best quality ultra-thin dielectric film is the deposition and subsequent oxidation of an elemental metal layer

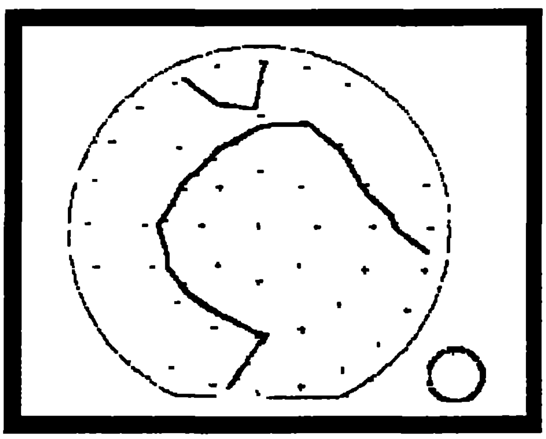

Figure 1
0.1% pvd Aluminium Film (200 mm)

For applications such as MRAM, the integrity and quality of the Ultra-thin tunnel barrier is key to successful device performance Furthermore the within wafer non-uniformity of the film is a major contribution to the yield, (junction resistivity control), for a device array

Nordiko have built structures using both Physical Vapour Deposition, pvd and Broad Ion Beam Deposition, bibd techniques For the pvd the deposition module used was the 7000, and for the bibd the 3400 module The pvd technique has been used to deposit metal films with exceptional uniformity, followed by oxidation to form the dielectric In this instance Al was deposited and oxidised to form Al_2O_3

Using our ion beam technology we have developed both ceramic and reactive processes for a variety of materials Specifically here we present uniformity results for a reactively deposited Ta_2O_5 thin film

Ultra-thin films in the region of 0 5 to 5 nm are very difficult to characterise and measure The results presented here are for thicker films readily characterised within our metrology laboratory

Results

The films presented here have been deposited using demonstration equipment at the Havant factory For the pvd deposition a 7000 module was used to sputter Aluminium Ta_2O_5 has been reactively deposited from a metal target by broad ion beam deposition For this the 3400 module incorporating the Patented ***Nordiko*** rf source was used

Figure 1illustrates a resistivity plot of an aluminium film deposited by pvd on to a 200 mm silicon wafer The 1σ non-uniformity for this 100 nm Aluminium film is 0 1%

Figure 2 illustrates a thickness profile measured on a spectroscopic ellipsometer for a Ta_2O_5 film reactively deposited on a 150 mm silicon wafer The 1σ non-uniformity for this 100 nm Aluminium film is 0 02%

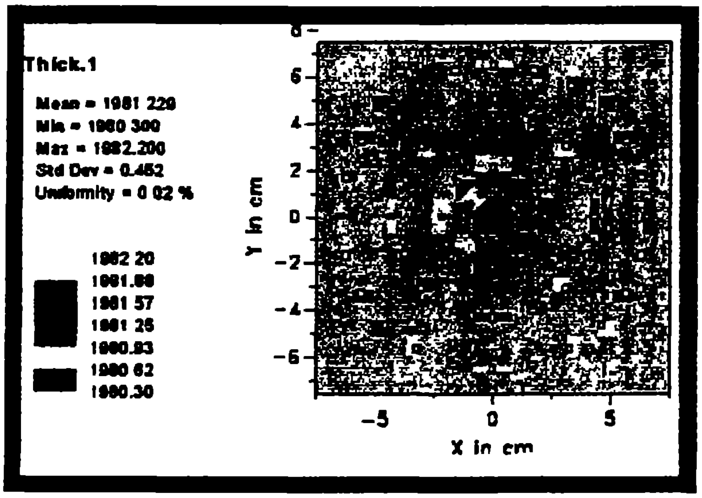

Figure 2
0.02% bibd Ta_2O_5 Film (150 mm)

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Application Note
Application Note
Application Note
Application Note

NA99016

Integrated SIMS End-Point Detection Precision Ion Milling System

[Key Benefits]

Ultra low rate, 0 6 nm min^{-1} for Al_2O_3, 4 nm min^{-1} for Cu — Excellent within wafer non-uniformity across 150 mm Ø wafer, ±2% — Excellent reproducibility, ±1%
Demonstrated to provide repeatable end-point signal at <2% exposed area.

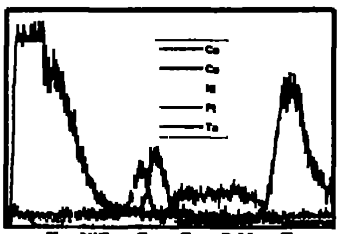
Nordiko has developed both hardware and a process for Ultra Low Rate ion milling for patterning the spin-valve sensor stack. This application requires both the ability to control the process precisely and to stop within a very thin layer The technique adopted to determine the end-point is Secondary Ion Mass Spectroscopy, SIMS The instrument used is a customised 1 to 300 amu qudrapole mass spectrometer with differential pumping

This additional hardware has been integrated with the ***Nordiko*** 7000 Fidelity precision ion milling system It is available as a stand alone system mated to the Discovery wafer handling system, or integrated with additional process modules with a cluster tool

Combined with the Fidelity Ion Mill ***Nordiko*** has demonstrated process capability to offering excellent within wafer non-uniformity, ±2% and a reproducibility of ±1% for milling ultra thin layers, combined with a demonstrated end-point capability capable of detection at <2% exposed area

The Fidelity Ion Mill module is one of five ion beam process modules, two milling and three deposition offered by ***Nordiko*** Each benefits from our Patented rf ion source technology together with carefully considered approach to ion extraction matched to suit the application

The systems are designed to handle wafers up to 200 mm diameter The standard system milling is offered with a high capacity turbomolecular pump group This can be optionally substituted by or augmented with cryogenic pumping



$Ta_5.NiFe_{18}\ Cu_{2.5}.Co_{2.6}.PtMn_{30}.Ta_5$
Normalised milling rate for NiFe, 2 nm min^{-1}
2% exposed area.

By considerate integration of the SIMS probe, and the intrinsic performance of the ***Nordiko*** ion source a very high degree of sensitivity has been realised

Titles of invited talks

Wolf-Dieter Schneider
Scanning tunneling microscopy and spectroscopy of nanostructures

Masatake Haruta
Mechanism for low temperature CO oxidation over gold nanoparticles deposited on TiO_2

Joost Wintterlin
Non-uniformities and spatial patterns in catalytic reactions

Hermann Nienhaus
Surface reactions monitored with nm-structured electronic devices

Zhong-Qun Tian
Some Issues related to metal nanorods and surface science

Frederick M. Leibsle
Creating nanostructures on copper surfaces

Flemming Besenbacher
Atomic-scale STM study of model catalysts

Masaru Tsukada
Nano-mechanics ---novel materials properties observed and controlled by Atomic force microscopy

Han Woong Yeom
Novel electronic structures of the self-organized atomic chains on silicon surfaces   achievement and controversy

Hanno Weitering
Electrical conductance in surface states and monolayers

Roland Wiesendanger
Spin-resolved spectro-microscopy at the atomic level

Stanley Williams
Size and shape of epitaxial nanostructures
surface tension, substrate strain, surfactants and symmetry

Oliver G. Schmidt
Ordering phenomena in ensembles of self-assembled semiconductor nanostructures

Shunri Oda
Nanocrystalline silicon quantum dots fabrication, characterization and application

Robert J. Hamers
Organic-inorganic hybrid interfaces chemistry, structure, and technical applications

Chuhei Oshima
Young's Interference in Electron Emission Patterns from Carbon Nanotubes

Hiroyuki Akinaga
Metal- nanocluster equipped GaAs surfaces designed for high-sensitive magnetic field sensors

November 13, Tuesday, 2001

16 00-19 00	**Registration** at the Auditorium of National Institute of Advanced Industrial Science and Technology
17 15-20 00	**Welcome Reception**

November 14, Wednesday, 2001

9 30		**Opening**
9 50	**P1**	Scanning tunneling microscopy and spectroscopy of nanostructures Wolf-Dieter Schneider Universite de Lausanne
10 50		Conference photograph
11 00		**Intermission**
11 20	**WT1**	Mechanism for low temperature CO oxidation over gold nanoparticles deposited on TiO_2 Masatake Haruta AIST
12 00	**WT2**	Non-uniformities and spatial patterns in catalytic reactions Joost Wintterlin Fritz-Haber-Institute der Max-Planck-Gesellschaft
12 40		**Lunch**
13 30	**WT3**	Surface reactions monitored with nm-structured electronic devices Hermann Nienhaus Gerhard-Mercator-Universitat Duisburg
14 10	**WT4**	Some issues related to metal nanorods and surface science D Y Wu, J L Yao, Y F Xu, J Q Hu, Z L Yang, B Ren, B W Mao and <u>Zhong-Qun Tian</u> Xiamen University
14 50	**WT5**	Creating nanostructures on copper surfaces Frederick M Leibsle University of Missouri
15 30		**Intermission**
15 50	**WT6**	Atomic-scale STM study of model catalysts Flemming Besenbacher University of Aarhus and CAMP
16 30-16 55		**Invited poster presentation 1**
	WI1	An AES, XPS and TDS study on the growth and property of silver thin film on the Pt(110)-(1x2) surface Weixin Huang, Zhiquan Jiang, Dali Tan, <u>Fei Dong</u> and Xinhe Bao Chinese Academy of Sciences
	WI2	Carbon formation by CO and C_2H_4 dissociative adsorption on Ni(111) J Ogawa, H Nakano and Junji Nakamura University of Tsukuba

WI3 Dynamic behavior of Si magic clusters on Si(111) surfaces

Ing-Shouh Hwang, Mon-Shu Ho and Tien T Tsong
Academia Sinica

WI4 Silicon-germanium nanostructures formation by molecular beam epitaxy

Oleg P Pchlyakov[1], Yu B Bolkhovityanov[1], A I Nikiforov[1], B.Z Olshanetsky[1], L V Sokolov[1], S A Teys[1] and B Voigtlander[2]
[1] SB RAS, [2] IGV

WI5 Theoretical interpretation of novel adsorption spectra of NO/Pt(111)

H Aizawa[1], Y Morikawa[2], S Tsuneyuki[3], K Fukutani[3] and T, Ohno[1]
[1] National Institute for Materials Science, [2] AIST, [3] University of Tokyo

17 00-19 00 **Poster session W**

W 1 Nanocatalysis tuning efficiency and selectivity atom by atom

S Abbet[1], U Heiz[2] and W -D Schneider[1]
[1] Universie de Lausanne, [2] University of Ulm

W 2 Formate synthesis on Cu(111) via an Eley-Rideal type mechanism

J Nakamura[1], M Sano[1] and T Fujitani[2]
[1] University of Tsukuba, [2] AIST

W 3 Thermal decomposition of acetylene on Pt(111) studied by scanning tunneling microscopy

Osamu Nakagoe, Noriaki Takagi and Yoshiyasu Matsumoto
SOKEN-DAI

W 4 Absorption of hydrogen into Pd(111)

K. Nobuhara[1], H Kasai[1], H Nakanishi[1] and A Okiji[2]
[1] Osaka University, [2] Wakayama National College of Technology

W 5 Adsorption and decomposition of NO on Pd surface

I Nakamura, T Fujitani and H Hamada
AIST-Tsukuba

W 6 The deuterium-edge-termination effects on the electronic structure of a single-layer graphite nanocrystal

Daisuke Ino[1], Ikuo Kinoshita[2], Kaoru Nagata[2], Kazuya Watanabe[1], Noriaki Takagi[1] and Yoshiyasu Matsumoto[1]
[1] SOKEN-DAI, [2] Yokohama City University

W 7 Potential controlled phase transitions in cystamine self-assembled monolayers on Au(111) in aqueous solution studied by in situ STM

Hiroyuki Noda and Masatoshi Osawa
Hokkaido University

W 8 In-situ surface X-ray diffraction study of Cu UPD on the Au(111) electrode

M Nakamura[1], O Endo[1], T Senna[1], M Ito[1] and Y Yoda[2]
[1] Keio University, [2] JASRI

W 9 Adsorption processes and electrical conduction of self-assembled monolayers made from terphenyl thiols

Takao Ishida[1,2], Wataru Mizutani[3], Hiroaki Azehara[3], Koji Miyake[1], Yohichiro Aya[4], Shinya Sasaki[1] and Hiroshi Tokumoto[3]
[1] IMSE-AIST, [2] PRESTO-JST, [3] JRCAT-AIST, [4] JRCAT-ATP

W10 Nitride nucleation on Si(111)-7x7 surface by NO
Noriyuki Miyata[1] and Masakazu Ichikawa[2]
[1] JRCAT-AISTJ, [2] RCAT-ATP

W11 Local surface structure and electronic structure of nanoscale Si islands on Si(111)-7x7 substrate
R. Negishi and Y Shigeta
Yokohama City University

W12 Formation of iron silicide nanodots on Si(111)-sqrt(3) x sqrt(3)Ag
Y Takagi, A Nishimura, A Nagashima and J Yoshino
Tokyo institute of Technology

W13 Local electronic states at steps on the epitaxial Fe(001) film surface studied by differential conductivity imaging using STM
T Kawagoe[1], E Tamura[1], Y Suzuki[2] and K Koike[2]
[1] JRCAT-ATP, [2] JRCAT-AIST

W14 STM-tip induced magnetic state change of Fe atom bridge
Hiroshi Nakanishi[1], Hideaki Kasai[1], Ayao Okiji[2] and Fumio Komori[3]
[1] Osaka University, [2] Wakayama National College of Technology, [3] University of Tokyo

W15 Enhancement of SHG intensity by Ag nano-islands on Si(111)7x7 surface
H Hirayama,T Kawata and K. Takayanagi
Tokyo institute of Technology

W16 Atom-resolved microscopy and spectroscopy of Si(111)-(5x2)-Au
H -S Yoo, S -J Pak, J -E. Lee and I -W Lyo
Yonsei University

W17 STM study of (sqrt(3) x sqrt(3))-Sn,Pd/Si(111)surface
H Morikawa, K. Horikoshi and S Hasegawa
University of Tokyo

W18 High-resolution photoemission spectroscopy on Sn/Si(110) surface
E S Cho[1], N. H Kim[1], Y K. Kim[1], J C. Moon[1], T Okuda[2], A Harasawa[2], T Kinoshita[2], A Kakizaki[2], J H Oh[3], C C Hwang[4], K S An[5] and C -Y Park[1]
[1] Sung Kyun Kwan University, [2] University of Tokyo in KEK, [3] University of Tokyo, [4] POSTEC, [5] Korea Research institute of Chemical Technology

W19 The investigation about the surface states of the Si(110)2x3-Cs
Y K. Kim[1], J C Moon[1], Y J Kim[1], K S An[2] and C Y Park[1]
[1] Sung Kyun Kwan University, [2] Korea Research institute of Chemical Technology

W20 High-resolution electron energy loss spectroscopy study of the K/Si(111)-(3x1) surface
H Ashima, K Sakamoto, H Takeda and W Uchida
Tohoku University

W21 STM observations of alkali-metal adsorptions on Si(111)-sqrt(3) x sqrt(3)-Ag surface
Canhua Liu and Shuji Hasegawa
University of Tokyo

W22 Local tunneling barrier height studies on Cs adsorbed Si(111)7x7 surface
Yoichi Yamada, Asawin Sinsarp, Masahiro Sasaki and Shigehiko Yamamoto
University of Tsukuba

W23 Formation of nanoscale Ge magic island on Si(111)-7x7 substrate
M Suzuki, K. Masuda and Y Shigeta
Yokohama City University

W24 Evolution of atomic step arrangement on Si(111) surface patterned with arrays of holes an STM study
Koji Sumitomo, Feng Lin, Hiroki Hibino and Toshio Ogino
NTT Basic Research Laboratories

W25 p(2x2) phase of Si(100) at 10K
S Yoshida[1], O Takeuchi[1,2], K. Hata[3] and H Shigekawa[1,2,4]
[1] University of Tsukuba, [2] CREST-JST, [3] University of Harvard, [4] University of Tokyo

W26 Structures and electronic states of the InSb{111}A,B-(2x2) surfaces
Toyoaki Eguchi, Sung-Pyo Cho, Takuya Kadohira, Nobuyasu Naruse and Toshiaki Osaka
Waseda University

W27 Site-dependent analysis of rare gas adsorption on Si(111)-7x7 surface at 8K

Y J Li[1], O Takeuchi[1], D N Futaba[1], H Oigawa[1], K Miyake[1], H Shigekawa[1],
R. Morita[2] and M Yamashita[2]
[1] CREST, Universty of Tsukuba, [2] CREST, Hokkaido University

W28 Unoccupied molecular orbitals of C_{60} molecules adsorbed on Si(001)-(2x1) and Si(111)-(7x7) surfaces studied by NEXAFS
Daiyu Kondo[1], Kazuyuki Sakamoto[1], Hideo Takeda[1], Fumihiko Matsui[2], Kenta Amemiya[2], Toshiaki Ohta[2], Wakio Uchida[1] and Atsuo Kasuya[1]
[1] Tohoku University, [2] University of Tokyo

W29 Angle-resolved photoemission study of quantum size effect in $CoSi_2$ nanofilm
Y Kuriyama, A Tanaka, H Sasaki, T Nagasawa, S Suzuki and S Sato
Tohoku University

W30 Growth of Ag two-dimensional islands on Ge(001)
K Nakatsuji[1], Y Naitoh[2], M Yamada[1], S Ohno[1], T Iimori[1] and F Komori[1,2]
[1] University of Tokyo, [2] CREST-JST

W31 STM and RHEED studies on low temperature growth of GaAs(001)
A Nagashima, M Tazima, A Nishimura, Y Takagi, J Yoshino
Tokyo Insititute of Technology

W32 Surface sheet conductance measured by micro-four-probe method
T Tanikawa[1], S Hasegawa[1], I Shiraki[1], T M Hansen[2], P Boggild[2] and F Grey[2]
[1] University of Tokyo, [2] Technical University of Denmark

W33 Mixed ordered arrangement of coadsorbed metal atoms on a Cu(001) surface (sqrt(5) x sqrt(5))R26 7° and (2x2) formed by Bi and K
Ming-Shu Chen, Seigi Mizuno and Hiroshi Tochihara
Kyushu University

W34 Surface charge-density waves on Cu(001)-c(4x4)-In surface
T Nakagawa, H Okuyama, M Nishijima and T Aruga
Kyoto University

W35 Selective vapor deposition polymerization on actively patterned surfaces
K Tsukagoshi[1], W Mizutani[2,3], H Tokumoto[2,3], T Miyamae[2] and H Nozoye[2]
[1] JST-AIST, [2] AIST, [3] JRCAT

W36 First-principles and classical molecular dynamics study of self-assembled monolayers on the Au(111) surface
Y Morikawa[1,2,3], C C Liew[2], T Hayashi4 and H Nozoye[2]
[1] JRCAT, [2] AIST,[3] Japan Advanced Institute of Science and Technology, [4] Universitaet Heidelberg

W37 Carbon-nanotube formation directly on a substrate
Ayumu Yasuda[1,2,3], Wataru Mizutani[1,2], Tetsuo Shimizu[1,2] and Hiroshi Tokumoto[1,2]
[1] AIST, [2] JRCAT, [3] NEDO

W38 Development of a low-energy electron diffraction technique using field-emitted electrons from STM tips
Seigi Mizuno and Hiroshi Tochihara
Kyushu University

W39 Nanoscale anodic oxidation on a Si(111) surface terminated by bilayer-GaSe
K.Ueno, R Okada, K Saiki and A Koma
University of Tokyo

W40 Time-fluctuation of the dimer structure on a Ge(001) surface studied by a Monte Carlo simulation
Hiroshi Kawai[1], Yoshihide Yoshimoto[2], Hiromitsu Shima[1], Yoshimichi Nakamura[3] and Masaru Tsukada[2]
[1] Kyushu University, [2] University of Tokyo, [3] University of Tokyo, CREST

W41 Theoretical study of interactions between the Si(111) surface and metal atoms
Eisaku Miyoshi, Tatsuo Iura, Yoshiko Sakai, Shinobu Tanaka and Hirotoshi Mori
Kyushu University

W42 Surface structure of low-coverage Ag on Ge(001) surface using first-principle caluculations
Akira Ishii and Kaori Seino
Tottori University

W43 First-principles study of inter nitrogen interaction energy of Cu(100)-c (2x2)N surface
Yoshihide Yoshimoto and Shinji Tsuneyuki
University of Tokyo

W44 Relaxation of nano-pyramidal island on Si(100) studied by Monte Carlo simulation
T Kawamura[1], S Toyoshima[1] and A Ichimiya[2]
[1] Yamanashi University, [2] Nagoya University

W45 A quantum mechanical/molecular mechanical calculation method for molecular aggregates adsorbed on noble metal surface
Yoshishige Okuno and Shinro Mashiko
Communications Research Laboratory

W46 Compositional patterning in irradiated immiscible alloys
Yohihisa Enomoto
Nagoya Institute of Technology

W47 Quantized conductance in AuAg nanocontacts under high biases
A Enomoto[1], J Mizobata[2], S Kurokawa[2] and A. Sakai[2]
[1] Toyota Moter corporation, [2] Mesoscopic Materials Research Center, Kyoto University

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November 15, Thursday, 2001

9 00 **P2** Nano-mechanics—novel materials properties observed and controlled by atomic force microscopy
Masaru Tsukada
University of Tokyo

10 00 **TT1** Novel electronic structures of the self-organized atomic chains on silicon surfaces achievement and controversy
Han Woong Yeom
Yonsei University

10 40 **Intermission**

11 00 **TT2** Surface-state electronic transport
Shuji Hasegawa
University of Tokyo

11 40 **TT3** Electrical conductance in surface states and monolayers
Hanno Weitering
Delft University of Technology

12 20 **Lunch**

13 20 **TT4** Magnetism of ferromagnetic nano-dots squarely arranged on Cu(001)-c (2x2)N surfaces
Fumio Komori
University of Tokyo, CREST-JST

14 00 **TT5** Spin-resolved spectro-microscopy at the atomic level
Roland Wiesendanger
University of Hamburg

14 40 **Intermission**

15 00-15 25 **Invited poster presentation 2**

TI1 Temperature-induced phase transitions on Si(113) and Si(100) surfaces
Chan-Cuk Hwang[1], T -H Kang[1,2], K.J Kim[1], B Kim[1], Y Chung[1], K S An[3] and C Y Park[2]
[1] Pohang University of Science and Technology, [2] Sung Kyun Kwan University, [3] KRICT

TI2 Quantum confinement in Ge dots grown on Si surfaces with a SiO_2 coverage
Alexander A Shklyaev and Masakazu Ichikawa
JRCAT-ATP

TI3 Early nucleation on the Si(001)-2x1 surface
T -W Pi[1], C -P Ouyang[1], J -F Wen[2], L -C Tien[2], J -C Hwang[2], C -P Cheng[3] and G K. Wertheim[4]
[1] SRRC, [2] National Tsing Hua University, [3] National Chiayi University, [4] Woodland Consulting

TI4 Carbon-induced nanostructures on Si(001) surface
Wondong Kim, Hanchul Kim, Geunseop Lee, Young-Kyu Hong, Dal-Hyun Kim, Chanyong Hwang and Ja-Yong Koo
KRISS

TI5 Nanoscale wiring by controlled chain polymerization
Yuji Okawa[1,2] and M Aono[1,2,3]
[1] RIKEN, [2] SORST-JST, [3] Osaka University

15 30-17 30 **Poster session T**

T 1 Chemical reactivity of the Si(111) surface modified with Au
K Kishi[1], M Date[1] and M Haruta[2]
[1] AIST-Kansai, [2] AIST-Tsukuba

T 2 Initial stage of CO adsorption on Si(111)-7x7 surface studied with STM
A Mizuma, K Ohkubo, K Hattori, Y Miyatake, F Matsui, S Takeda and H Daimon
NAIST

T 3 STM observation of an organogold complex on TiO_2(110) and Si(111) surfaces
Y Maeda[1], M Okumura[1], M Date[1], S Tsubota[1] and M Haruta[2]
[1] AIST-Kansai, [2] AIST-Tsukuba

T 4 The autocorrelation of acetates embedded in a formate monolayer on TiO_2 (110)
Hiroshi Uetsuka, Akira Sasahara and Hiroshi Onishi
KAST

T 5 Dynamics of ortho-para H2 conversion on a metal oxide surface -cartwheel-like rotations versus helicopter-like rotations-
R Muhida[1], W A Dino[1,2], Y Miura[1] , H Kasai[1], H Nakanishi[1], A Okiji[3], K Fukutani[2] and T Okano[2]
[1] Osaka University, [2] University of Tokyo, [3] Wakayama National College of Technology

T 6 Quantum dynamics of hydrogen abstraction from metal surfaces Eley-Rideal and hot-atom processes
Yoshio Miura[1], Hideaki Kasai[1], Wilson Agerico Dino[2] and Ayao Okiji[3]
[1] Osaka University, [2] University of Tokyo, [3] Wakayama National College of Technology

T 7 STM study of a Cu-Zn surface alloy grown on Cu(111)
M Sano[1], T Adaniya[1], T Fujitani[2] and J Nakamura[1]
[1] University of Tsukuba, [2] AIST-Tsukuba

T 8 The structural transformation of the Pt(110) electrode during the Cu UPD process
Osamu Endo[1], Norito Ikemiya[2] and Masatoki Ito[2]
[1] Tokyo university of Agriculture and Technology, [2] Keio University

T 9 Electrochemical reduction of PNTP-SAM films on Au(111) surface and coadsorption of anions and water molecules
M Futamata and C Nishihara
AIST-Tsukuba

T10 State-resolved femtosecond two-pulse correlation measurements in NO photodesorption from Pt(111)
T Yamanaka[1], R. A Pelak[1], W Ho[1], A Hellman[2] and Shiwu Gao[2]
[1] Cornell University, [2] Chalmers and Goteborg University

T11 The effects of nonmagnetic impurity atoms on the electronic states of CuO_2 planes
D Matsunaka[1], H Kasai[1], H Nakanishi[1] and A Okiji[2]
[1] Osaka University, [2] Wakayama National College of Technology

T12 Dehydrogenation and single-molecule vibrational spectroscopy of trans-2-butene
Y Kim[1], S Katano[1,2], H Fukidome[1], H S Kato[1], T Komeda[1] and M Kawai[1]
[1] RIKEN, [2] Tokyo Institute of Technology

T13 Magnetic properties of Fe-Ni alloy atom bridge
Hiroshi Nakanishi[1], Hideaki Kasai[1], Ayao Okiji[2] and Fumio Komori[3]
[1] Osaka University, [2] Wakayama National College of Technology, [3] University of Tokyo

T14 Spin-reorientation of the Cu/Ni crossed-wedge film on Cu(001)
Keiki Fukumoto[1], Hiroshi Daimon[1], Liviu Chelaru[2], Francesco Offi[2], Wolfgang Kuch[2] and Juegen Kirschner[2]
[1] NAIST, [2] Max-Planck-Institute of Micro Structure Physic

T15 Cs adsorbed structure and change of magnetism in fcc Co thin films grown on Cu(001) surfaces
T Iimori[1], M Xu[2], M Yamada[1], K Nakatsuji[1], K D Lee[2] and F Komori[1,2]
[1] University of Tokyo, [2] CREST-JST

T16 Simulation study for the decay process of nano structure on Si(100) surface using kinetic
Monte Carlo method
A Ishii, O Tomiyama and T Aisaka
Tottori University

T17 STM observation of electron standing wave on Pd/Au(111) and Pd/Cu(111)
Y Hasasegawa[1], T Suzuki[1] and T Sakurai[2]
[1] University of Tokyo, [2] Tohoku University

T18 Quantized electronic structure in Ag nanofilms grown on Fe substrates
H Sasaki, A Tanaka, Y Kuriyama, T Nagasawa, S Suzuki and S Sato
Tohoku University

T19 New step-induced electronic states on the stepped surface of Cu(755) studied
by angle-resolved photoemission spectroscopy using synchrotron radiation
K Ogawa, K Nakanishi, J. Fujimatsu, H Mizobata and H Namba
Ritsumeikan University

T20 Electronic structure of Cu-O/Ag(110)(2x2)p2mg surface
Daiishiro Sekiba[1], Yasushi Wakimoto[1], Daisuke Ogarane[1], Takanobu Goto[1] and Kazutoshi Yagi-Watanabe[2]
[1] University of Tsukuba, [2] AIST-Tsukuba

T21 Interacting electrons in one-dimensional confinements
Taro Shirai[1], Hideaki Kasai[1], Wilson Agerico Dino[1,2], Hiroshi Nakanishi[1] and Ayao Okiji[3]
[1] Osaka University, [2] University of Tokyo, [3] Wakayama National College of Technology

T22 Structure and fluctuation of the surface-charge density wave on the one-dimensional organic conductor,Beta-(BEDT-TIF)$_2$PF$_6$
K Tsuhara[1], Y J Li[1], O Takeuchi[1], M. Ishida[1], T Mori[2] and H Shigekawa[1]
[1] CREST,Universty of Tsukuba, [2] Tokyo Institute of Technology

T23 Vibrational spectra of carbon nano-ribbons
R Morizumi[1], T Tanaka[1], A Tajima[1], S Otani[2] and C Oshima[1]
[1] Waseda University, [2] National Institute for Researches in Inorganic Materials

T24 Electronic states of carbon nano-ribbons
M Hosoda[1], R. Ohno[1], M Okuzawa[1], H Tanaka[1], S Otani[2] and C Oshima[1]
[1] Waseda University, [2] National Institute for Materials Sciences

T25 Scanning tunneling microscopy observation of initial process of graphitization on the 6H-SiC(0001) surface
M Naitoh[1], M Kitada[1], S Nishigaki[1], N Toyama[1] and F Shoji[2]
[1] Kyushu Institute of Technology, [2] Kyushu Kyoritsu University

T26 Formation of hydrogen-induced vacancies during growth of the Fe layer studied by slow positron beam

K Takagi[1], N Furukawa[1], I Kanazawa[1], R Suzuki[2] and T Ohdaira[2]

[1] Tokyo Gakugei University, [2] Electrotechnical Laboratory

T27 Electronic states and growth processes of perovskite nanostructures on $SrTiO_3(100)$

Y Yamashita[1], K. Mukai[1], J Yoshinobu[1], M Lippmaa[1] and M Kawasaki[2]

[1] University of Tokyo, [2] Tohoku University

T28 Electric conduction on $SrTiO_3(110)$ surface-effect of surface anisotropy

Hiroshi Bando[1], Yoshihiro Aiura[1], Kazuhiro Oguchi[2], Yuichi Ochiai[2], Kazuyoshi Mitsugi[1] and Yoshikazu Nishihara[2]

[1] AIST-Tsukuba, [2] Ibaraki University

T29 Atomic controlled growth of high quality epitaxial SrO and TiO_2 oxide thin films on $SrTiO_3(001)$ by RHEED and STM

Yuji Matsumoto and Hideomi Koinuma

Tokyo Institute of Technology

T30 Selective thermal desorption of ultrathin Al_2O_3 layers induced by electron beams

Manisha Kundu[1], Noriyuki Miyata[2] and Masakazu Ichikawa[1]

[1] JRCAT-ATP, [2] JRCAT-AIST

T31 High-resolution analysis of the intermolecular interaction by using chemical force microscopy

M. Fujita[1], O Takeuchi[1], S Yasuda[1], S P Jarvis[2], I Suzuki[3], M Komiyama[4] and H Shigekawa[1,4]

[1] University of Tsukuba, CREST, [2] NRI-AIST, [3] Tohoku University, [4] University of Tokyo

T32 A microscopic theory of atom/molecule manipulation by scanning tunneling microscope

Kazuhiko Hasegawa[1], Hideaki Kasai[1], Wilson Agerico Dino[1,2], Ayao Okiji[3]

[1] Osaka University, [2] University of Tokyo, [3] Wakayama National College of Technology

T33 Numerical study of binding configuration at C_{60}/Si(111)7x7 interface before and after annealing at 670K

T Wakita[1,2], K Sakamoto[1], D Kondo[1], A Harasawa[2], T Kinoshita[2] and S Suto[1]

[1] Tohoku University, [2] University of Tokyo

T34 Adsorption and SiC island growth by the thermal reaction of cyclohexasilane on Si(111)7x7 and Si(100)2x1 surface

F Sawano[1], H Harada[1], S Doi[1], T Chiba[1], K Sakamoto[1], S Suto[1], A Watanabe[1], M Nanjo[2], X Liu[1], R Czajka[1] and A Kasuya[1]

[1] Tohoku University, [2] Gakushuin University

T35 Formation nano-composite of Sn_2 and Zn_3 clusters on a Si(111)-7x7 surface
Zhao-Xiong Xie[1], Toshihiro Egawa[2], Yusuke Uematsu[2], Hiroshi Tochihara[3], Mikio Aramata[4], Tetsuya Inukai[4] and Ken-ichi Tanaka[2]
[1] Xiamen University, [2] Saitama Institute of Technology, [3] Kyushu University, [4] Shin-Etsu Chem Co Ltd

T36 RHEED-STM study of iron silicide structures on Si(111)
N Minami, D Makino, T Matsumura, C Egawa, T Sato, K Ota and S Ino
Utsunomiya University

T37 Effect of Tb-doping on the nano-structural and optical features of nano-crystalline Si thin films
K -H Han, M -B Park and N -H Cho
Inha University

T38 Dynamic behavior of hydrogen on silicon surface studied by scanning electron-stimulated desorption ion microscope
Kazuyuki Ueda and Keiko Ogai
Toyota Technological Institute

T39 Flat-band excitonic states in Kagome lattice on semiconductor surfaces
Hiroyuki Ishii and Takashi Nakayama
Chiba University

T40 Quantum interference oscillation and effect of spin in de Haas van Alphen effect in the quantum-well materials
Keita Kishigi
JST, AIST

T41 The theoretical analysis of quantum mirages on the Cu(111) surface
Y Shimada[1], H Kasai[1], H Nakanishi[1], W A. Dino[1,2], A. Okiji[3] and Y Hasegawa[2]
[1] Osaka University, [2] University of Tokyo, [3] Wakayama National College of Technology

T42 First-principles calculations of electron transport of atomic wires
Nobuhiko Kobayashi[1], Masakazu Aono[2] and Masaru Tsukada[3]
[1] AIST-Tsukuba, [2] RIKEN,Osaka University, [3] University of Tokyo

T43 Theoretical study on ballistic conduction through surface states
Katsuyoshi Kobayashi
Ochanomizu University

T44 Phase diagrams of missing-row reconstructed surfaces
M Kaburagi and M Kang
Kobe University

T45 First-principles study of the single-walled carbon nanotube
Takanori Ito, Kazume Nishidate, Mamoru Baba and Masayuki Hasegawa
Iwate University

T46 Formation of one dimensional oxygen-nickel surface complexes on high Miller index surfaces of Ni studied by LEED-AES and work function measurements
Hidetoshi Namba, Hirokazu Kitaura and Koji Ogawa
Ritsumeikan University

18 00 **Conference Banquet**

November 16, Friday, 2001

9 00 **P3** Size and shape of epitaxial nanostructures surface tension, substrate strain, surfactants and symmetry
Stanley Williams
Hewlett-Packard Laboratories

10 00 **FT1** Design and functionalization of Si surfaces for self-assembled nano-architecture
T Ogino, Y Homma, Y Kobayashi, H Hibino, K. Prabhakaran, K Sumitomo, H. Omi, S Suzuki, T Yamashita, D J Bottomley, F Lin and A Kaneko
NTT Basic Research Laboratories

10 40 **Intermission**

11 00 **FT2** Ordering phenomena in ensembles of self-assembled semiconductor nanostructures
O G Schmidt, S Kiravittaya, H Heidemeyer, C Muller, N Y Jin Phillipp and Y Nakamura
Max-Planck-Institute for Solid State Research

11 40 **FT3** Nanocrystalline silicon quantum dots fabrication, characterization and application
Shunri Oda
Tokyo Institute of Technology

12 20 **Lunch**

13 20 **FT4** Organic-inorganic hydrid interfaces chemistry, structure, and technological applications
Robert J Hamers
University of Wisconsin

14 00 **FT5** Young's interference in electron emission patterns from carbon nanotubes
C Oshima[1], K Matsuda[1], T Kona[1], Y Mogami[1], M Komaki[1], Y Murata[1], T Yamashita[1], T Kuzumaki[2] and Y Hiroike[2]
[1] Waseda University, [2] University of Tokyo

14 40 **FT6** Metal-nanocluster equipped GaAs surfaces designed for high-sensitive magnetic field sensors
Hiroyuki Akinaga
JRCAT-AIST

15 20 **Closing**