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)

赴美國考察真空儀器設備暨參加美國真空年會出國報告

服務機關：行政院國科會精密儀器發展中心
出國人員：蕭銘華　專案副研究員
出國地區：美國
出國期間：九十二年十月二十八日至十一月七日
報告日期：九十三年一月十二日

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赴美國考察真空儀器設備暨參加美國真空年會出國報告

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

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關鍵詞:　真空設備,鍍膜系統,美國真空年會

內容摘要: 爲掌握國際上真空設備及鍍膜系統發展現況，以及收集最新鍍膜系統資訊，筆者奉派前往美國東岸紐澤西州參訪丹頓真空有限公司(Denton Vacuum LLC)、賓州SHI-APD Cryogenics 公司以及參加在馬里蘭州之巴爾的摩所舉行的第 50 屆美國真空學會年會。藉著參觀訪問以及參加真空相關之研討會，廣泛蒐集國際上真空、鍍膜、微機電系統、奈米材料、奈米檢測、生醫檢測領域之最新訊息，瞭解先進國家在此方面之發展趨勢。於研討會附帶舉辦之真空儀器展覽會中亦蒐集參展之相關真空元件及系統儀器資料，以求迅速掌握國際真空相關領域儀器之發展現況及各製造廠商之研發趨勢，以作爲本中心未來策略規劃及技術發展方向之參考。

本文電子檔已上傳至出國報告資訊網

摘　要

為掌握國際上真空設備及鍍膜系統發展現況，以及收集最新鍍膜系統資訊，筆者奉派前往美國東岸紐澤西州參訪丹頓真空有限公司(Denton Vacuum LLC)、賓州 SHI-APD Cryogenics 公司以及參加在馬里蘭州之巴爾的摩所舉行的第 50 屆美國真空學會年會。藉著參觀訪問以及參加真空相關之研討會，廣泛蒐集國際上真空、鍍膜、微機電系統、奈米材料、奈米檢測、生醫檢測領域之最新訊息，瞭解先進國家在此方面之發展趨勢。於研討會附帶舉辦之真空儀器展覽會中亦蒐集參展之相關真空元件及系統儀器資料，以求迅速掌握國際真空相關領域儀器之發展現況及各製造廠商之研發趨勢，以作為本中心未來策略規劃及技術發展方向之參考。

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壹、前言

本中心為因應奈米科技發展趨勢及配合國家科技發展政策，以多年累積的真空系統與微機電軟硬體製作累積之經驗及優勢技術能量與完整之儀器系統整合技術，持續努力不斷創新，冀能掌握未來前瞻技術新趨勢，並扮演好國家精密儀器研究發展與技術服務的重要角色。

真空技術的開發向為國科會精密儀器發展中心之重點任務，經過多年努力在國內相關研究領域已具舉足輕重地位。為維繫技術之永續發展，參加真空技術之相關國際研討會，除可精確掌握國際上相關技術的研發脈動之外，並研擬具前瞻性且契合先進國家發展趨勢之研究主題，藉以提升中心之研發能量。

美國真空學會為世界真空學界最大之組織，其每年年會參加人數超過三千多人。舉行期間同時亦舉辦為期一週之學術研討會及儀器展示會，規模日趨盛大，參與發表之論文總數多達千餘篇，皆為最具水準與代表性研究成果。今年將參與此一國際盛會並蒐集相關研究之最新訊息，以提供中心規劃研究方向作為重要參考。

此行除了參加美國真空學會年會之外，另外將參訪丹頓真空公司（Denton Vacuum）及與其合作之相關廠商，訪查精密光學鍍膜系統之相關組件（如蒸發源、光學監控系統、試片旋轉系統、離子助鍍系統）及其整合系統，以作為採購鍍膜系統時規格之參考。

貳、目的

(一) 參訪丹頓真空公司（Denton Vacuum LLC）

美國丹頓真空有限公司由理查德丹頓先生於 1964 年創立，總部設在美國東海岸的紐澤西州，是一家專業從事真空鍍膜系統開發和鍍膜服務的高科技企業。

丹頓真空製造的系列鍍膜系統廣泛用於精密光學、眼視光學、微電子/半導體、光電、通訊、顯示器、醫療器械、薄膜材料應用等領域的科學研究、產品開發、樣品製備和大規模生產。而其客戶遍及全球各地，包括通用電氣（GE）IBM、美國電話電報公司(AT&T)、柯達（Kodard）、施樂（Xerox）、英代爾（Intel）摩托羅拉（Motorola）、賓得（Pentax）、德州儀器（TI）、瓦裏安（Varian）、德國蔡司(Zeiss)、諾思洛普-格魯曼公司(Northrop-Grumman)、高速光纖設施公司(JDS Uniphase Corp.)、3M、蘇拿光學（Sola）等跨國企業，也包括諸多世界著名的學府和研究機構，如華盛頓天主教大學（Case Western Reserve University）、蒙特利爾生態工藝學院和賓州州立大學等。

此行除了參觀各式鍍膜系統（包括熱蒸鍍、電子束蒸鍍、磁控濺鍍、電漿輔助化學氣相沈積（PECVD）等系統）之外，

將與其技術人員討論並瞭解該公司之核心專利技術，以及其自行研製之光學監控儀，對薄膜生長過程進行即時監測和超高精度控制、以及鍍膜過程之自動化軟體作業平台（Process Pro）。

在系統維護保養方面，丹頓真空公司建立之作業平台（Process Pro）軟體具有遠端存取功能，可利用網際網路對客戶購置的丹頓鍍膜系統進行即時診斷和過程支援。此為該公司之一大特色，具省時及降低維修成本考量。因此此次參訪亦將此項目列入重點之一。

(二) 參訪 SHI-APD Cryogenics 公司

APD Cryogenics 原為美國冷凍幫浦製造商，而日本 Sumitomo 重工(Sumitomo Heavy Industries)在 2002 年 2 月併購了 APD Cryogenics 公司，由於 SHI 公司的主要核心技術為低溫技術，因此併購 APD Cryogenics 公司後使得 SHI 更加擴展其冷凍科技技術方面的市場。APD Cryogenics 公司創立於 1959 年，目前主要生產真空抽氣設備，其應用市場含括了半導體製程、鍍膜系統、偵測器冷卻系統、生醫診斷系統、工業真空系統等等。該公司主要工程和製造業設施位於日本 Tanashi，銷售與服務中心設於美國加州與英國。該公司與丹

頓公司具有長期合作關係，主要是提供丹頓公司真空抽氣系統(冷凍幫浦)部分，此次之行將參訪與丹頓公司具有合作關係之相關廠商，以瞭解相關組件之運作情形。

(三) 參加美國真空學會第50屆國際研討會

美國真空學會每年舉辦一次年會，為世界真空學界之年度大會，今年將舉辦第50屆年會，舉辦地點位於美國馬里蘭州之巴爾的摩。今年研討會論文依學門領域劃分包括先進表面工程（Advanced Surface Engineering）、應用表面科學（Applied Surface Science）、生物材料界面（Biomaterial Interfaces）、電化學及液/固界面（Electrochemistry & Fluid-Solid Interfaces）、電子材料與元件（Electronic Materials and Devices）、磁性界面與奈米結構（Magnetic Interfaces and Nanostructures）、微機電系統（MicroElectroMechanical Systems）、製造科學與技術（Manufacturing Science and Technology）、奈米尺度結構（Nanometer Structures）、奈米管（Nanotubes）、有機薄膜與元件（Organic Films and Devices）、光子晶體材料與元件（Photonic Materials and Devices）、電漿科學與技術（Plasma Science and Technology）、奈米尺度製程（Processing at the Nanoscale）、半

導體材料（Semiconductors）、表面科學（Surface Science）、應用科學及驗證（Technology and Sustainability）、薄膜技術（Thin Films）及真空技術（Vacuum Technology）等共計十九個主題，其中與本中心現正執行與未來將發展之真空、鍍膜、表面分析、微系統製造、奈米檢測、奈米材料及奈米結構加工等技術均息息相關，透過此行的參與將可獲取最新的發展訊息，有效提供中心規劃中長期計畫作為重要參考。

除了研討會之外，另外則有四百逾家真空專業製造廠商參與之儀器展示會，亦為年會之一大盛事。而在年會中舉辦之短期真空技術研習班亦為一大特色，每日皆有十餘場次同時舉行，提供研究生、專業人員及產業界人士參加以提高技術水準。參與本次年會除了瞭解目前最新之研究發展動態，另外在真空儀器展示會中將可廣泛蒐集各著名儀器製造商最新研發資料與儀器發展資訊，以為本中心未來發展相關技術之參考。

參、過程

一、訪察行程表：

地點：美國

日期	起	至	工作內容
92.10.28(二)	台北	洛杉磯（轉機）	起程
92.10.29(三)	洛杉磯（轉機）	費城	安排住宿
92.10.30(四)	費城	Moorestown	參訪丹頓真空公司
92.10.31(五)	費城	Allentown	參訪 SHI-APD Cryogenics 公司
92.11.1(六)	費城		整理資料與報告撰寫
92.11.2(日)	費城	巴爾的摩	參加第 50 屆美國真空年會，辦理報到及註冊手續
92.11.3(一)	巴爾的摩		參觀儀器展示會及參加研討會
92.11.4(二)	巴爾的摩		參觀儀器展示會及參加研討會
92.11.5-7(三、四、五)	巴爾的摩	台北	回程

二、參訪丹頓真空公司（Denton Vacuum）

日期：九十二年十月三十日(星期四)

地點：美國紐澤西州之 Moorestown

訪察主要經過概述如下：

(一)美國丹頓真空有限公司總部設在美國東岸的紐澤西州，從事薄膜研究、設備製造和鍍膜服務，已有四十年的歷史。筆者於十月三十日前往該公司拜訪，首先由市場行銷部門經理 James P. C .接待，在一陣寒暄之後，James 經理作了簡短的簡報，主要內容為該公司之發展歷史、部門介紹，以及該公司產品及技術服務等介紹。

(二)在簡報之後，則由設備部門經理 R. Wang 帶領參觀多套正在進行組裝之鍍膜系統，並介紹該公司正為美國國防部組裝製造之超大型光學鍍膜系統。從鍍膜腔體製造、抽器系統組裝、試片基座旋轉機構以及光學監控系統等皆一一作了詳細的介紹。

(三)除了參觀正在進行組裝之鍍膜系統，另外亦參觀該公司之鍍膜服務廠，現場有多套鍍膜系統以及技術人員正進行製鍍工作。印象較為深刻的是其中一套系統正在製鍍手術用

之燈罩，膜層除了具備反射的功能外，還須將反射光之顏色作校正，以免造成手術時的誤判。除了參觀之外，並與該公司製程部 David W. K.經理對於製程方面作討論及意見交流。

三、參訪 SHI-APD Cryogenics 公司

日期：九十二年十月三十一日(星期五)

地點：美國賓州之 Allentown

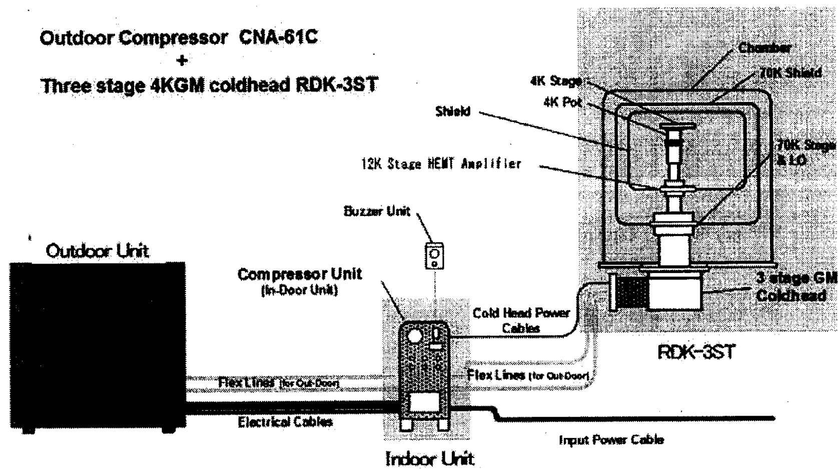
訪察主要經過概述如下：

(一)APD Cryogenics 原為美國冷凍幫浦製造商，而日本 Sumitomo 重工(Sumitomo Heavy Industries)在冷凍低溫方面具有前瞻技術，2002 年 2 月日本 Sumitomo 重工併購了 APD Cryogenics 公司，由於 SHI 公司的主要核心技術為低溫技術，因此併購 APD Cryogenics 公司後使得 SHI 更加擴展其冷凍科技技術方面的市場，目前主要生產之真空抽氣設備，其應用市場含括了半導體製程、鍍膜系統、偵測器冷卻系統、生醫診斷系統、工業真空系統等等。該公司主要工程和製造業設施位於日本 Tanashi

及美國賓州，銷售與服務中心設於美國加州與英國。該公司生產的產品包括了冷凍幫浦、冷凝器、低溫恆溫器等等。目前該公司正發展三段式冷卻系統(3-stage GM cryocooler)示意圖如下所示，該公司與丹頓公司具有長期合作關係，主要是提供丹頓公司真空抽氣系統部分，此行參訪除了聽取該公司人員簡報及參觀該公司的生產線之外，並與該公司之技術人員討論，對於低溫技術方面的瞭解及應用，有多一些的瞭解。

3 STAGE 4KGM CRYOCOOLER

SRDK-3ST SYSTEM



四、參加美國真空學會第 50 屆國際研討會及真空儀器展覽會

舉辦日期：九十二年十一月二日（星期日）至九十二年十一月四日（星期二）

舉辦地點：美國馬里蘭州巴爾的摩之 Convention Center

美國真空學會（American Vacuum Society）係屬美國物理學院轄下的重要學會之一，會員涵蓋世界各有關研究領域之成員，為一世界性組織，其下亦包括有十餘個分支學會，歷史悠久，迄今已歷 50 屆，每年至少吸引三千人以上來自世界各地學術界與產業界人士參加，本次之研討及展覽會係配合其每年年會舉辦，主要內容包括口頭論文發表會、壁報論文發表會、部門委員會議、分組委員會議、會員大會、儀器技術短期研習會及頒獎典禮等，詳細內容概述如下：

(一)口頭論文發表會：

口頭論文發表會為本次大會的重點項目，蒐羅世界各國真空學界相關論文，經過大會各學門分組之遴選委員會選出一千餘篇論文，於大會舉行期間發表，再依各學門選出其中最具代表性之論文約七百餘篇在各會議室中作二十分鐘之精要發表，其餘各篇則於週二下午及週三早上在會場一樓以壁報方式

解說予參觀人士。口頭論文發表會型式為主題研討會，其下再劃分數個分項子題，每一子題皆設有主持人統籌會場發表時程、聯繫、介紹等事宜。各個主題研討會分述如下：

(1)前瞻表面工程之分項子題包括：

a.表面工程的現代新挑戰

b.硬質鍍膜：製備、性質以及奈米磨耗

c.奈米結構複合材料以及功能性漸層鍍膜

d.高溫保護鍍膜

(2)應用表面科學則包括：

a.表面科學實務

b.奈米管及奈米粒子分析

c.影像分析及高分子分析

d.生醫材料分析

e.高介電材料界面分析

f.燃料電池與電池材料/腐蝕

g.電子與光子能譜技術

h.二次離子質譜技術

(3)生物材料界面之子題則有：

a.生醫材料

b.蛋白質/表面反應

c.細胞/表面反應

d.生物介面/生物摩擦學

e.奈米尺度生醫分析

f.生物分子表面科學與微流體學

g.生醫感測器

h.生醫診斷學

i.生物界面之電漿處理方法

(4)電化學與液/固界面包括：

a.水在界面之結構與電化學

(5)電子材料與元件包括：

a.電子材料與元件之缺陷及界面

b.電子材料

c.多功能性電子材料

d.電子與光電之未來議題

e.鑽石與碳化矽之接合

f.材料與半導體介面之異質接合

(6)磁性材料界面與奈米結構包括下列分項子題：

a.磁儲存結構

b.磁影像與磁譜學

c.自組與奈米磁性

d.磁性薄膜

e.新自旋材料

f.磁化動力學

(7)製造科學與技術包括：

a.製程與設備發展

b.半導體先進材料與新製程的挑戰

c.封裝及界面工程在積體電路製程的角色

d.下一世代半導體走向

e.感測器度量及控制學

(8)微機電系統包括：

a. MEMS 材料發展與分析

b.MEMS 元件製作及分析

c.微系統新領域：NEMS 及 BioMEMS

(9)奈米尺度結構包括下列子題

a.量子點及奈米元件

b.奈米管

c.奈米機械學

d.奈米摩擦學

e.先進掃瞄探針

f.奈米科技及生物學

(10)奈米管包括：

a.奈米碳管性質

b.奈米管之成長與製備

(11)有機薄膜與元件，包括：

a.分子及有機薄膜之電子元件

b.分子及有機薄膜之光電元件

c.分子電子學

(12)電漿科學與技術包括：

a.臨界尺度蝕刻

b.MEMS 蝕刻

c.電漿源

d.電漿輔助化學氣相沈積

e.電漿製程診斷

f.介電體蝕刻

g.奈米結構與奈米材料之電漿製程

h.電漿/表面反應機制

i.大氣電漿與微放電加工

j.電漿/表面反應製鍍

k.電漿/表面反應蝕刻

l.低介電材料蝕刻

m.電漿診斷機制

(13)奈米尺度製程，包括

a.奈米尺度微影製程

b.分子級單層膜

(14)半導體方面包括

a.寬能帶異質半導體

b.窄能隙半導體

c.化合物半導體成長與製程

d.異質磊晶與應變工程

e.鐵電及磁性半導體

f.小尺度結構及非晶矽

(15)表面科學，包括

a.氣體-表面動力學

b.分子表面之吸收與催化反應

c.表面的擴散與潤溼性質

d.表面催化反應

e.磨耗、附著性與摩擦性質

f.金屬簇的結構與反應性

g.碳氫化合物在金屬表面的催化反應

h.成核與成長

i.半導體與複合材料的表面與界面

j.半導體表面的有機功能化

k.有機薄膜的成長與分析

l.半導體的圖紋成長與蝕刻

m.高壓與低壓的催化反應

n.氧化物結構、成長與缺陷

o.單層結構的自組

p.氧化與催化反應

q.複雜系統的反應性及催化

r.氧化物表面及界面

(16)永續性的科學包括了

a.持續過程的發展與完成

b.關於全球效應的科學與技術：放射、氣候與輸送

(17)薄膜方面則包括有下列幾項子題：

a.原子級膜層鍍膜

b.原子級膜層鍍膜與低介電性質

c.有機、高分子及生物材料基材上的薄膜成長

d.透明導電氧化膜

e.光學薄膜

f.感測器、智慧型薄膜以及功能性材料

g.複合型薄膜

h.薄膜成長的基礎理論

i.臨場/離場之監控

j.薄膜的機械性質

(18)真空技術包括下列幾種子題：

a.真空科技五十年回顧

b.動態真空系統

c.釋氣及大型真空系統

d.真空與製程量測之再現性與準確度

e.工業真空應用

由上述幾種子題學門的分類可以發現奈米科技相關研究佔了三分之一以上，顯而易見的奈米科技的研究已然成為未來科技發展的主流。以薄膜學門而言，前幾年極為熱門與光通訊有關之窄波通濾光膜研究正快速的隨產業的衰退而大幅減少，代之而起的是原子級鍍膜以及透明導電氧化膜的研究與應用大受重視。

(二)壁報論文發表會：

壁報論文發表會則是海報製作方式發表論文，提供參與人士瞭解其研究成果。論文歸納分為前瞻表面工程、應用表面

科學、生物材料界面、電子材料與元件、磁性材料界面與奈米結構、製造科學與技術、微機電系統、奈米尺度結構、奈米管、有機薄膜與元件、電漿科學與技術、半導體、表面科學、薄膜、真空技術等幾個學門，由各組委員會主席負責壁報論文之遴選、分類、位置、時程安排等工作，地點設於一樓真空儀器展示會旁場地，時間則是安排於星期二下午與星期三早上。

(三)真空儀器展覽會：

真空儀器展覽會中，展示儀器涵蓋了薄膜鍍製系統如濺鍍系統及離子束鍍膜系統；各式真空計；測漏儀；流量控制器；膜厚監控器；真空幫浦；電源供應器以及各式分析儀器如橢圓偏光儀以及一些表面分析儀器等等。另外亦有許多廠商展出諸多學門領域所用之真空零件材料及工具等產品。參展廠商共超過 400 家，其中除了美國本土製造商外，亦不乏世界著名之有關儀器製造商參與展覽。展覽會由於是搭配年會及研討會而舉行，時間較短，由星期二中午展示至星期四下午結束，地點則在 Baltimore Convention Center 會場一樓展覽大廳。

五、九十二年十一月二日（星期日）

(一)本日工作重點為辦理報到及註冊手續、領取資料。本次年

會共舉辦了兩個專題邀請演講，主題分別為濺鍍製程與生醫材料，會場在 Baltimore Convention Center 二樓。上午為濺鍍製程邀請演講，共有三場，各場演講時間約 40 分鐘。下午兩個專題邀請演講則包括濺鍍製程及生醫材料。

(二)上午有關濺鍍製程方面共有三場專題邀請演講：

1.反應性濺鍍製程的基礎：由瑞典的 Berg 教授主講。

2.反應性濺鍍靶中毒之淺層植入機制：由比利時的 Gryse 教授主講。

3.虛擬濺鍍工具建立：由 Veeco 公司之 Kools 先生主講。

(三)下午在濺鍍製程方面則有四場專題邀請演講：

1.薄膜成長之微結構控制：由伊利諾大學的 Petrov 教授主講。

2.濺鍍系統中的前瞻電源供應器：由 Advanced Energy Industries, Inc.的 Scholl 先生主講。

3. 陰極電弧及高功率脈衝磁控濺鍍：由 Lawrence Berkeley 的 Anders 先生主講。

4.iPVD：由東北大學的 Hopwood 先生主講。

(四)下午生醫材料方面共有三場專題邀請演講：

1.利用 X ray 量測水中氫的鍵結：由史丹福同步輻射實驗室的 Nilsson 先生主講。

2.生物感測器表面的人造感受體：由瑞典的 Lundstrom 教授主講。。

3.多價染色體在生物化學的應用：由哈佛大學的 Whitesides 先生主講。

(五)所聆聽之專題邀請演講主要以濺鍍製程為主，其中第一場演講 Berg 教授講述有關反應性濺鍍之基本原理及物理現象，並提出 Berg's model 來解釋反應性濺鍍過程的基本行為。並預測氣體分壓與濺鍍速率、組成成分的關係。而 Gryse 教授則以淺層植入機制來解釋靶面毒化現象，並提及絕對靶面電壓(Absolute target voltage)增高時，靶面即有毒化現象。早上最後一場演講則由 Veeco 公司之 Kools 先生則談到利用電腦模擬來建立一套虛擬濺鍍系統，預測鍍膜成長行為及薄膜性質。並與實際的實驗結果對照，以應用於實際之鍍膜工業上。

下午的邀請演講中，Petrov 教授著重於薄膜成長微結構的控制，鍍膜成長機制包括成核，晶粒成長，再結晶等。並討論成長溫度與鍍膜微結構的關係。第二場演講則是有關濺鍍系

統中的電源供應器方面的演講。接下來的演講則是是講述有關高功率脈衝磁控濺鍍(HPPMS)系統，其系統具有高離化率，高鍍膜速率等優點，製鍍的鍍膜亦具備了高附著性，高壓縮應力，高緻密性等優點。

六、九十二年十一月三日（星期一）

(一)上午自 8 點 20 分開始，有十五個主題分別舉行：

1.應用表面科學：子題為表實用表面科學，由堪薩斯州的 Sherwood 教授主持，共有 10 篇論文宣讀。

2.生物材料界面：子題蛋白質表面反應，由 Duke 大學的 Chilkoti 教授主持，計有 9 篇論文宣讀。

3.高介電閘極元件：子題為高介電質電性及界面性質，由德拉威州大學的 Opila 教授主持，計有 8 篇論文宣讀。

4.製造科學與技術：子題為製程及設備發展，由伊利諾大學的 Seebauer 教授主持，共有 11 篇論文發表。

5.奈米尺度結構：子題為量子點及奈米尺度元件，由加州大學的 Yu 教授主持，共有 10 篇論文宣讀。

6.有機薄膜與元件：子題為分子及有機薄膜，由普林斯頓大學的 Kahn 教授主持，共有 9 篇論文宣讀。

7.電漿科學與技術：子題為臨界尺度蝕刻，主持人由Alilent實驗室的Seaward教授主持，有10篇論文宣讀。

8.主題會議：子題為表面前瞻定量技術分析，由NIST的Powell博士主持，有5篇論文在會中發表。

9.半導體方面：子題為寬能帶異質磊晶半導體，由Sandia國家實驗室Bogart博士主持，共有10篇論文在會中發表。

10.前瞻表面工程：子題為表面工程的現代新挑戰，由空軍研究實驗室的Voevodin博士主持，共有5篇論文發表。

11.表面科學：子題為氣體-表面動力學，由倫敦大學的Kolasinski教授主持，共有9篇論文在會中宣讀。

12.表面科學：子題為分子表面之吸收與催化反應，由馬里蘭大學的Reutt-Robey教授主持，共有10篇論文在會中發表。

13.表面科學：子題為表面的擴散與潤溼性質，由Sandia國家實驗室Kellogg博士主持，共有10篇論文在會中發表。

14.薄膜：子題為原子級膜層鍍膜，由 IBM 的 Rossnagel 博士主持，共有 8 篇論文在會中發表。

15.真空技術：子題為真空科技五十年回顧，由 Elvac 實驗室的 Kendall 博士主持，共有 5 篇論文在會中發表。

(二)下午自 2 點開始，分別有十八個主題分別舉行：

1.應用表面科學：子題為奈米管及奈米粒子分析，由 GE 全球研究中心的 Burrell 博士主持，共有 10 篇論文宣讀。

2.生物材料界面：子題為生物分子表面與微流體學，由華盛頓大學的 Castner 教授主持，計有 8 篇論文宣讀。

3.高介電閘極元件：子題為高介電質的穩定性質，由 Agere 的 Chabal 博士主持，計有 7 篇論文宣讀。

4.電子材料與元件：子題為電子材料與元件之缺陷及界面，由 Palo Alto 研究中心的 Walle 博士主持，共有 8 篇論文發表。

5.磁性材料界面與奈米結構：子題為磁儲存結構，由 NVE 公司的 Tondra 博士主持，共有 8 篇論文宣讀。

6.製造科學與技術：子題為半導體先進材料與新製程的挑戰，由瓦里安公司的 Testoni 博士主持，共有 5 篇論文

宣讀。

7.電漿科學與技術：子題為臨界尺度蝕刻，主持人由 Alilent 實驗室的 Seaward 教授主持，有 10 篇論文宣讀。

8.主題會議：子題為分子及分子薄膜，由德國 Technische 大學的 Zahn 教授主持，有 9 篇論文在會中發表。

9.半導體方面：子題為寬能帶異質磊晶半導體，由 Sandia 國家實驗室 Bogart 博士主持，共有 10 篇論文在會中發表。

10.前瞻表面工程：子題為表面工程的現代新挑戰，由空軍研究實驗室的 Voevodin 博士主持，共有 5 篇論文發表。

11.電漿科學與技術：子題為 MEMS 蝕刻，由 Celii 博士主持，共有 9 篇論文在會中宣讀。

12.電漿科學與技術：子題為電漿源，由 Sandia 國家實驗室 Barnat 博士主持，共有 9 篇論文在會中發表。

13.主題會議：子題為薄膜量測，由北卡羅來納州立大學 Stevie 教授主持，共有 6 篇論文在會中發表。

14.前瞻表面工程：子題為硬質鍍膜：製備、性質以及奈

米磨耗，由瑞典 Linkoping 大學的 Hultman 教授主持，共有 9 篇論文在會中發表。

15. 表面科學：子題為表面催化反應，由加州大學的 Yarmoff 教授主持，共有 9 篇論文在會中發表。

16. 表面科學：子題為磨耗、附著性與摩擦性質，由愛爾蘭 Trinity 大學的 Jarvis 教授主持，共有 9 篇論文在會中發表。

17. 表面科學：子題為金屬簇的結構與反應性，由華盛頓大學的 Campbell 教授主持，共有 9 篇論文在會中發表。

18. 薄膜：子題為原子級膜層鍍膜與低介電性質，科羅拉多州立大學的 George 教授主持，共有 8 篇論文在會中發表。

(三)所聆聽的演講大部分屬於薄膜製鍍及真空技術方面，其中原子級薄膜沈積技術在未來將愈來愈受重視，其技術可應用於為電子方面以及其他前瞻性領域(如 MOS、奈米粒子)等等。在真空技術方面則回顧了五十年來真空科學發展史、真空的量測，以及超高及極高真空科技的發展。其他主題如表面分析儀器如光電子能譜儀(XPS)、二次離子質譜儀(SIMS)的定性、定

量以及縱深分析技術等。在奈米結構方面則聆聽有關量子點的成核及成長，奈米晶體結構等等。

七、九十二年十一月四日（星期二）

(一)上午自 8 點 20 分開始，有十六個主題分別舉行：

1.應用表面科學：子題為影像分析及高分子分析，由北卡羅來納州立大學 Stevie 教授主持，共有 11 篇論文宣讀。

2.生物材料界面：子題細胞/表面反應，由加州大學的 Healy 教授主持，計有 9 篇論文宣讀。

3.高介電閘極元件：子題為高介電材料製備與成長，由加州大學的 Chang 教授主持，計有 9 篇論文宣讀。

4.電化學與液/固界面：子題為水在界面之結構與電化學，由華盛頓大學的 Stuve 教授主持，共有 9 篇論文發表。

5.磁性材料界面與奈米結構：子題為磁影像與磁譜學，由密蘇里大學的 Waddill 教授主持，共有 8 篇論文宣讀。

6.微機電系統：子題為 MEMS 及 NEMS 材料的發展，由 CaseWestern Reserve 大學的 Zorman 教授主持，共有 10 篇論文宣讀。

7.製造科學與技術：子題為封裝及界面工程在積體電路製程的角色，由 SEMATECH 的 Larson 博士主持，有 5 篇論文宣讀。

8.奈米尺度結構：子題為奈米管，由伊利諾大學的 Cahill 教授主持，有 10 篇論文在會中發表。

9.有機薄膜與元件：子題為分子及有機薄膜之電子元件，由 GE 全球研究中心 Duggal 博士主持，共有 9 篇論文在會中發表。

10.電漿科學與技術：子題為電漿輔助化學氣相沈積，由 Naval 研究實驗室的 Guerin 博士主持，共有 9 篇論文發表。

11.電漿科學與技術：子題為電漿製程診斷，由日本名古屋大學的 Sugai 教授主持，共有 10 篇論文在會中宣讀。

12.半導體：子題為窄能隙半導體，由加拿大的 Desjardins 先生主持，共有 7 篇論文在會中發表。

13.前瞻表面工程：子題為奈米結構複合材料以及功能性漸層鍍膜，由西北大學的 Chung 教授主持，共有 9 篇論文在會中發表。

14.表面科學：子題為碳氫化合物在金屬表面的催化反應，由加州大學的 Koel 教授主持，共有 9 篇論文在會中發表。

15.表面科學：子題為成核與成長，由 Oak Ridge 國家實驗室的 Wendelken 博士主持，共有 10 篇論文在會中發表。

16.薄膜：子題為有機、高分子及生物材料基材上的薄膜成長，由北卡羅來納州立大學的 Parsons 教授主持，共有 9 篇論文在會中發表。

(二)下午自 2 點開始，分別有十八個主題分別舉行：

1.應用表面科學：子題為生醫材料分析，由新墨西哥大學的 Fulghum 教授主持，共有 9 篇論文宣讀。

2.主題會議：子題為高介電分析，由 Rutgers 大學的 Garfunkel 教授主持，計有 8 篇論文宣讀。

3.電子材料與元件：子題為電子材料，由俄亥俄州大學的 Brillson 教授主持，計有 4 篇論文宣讀。

4.磁性材料界面與奈米結構：子題為自組與奈米磁性，由 Argonne 國家實驗室的 Bader 博士主持，共有 8 篇論文

發表。

5.微機電系統：子題為 MEMS 元件製作與分析，由 NorthropGrumman 的 Freidhoff 博士主持，共有 9 篇論文宣讀。

6.製造科學與技術：子題為下一世代半導體走向，由英特爾公司的 Shankar 博士主持，共有 5 篇論文宣讀。

7.奈米尺度製程：子題為奈米尺度微影製程，由 Hitachi 的 Terris 博士主持，有 7 篇論文宣讀。

8.有機薄膜與元件：子題為分子及有機薄膜之光電元件，由 Naval 的 Makinen 博士主持，有 7 篇論文在會中發表。

9.電漿科學與技術：子題為介電體蝕刻，由 IBM 華森研究中心 Steen 博士主持，共有 9 篇論文在會中發表。

10.半導體：子題為複合半導體製程與成長，由明尼蘇達州州立大學的 Cohen 教授主持，共有 9 篇論文發表。

11.前瞻表面工程：子題為高溫保護鍍膜，由 Hull 大學的 Matthews 教授主持，共有 8 篇論文在會中宣讀。

12.表面科學：子題為水在界面之吸收層，由威斯康辛大學的 Hirschmugl 主持，共有 7 篇論文在會中發表。

13.表面科學：子題為半導體與複合材料的表面與界面，由威斯康辛大學的 Himosel 教授主持，共有 9 篇論文在會中發表。

14.表面科學：子題為半導體表面有機功能化，由愛爾蘭 Trinity 大學的 Boland 教授主持，共有 9 篇論文在會中發表。

15.薄膜：子題為透明導電氧化膜，由 OCLI-JDS Uniphase 的 Ockenfuss 先生主持，共有 7 篇論文在會中發表。

(三)在薄膜主題方面，所聆聽的主要為透明導電薄膜(如 ITO、IZO 等)製程、薄膜光學性質及導電性分析等等。另外則是將透明導電薄膜鍍於可撓式高分子基板上，以擴展其應用面。在製程方面，則是關於高動能離子束對於薄膜成長之微結構及薄膜材料光學特性的影響。在奈米結構主題方面，不外乎奈米管、奈米線之成長及分析等，如氣-液-固(VLS)技術成長 ZnO 之奈米柱。

肆、達成之任務

本次赴美國參訪丹頓真空公司、SHI-APD Cryogenics 公司以及參加美國真空學會第 50 屆國際研討會計畫行程均順利的按預定規劃目標逐項完成，所達成之任務成果如下：

一、參訪丹頓真空公司

藉由參觀各式鍍膜系統（包括熱蒸鍍、電子束蒸鍍、磁控濺鍍、電漿輔助化學氣相沈積（PECVD）等系統）之外，實地瞭解鍍膜系統製造過程及系統穩定性，並與技術人員討論其自行研製之光學監控儀，對薄膜生長過程進行即時監測和超高精度控制、以及鍍膜過程之自動化軟體作業平台（Process Pro）。

在系統維護保養方面，丹頓真空公司建立之作業平台（Process Pro）軟體具有遠端存取功能，可利用網際網路對客戶購置的丹頓鍍膜系統進行即時診斷和過程支援，如此一來，客戶端可在系統發生問題時，利用網際網路將儲存於系統電腦內之相關系統運轉資料傳至原廠，作立即的系統診斷，可節省不少的時間與金錢成本。

此次參訪丹頓真空公司，對於鍍膜系統之軟硬體，皆有所

接觸與瞭解，對於鍍膜系統的採購有相當大的幫助。

二、參訪 SHI-APD Cryogenics 公司

參觀該公司之冷凍幫浦及及低溫相關產品，透過與技術人員交流，了解其相關組件之製造及組裝過程，以及該公司對於使用客戶提供的產品及服務，可作為參考。

三、參加美國真空學會第 50 屆國際研討會

本次年會多達一千餘篇論文發表，領域涵蓋了除真空技術與薄膜兩個學門外，其真空應用領域更包括應用表面科學、應用表面工程、生物材料介面、電化學與液/固介面、電子材料與製程、磁性介面與奈米結構、製造科學與技術、微機電系統、奈米尺度科學與技術，奈米尺度製程、有機薄膜與元件、電漿科學與技術，表面科學等學門，其中新興熱門領域的奈米科技有關論文約佔三分之一，而表面科學相關論文則更佔三分之一強，由此次研討會可見真空科技的廣度。

由於行程中安排參加研討會時間僅三天，故而將參加重點鎖定在薄膜技術，表面科學與奈米科技等三個主題，希望能儘量將與中心未來發展息息相關的最新研究資訊與發展趨勢蒐羅，以供作未來研發計畫規劃參考。

藉由參觀此次年會附帶舉辦之真空儀器展示會，亦蒐羅了各家鍍膜系統資訊，真空元件型錄，濺鍍及蒸鍍材料廠商資訊。

伍、心得

本次計畫行程共有三項重點任務，一為參訪丹頓真空公司；二為參訪 SHI-APD Cryogenics 公司以及三為參加美國真空學會第 50 屆國際研討會。由於經費預算關係，參與真空年會行程只有三天，雖然時間頗為匆促，但也聽取不少論文發表會、壁報論文發表，以及參觀了真空儀器展示會，收集了不少有關真空科技方面之資訊，如鍍膜監控儀器、薄膜即時分析儀器及真空系統組件資料，以下則是此一行程的心得：

一、參訪丹頓真空公司

此行參訪丹頓真空公司，現場從腔體製造、線路搭配、抽氣系統組裝、光學監控系統以及機台測試過程，每一階段皆有專門負責人員，且人員相互之間配合度極高；除了與硬體相關技術人員現場討論之外，並與製程相關部門人員討論，收穫良多。

二、參訪 SHI-APD Cryogenics 公司

此行參訪 SHI-APD Cryogenics 公司，參觀了其生產線，並聽取相關人員的介紹，對於低溫技術及冷凍幫浦抽氣系統則有更進一步的認識。另外，掌握核心技術，乃是掌握市場的主

要關鍵，透過合併或併購，便能將市場掌握住。

三、參加美國真空學會第 50 屆國際研討會

美國真空學會所舉辦之國際研討會已歷 50 屆，每年均吸引數千名來自世界各國之真空相關領域研究人員參加，由於研討會水準相當高，因此投稿者眾多，而其涵蓋學門多達十九個，幾乎與真空技術有關之領域均被納入，所以參加此一研討會可以聽取到所有相關研究領域之最新研究成果。

在研討會中宣讀論文者有許多是年輕學者，在大會所準備的準備室中可以發現有許多人不斷練習，以求在規定的 20 分鐘內將論文完整發表。另外，大會亦安排幾場的邀請演講，受邀者包括世界各國在各不同研究學門之重量級專家學者在會中發表他們在研究上的最新成果，吸引相當多的聽眾參加，有些主題不但走道站滿人，甚至延伸至會議室門外。在論文報告完畢之後，每個人即尋找下一場欲聆聽主題之場地，臉上一股熱切求知的表情，實在值得學習。

參與此次盛會，在會場中除了可與各國相關領域人士討論之外，並且可以觀摩各國參與學者所製作之海報論文。

陸、檢討與建議

(一)美國真空學會所舉辦之國際研討會歷史悠久，迄今已歷 50 屆，每年均吸引許多真空領域優秀的研究論文投稿，會中所發表之論文皆為當前世界一流的研究成果，而且國際化程度極高，其中論文有三分之一左右來自美國以外國家，參加研討會人士東方面孔相當多，尤其是日本與韓國，在本次研討會參與人數眾多。由於此一國際研討會除了狹義之真空領域外，涵蓋層面甚廣，包括半導體製程、奈米科技、微機電系統、有機化學甚至還包括了生物科技與國家安全相關之生物和化學偵測技術。因此參加此一研討會確實是一種可以快速蒐集研究題材作為擬定計畫規劃的有效方式。

(二)會議的安排井然有序，各會議室門口皆有大型看板之論文報告時間表，以及每一間會議室皆配置 2~3 個服務人員，分別負責不同工作如茶水、投影機、電腦、麥克風以及門口駐守人員等服務，讓尋找會議主題之聽眾，能清楚且不費力的找到其場地。這與國內所舉辦之會議，通常每一會議室只有會議主持人一人，當硬體發生問題時，往往不知所措，延誤會議時程，其人力配置與國外比較，實有天壤之別。

(三)真空科技為近代高科技產業之母，以真空技術為基礎的技術領域包括奈米科技、半導體元件、微機電系統、表面分析技術、生物科技等均是，在此研討會中可以觀察到單項真空學門的論文數量不多，然而其它領域的論文的數量卻有大幅增加，尤其是與奈米科技相關之論文數量即佔了約三分之一，由此可見奈米科技已然成為未來研究發展的主流之一，值得本中心投注更多心力於此領域的研發工作。

(四)適逢真空年會五十週年，大會將五十年來與真空有關之發展歷程，製作成大型看板陳列於大會走廊上，使參與此盛會的來賓，可以藉此了解真空學會、真空的發展歷程，以及相關之人物代表，值得參考。

柒、結語

在此次赴美國參訪真空系統設備廠商及參加國際研討會行程中，可以接觸到各式各樣的真空硬體元件及設備，以及表面分析或光學分析儀器，可謂拓展了視野。美國真空年會屬於大型國際會議，參與人數每日多達數千人，分別在十餘個場地同時舉行，要讓其有條不紊的順利進行，必須極精確的掌握時間與有力的週邊支援，大會在這方面的行政掌控能力良好，配合美國守時習慣，雖然參與人數眾多而且不斷在各場次穿梭，整個過程卻是十分流暢，值得國內舉辦大型國際研討會時借鏡。

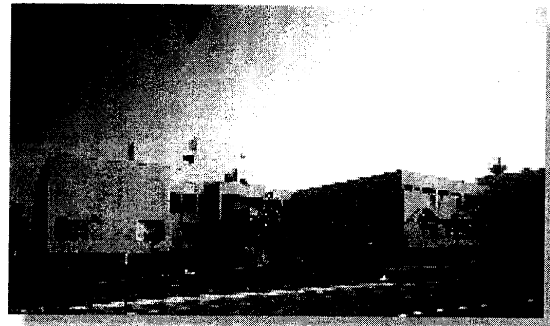
經由研討會之論文數量分析，可以明確感受到奈米科技的快速發展，已然在國際間形成研發的主流。本中心基於過去技術開發歷程與具備基礎，確實應當投注於從事奈米相關製程與檢測技術開發，以迎接奈米世代的來臨。

附　　件

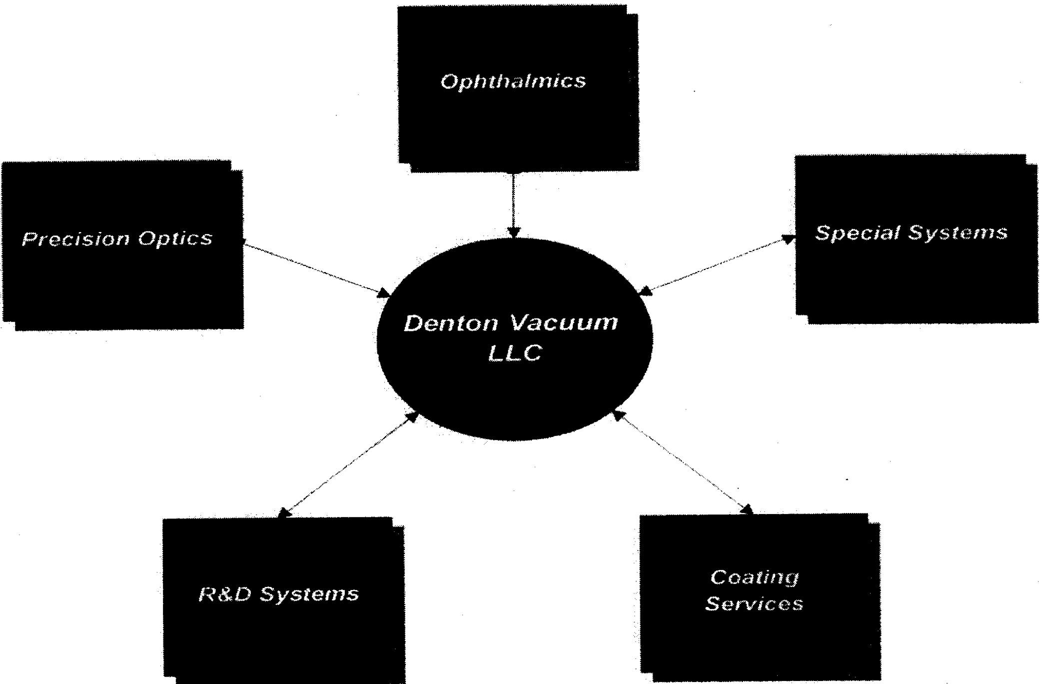
DENTON VACUUM, LLC

Good Morning

Precision Instruments Development Center



DENTON VACUUM LLC
Corporate Overview



DENTON VACUUM LLC
Corporate Overview

- Thin Film Equipment:
  - Precision Optics
  - Ophthalmic (AR & Sunwear)
  - Electronics / semiconductor
  - R&D/Microscopy Systems
  - Telecommunications
  - Special Applications
- Thin Film Coating Services

DENTON VACUUM LLC
Corporate Overview

- 40 years of process knowledge
- Process Driven Engineering Group
- Technology transfer from Denton Coating Division
- Worldwide representation / support
- Full 1 year warranty including delivered processes

DENTON VACUUM LLC
Technical Competencies

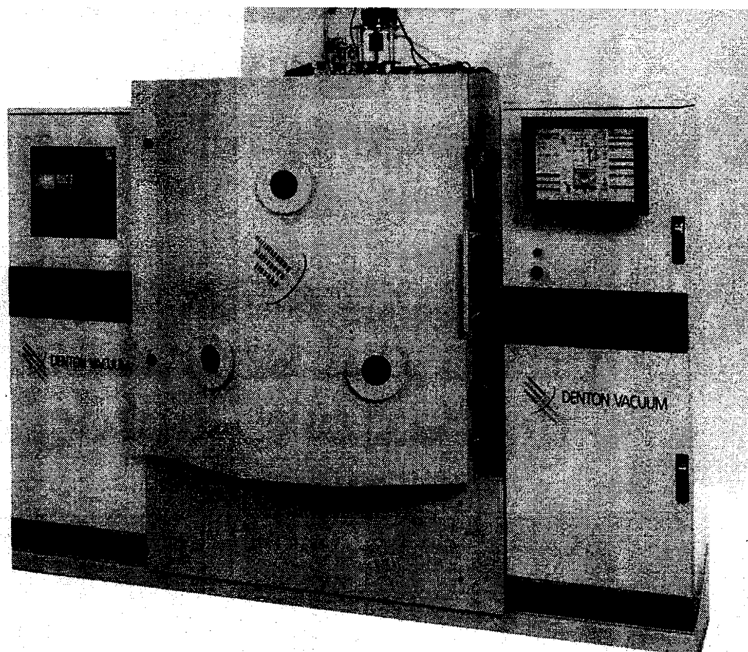
- **Process Expertise:**
  - Hands-on production experience
  - Optical thin film design capabilities
  - E-beam, thermal, and sputter deposition
  - Process modeling expertise
  - Ion assisted process expertise
  - Custom integration / design of customer specific hardware

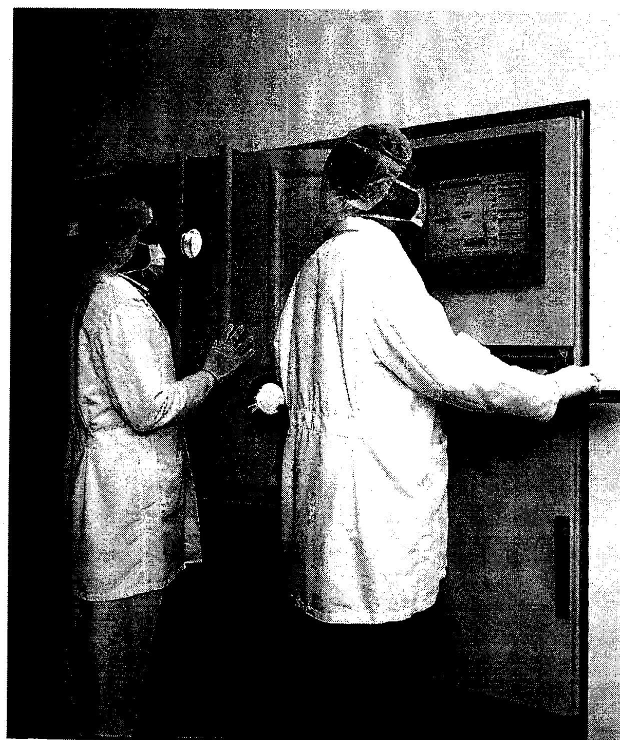
DENTON VACUUM LLC
Technical Competencies

- **Hardware Integration**
  - NEC/UL-3101/CE compliance
  - Robust build quality

- **Automation/Controls**
  - ProcessPro®
  - Remote Diagnostics
  - Intuitive operation

INTEGRITY® Precision Optics Systems

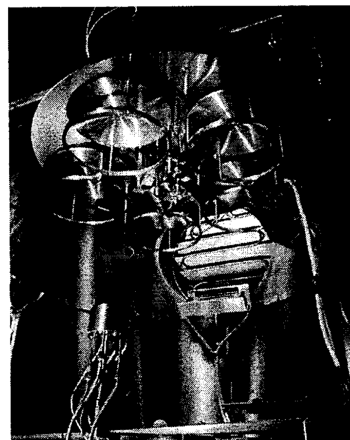
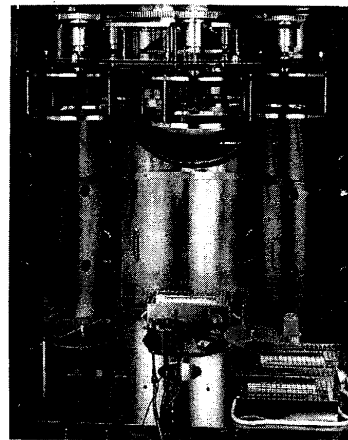
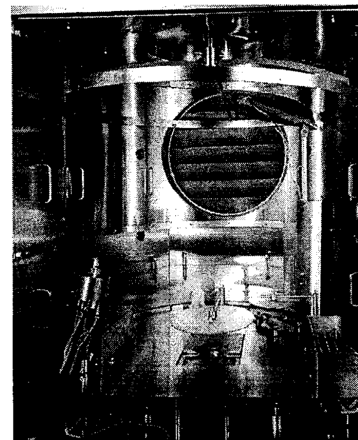




- Clean Room Friendly Configurations

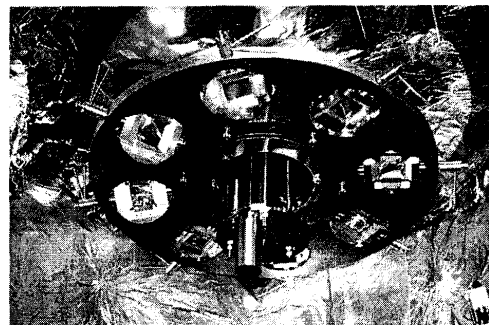
DENTON VACUUM LLC
Integrity® Precision Systems

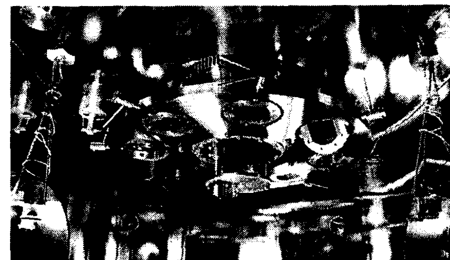
- Integrity® 29"- 80":
  - Dome-calotte, flip-over, flat plate and planetary fixturing
  - Cryogenic and diffusion pumped configurations
  - IAD Compatible

DENTON VACUUM LLC
Integrity® Deposition Systems

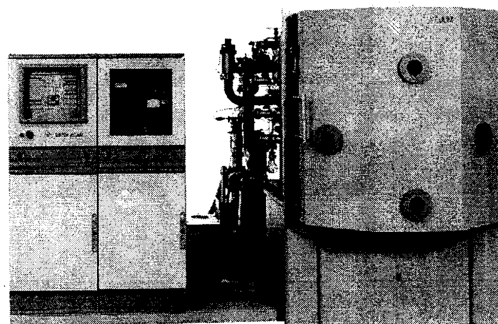
- <u>Integrity®</u>:
  - Flip-over tooling
  - Interface to customer specific tooling
  - Quartz crystal and/or optical monitoring control

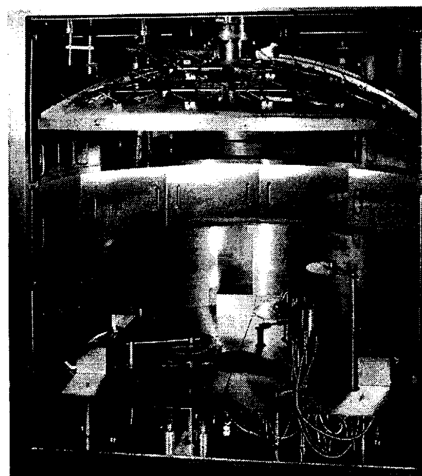




DENTON VACUUM LLC
Integrity® Deposition Systems

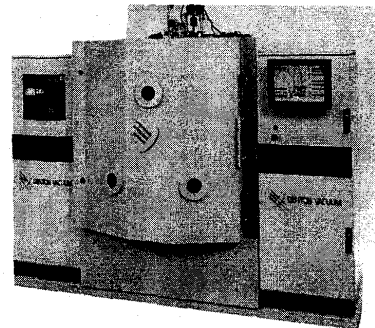
- <u>Integrity®</u>:
  - Twin control/power cabinets (per size and layout requirements)
  - Dome-calotte, flip-over, and planetary fixturing

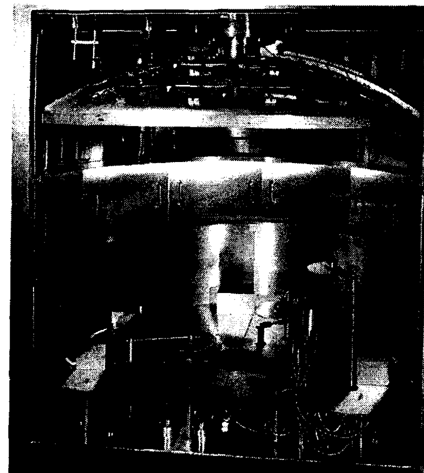




DENTON VACUUM LLC
Integrity® Deposition Systems

- **<u>Integrity</u>®:**
  - **Cryogenic and diffusion pumped configurations**
  - **Ion Assisted Configurations**



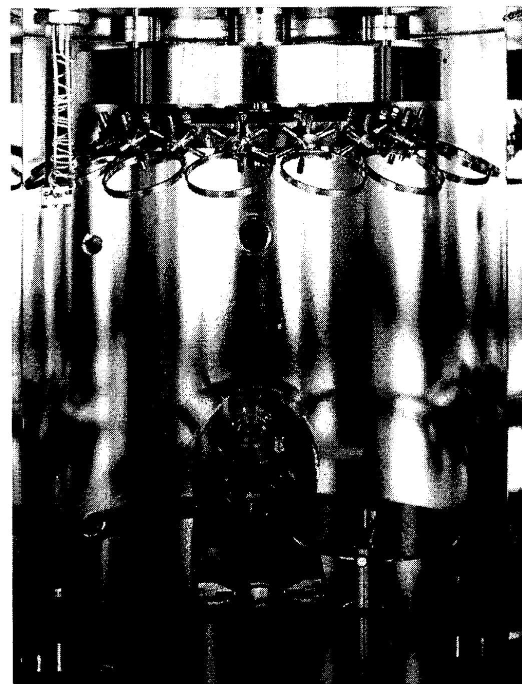


DENTON VACUUM LLC
Integrity® Deposition Systems

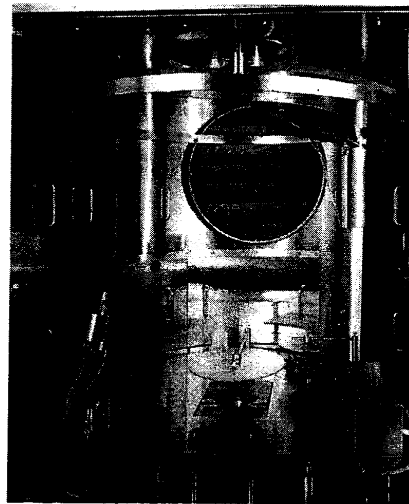
- **<u>Performance:</u>**

- **Dielectric Applications**
  - Insulators
  - Interference systems

- **Metal Applications**
  - Semiconductor
  - Protective
  - Sputtering



DENTON VACUUM LLC



ProcessPro®
Automatic Process Control Software

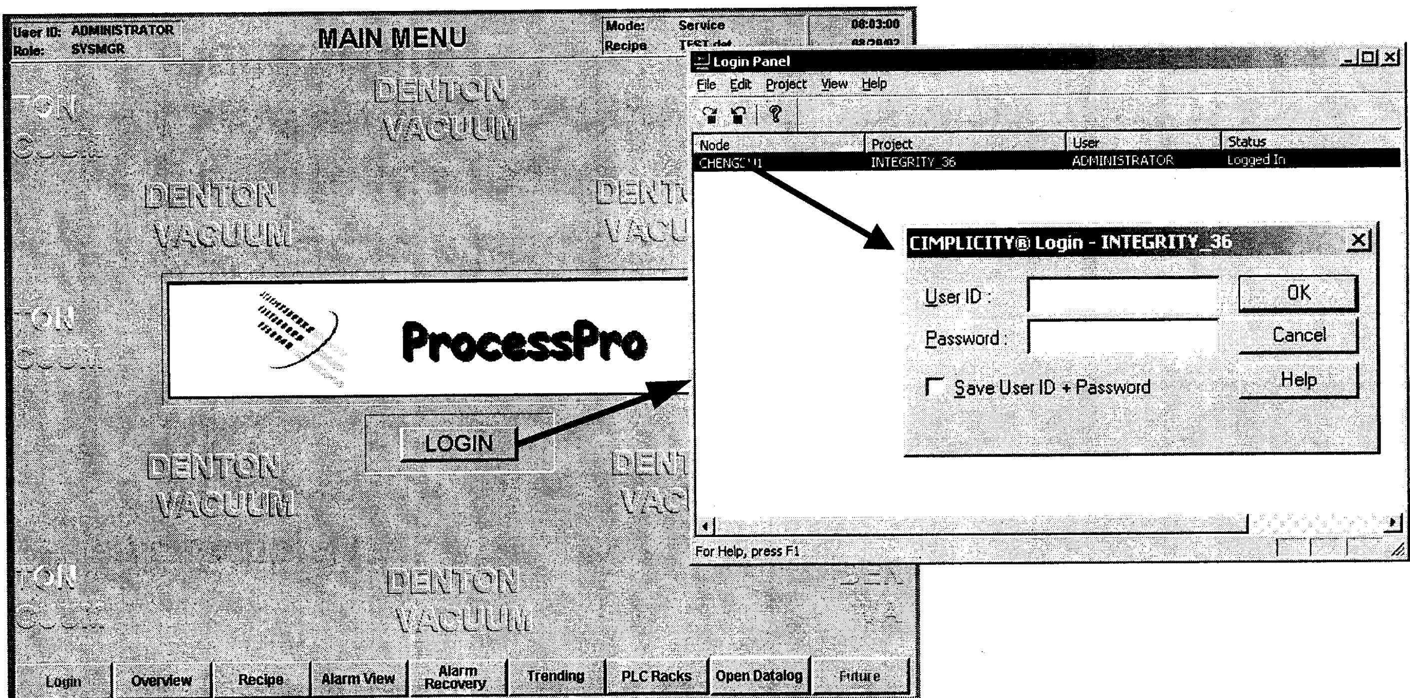
DENTON VACUUM LLC
ProcessPro® Control

- Deposition Control System Requirements:
  - **Graphically driven**
  - **Coordinate distributed intelligence (multitasking)**
  - **Facilitate new process development**
  - **Permit inevitable system evolution**
  - **Integratable into a production environment**
  - **Support remote diagnostics**
  - **Limited use of "custom" software**

DENTON VACUUM LLC
ProcessPro® Control

- ProcessPro®:
  - Application developed on GEF-Cimplicity® HMI:
    - Windows NT environment
    - Dynamic Data Exchange (DDE)
  - Data acquisition through MS Access®
  - Remote diagnostic through pcANYWHERE®
  - LabView application for automatic optical monitoring:
    - monochromator/lock-in-amplifier/data storage
  - 30 systems delivered since 1/98 introduction!

CIMPLICITY LOGIN SCREENS
(Available at System Start-up)



OVERVIEW

OVERVIEW SCREEN

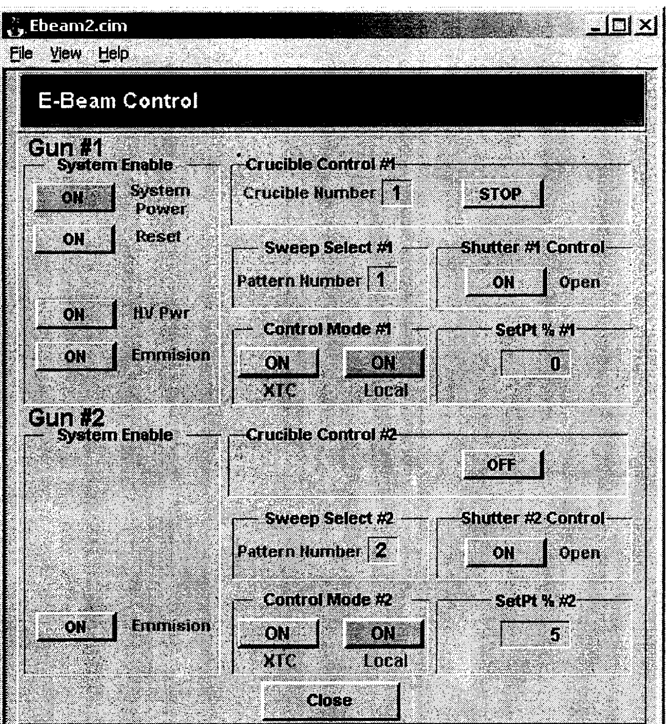
- Auto, Manual, Service mode selection
- Recipe information displayed
- Graphic display of current system conditions: alarms, interlocks, valves open/closed, rotation speed, e-gun pocket selection, etc.
- Digital data displayed from remote gauges, power supplies, temperature control, mass flow controllers, etc.

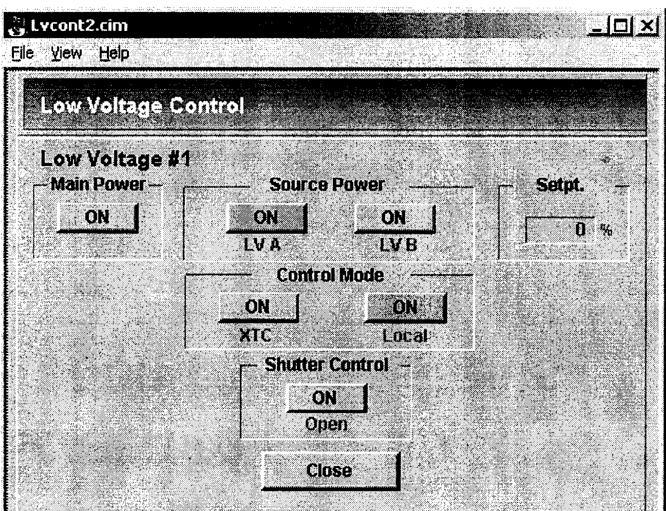
(Continued)

OVERVIEW SCREEN

- Manual control of mass flow controllers
- Access from Overview Screen to pop-up screens for manual operation of subsystems

MANUAL LOW VOLTAGE AND E-GUN SOURCE CONTROL





ALARM SCREEN

User ID: ADMINISTRATOR
Role: SYSMGR

ALARM VIEW

Mode: Service
Recipe TEST.dat

08:20:00
08/20/02

	Date	Time	Message	Duration
	Aug 20	07:51	AUTO PROCESS COMPLETE	29:28
*	Aug 20	07:47	AUTO PROCESS ALARM - DOOR NOT CLOSED!!	03:22
	Aug 20	07:10	Range limits exceeded IG_1_FB	70:30
	Aug 20	07:09	Range limits exceeded IG_2_FB	00:39
	Aug 19	16:40	XTC or OMNISERVER DOWN!! Reboot System CPU	15.2h
*	Aug 19	16:40	Comm error or dynamic disable, device: CHENGDU1 : XTC_2_#2	00:02

6 Aug 20 07:51

Reset Delete

Ack

Login | Overview | Recipe | Alarm View | Alarm Recovery | PLC Racks | Trending | Open Datalog | Future

ALARM RECOVERY SCREEN

User ID: ADMINISTRATOR
Role: SYSMGR

Alarm Recovery

Mode: System Mode
Recipe: TEST.dat

08:21:00
08/20/02

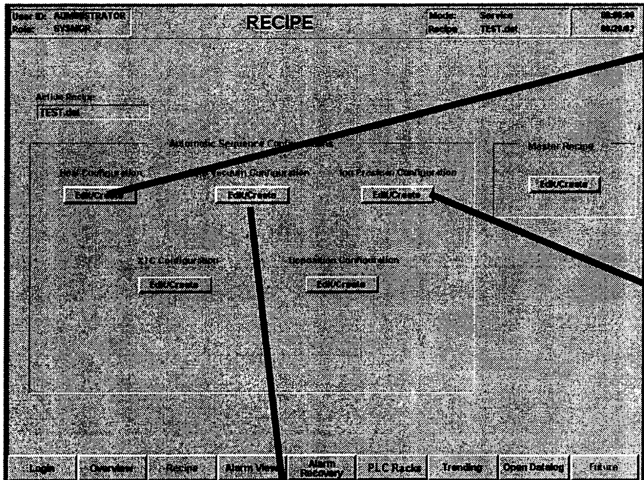
Recipe Name	Step Name	XTC/2 Thickness	Total Time
TEST.dat	TiO2(3)	#1 2.539 #2 2.539	00:00:00

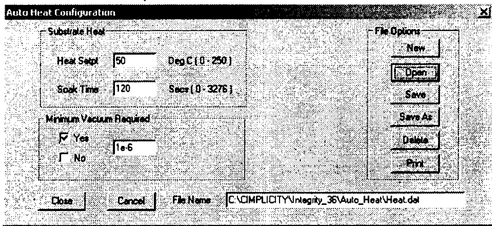
Date	Time	Message
Aug 20	07:51	AUTO PROCESS COMPLETE
Aug 20	07:47	AUTO PROCESS ALARM - DOOR NOT CLOSED!!
Aug 20	07:10	Range limits exceeded IG_1_FB
Aug 20	07:09	Range limits exceeded IG_2_FB
Aug 19	16:40	XTC or OMNISERVER DOWN!! Reboot System CPU

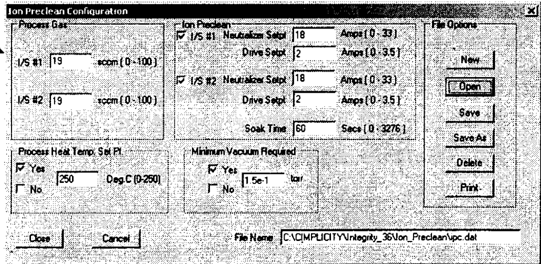
6 Aug 20 07:51

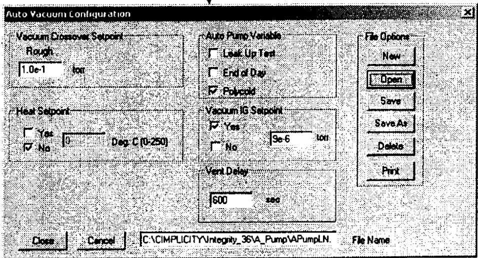
Login | Overview | Recipe | Alarm View | Alarm Recovery | PLC Racks | Trending | Open Datalog | Future

RECIPE SCREEN









Vacuum, Heat, Ion Pre-clean Recipe Configurations

DEPOSITION & XTC CONFIGURATION

Deposition Configuration

Process Heat
Yes Temp Setpt 0 Deg C (0 - 1120)
No

Minimum Vacuum Required
Yes VAC Setpt 2e-5 torr
No

Termination Configuration
Enter a file number XTC #1 001 (001 - 999)
Enter a file number XTC #2 002 (001 - 999)

Ion #1 Assisted Deposition
Yes Neutralizer Setpt 0 Amps (0 - 33)
No Drive Setpt 0 Amps (0 - 5)

Deposition Sources
Electron Beam Gun #1
Yes Crucible Number 1 (1 - 4)
No Sweep Pattern Number 1 (1 - 4)
Electron Beam Gun #2
Yes
No Sweep Pattern Number 1 (1 - 4)

Low Voltage Source
Yes
No
Source A
Source B
Source Soak
Power Level 000 (0-100%)

Process Gas
Select Gas Flow Mode
PID Fixed 5e-5 torr (1e-4)
Chamber 000 sccm (0 - 200)
Ion Source #1 000 sccm (0 - 200)
Ion Source #2 30 sccm (0 - 200)

Ion #2 Assisted Deposition
Yes Neutralizer Setpt 20 Amps (0 - 33)
No Drive Setpt 3 Amps (0 - 5)

File Options
New
Open
Save
Save As

Close Cancel File Name E:\CIMPLICITY\Integrity_36_2\Depositior

Open Deposition File

Look in: Deposition

1.dat
CalSiO2.dat
CalTiO2.dat
SiO2(2).dat
SiO2(4).dat
TiO2(3).dat
TiOx(1).dat

File name:
Files of type: dat Files
Open
Cancel

XTC Configuration

00:30 Rise Time 1 (Min:Secs)
18 Soak Power 1 (%)
01:00 Soak Time 1 (Min:Secs)
00:05 Rise Time 2 (Min:Secs)
15 Soak Power 2 (%)
01:00 Soak Time 2 (Min:Secs)
00:00 Hold Time (Min:Secs)
0.0 New Rate (A/s)
00:00 Rate Ramp Time (Min:Secs)

00:00 Idle Ramp (Min:Secs)
0.0 Idle Power (%)
0 Xtal Switch S
0 Xtal Switch Q
88 Tool Factor 1
88 Tool Factor 2
3.5 Deposition Rate (A/s)
.09 Final Thickness (kA)
0 Thickness Setpt. (kA)

Shutter Delay
Time Power

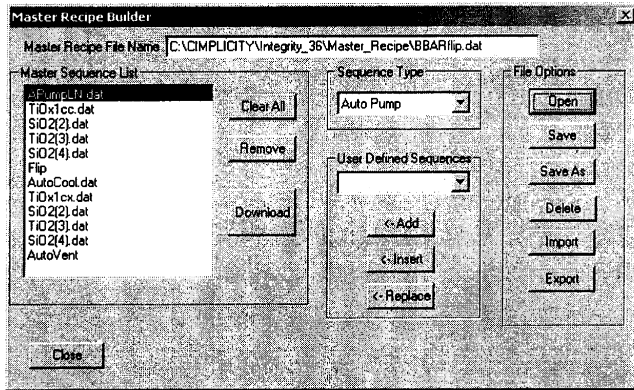
4.6 Density (gm/cc)
1 Z-Ratio
1 Sensor (1 or 2)
1 Source (1 or 2)
0 Crucible (0 - 8)
4 Control Gain
0.1 Control TC
0.1 Control DT
20 Max. Power (%)
5 Sample

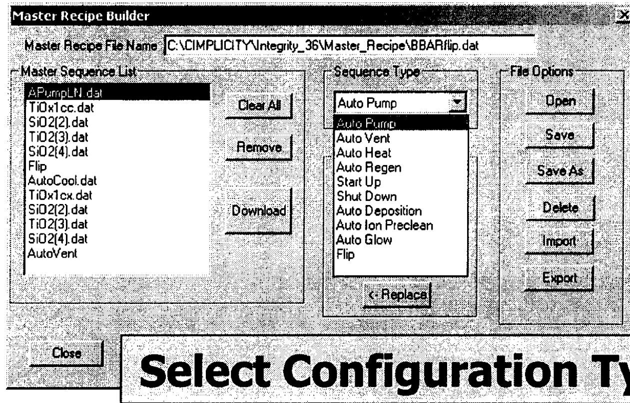
File Options
New
Open
Save
Save As
Delete
Print

Close Cancel File Name C:\CIMPLICITY\Integrity_36\XTC\XTC007.dat

Windows based
Recipe file structure

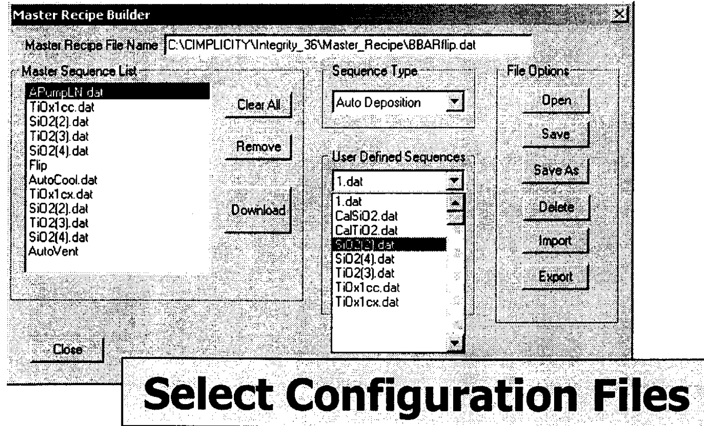
MASTER RECIPE BUILDER





Select Configuration Type

Build recipes from configuration files



Select Configuration Files

TRENDING

User ID: ADMINISTRATOR
Role: SYSMGR
TRENDING
Mode: System Mode
Recipe: TEST.dat
08:23:00
08/20/02

e-1 e-2 e-3 e-4 e-5 e-6 e-7 e-8 e-9 e-10 e-11

e+3 e+2 e+1 e+0 e-1 e-2 e-3 e-4

IG #1 IG OFF
IG #2 1.09e-007
PR #1 6.1e-003
PR #2 7.8e+002
PR #3 8.1e-003

100
-1
08/20/2002 8:23:28 AM
08/20/2002 8:23:58 AM

XTC Rate
0.00
XTC Power %
0.00
XTC Rate #2
0.00
XTC Power % #2
0.00

Login | Overview | Recipe | Alarm View | Alarm Recovery | PLC Racks | Trending | Open Datalog | Future

CIMPLICITY Trend Control Properties

Lines | Axis | Chart | Legend | Grid | Runtime Actions

Color	Axis ID	Type	Visible
	Chart X Axis	X time	
	Chart Y Axis	Y	

Label:
Duration: 00:00:30 No scroll
Start time
Now minus days 0
Now minus time 01:00:00
Ticks: 11 Numbered

OK | Cancel | Apply | Help

Configurable real-time data display

DATALOG

Microsoft Access

File Edit View Insert Tools Window Help

Chengdu1 : Database (Access 2000 file format)

Open Design New

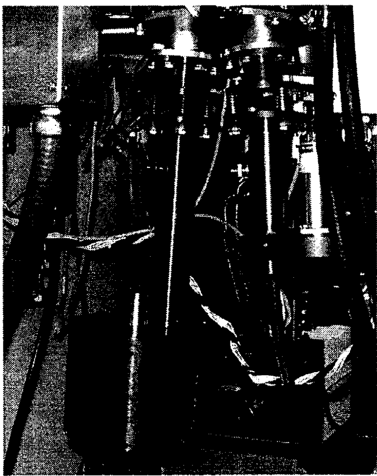
Objects
Tables
Queries
Forms
Reports
Pages
Macros
Modules
Groups
Favorites

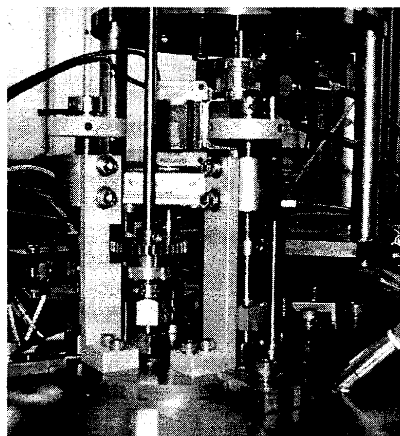
Create table in Design view
Create table by using wizard
Create table by entering data
ALARM_LOG
A_DEP
A_DEP_SP
A_HEAT
A_HEAT_SP
A_IPC
A_IPC_SP
A_PUMP
A_PUMP_SP
EVENT_LOG

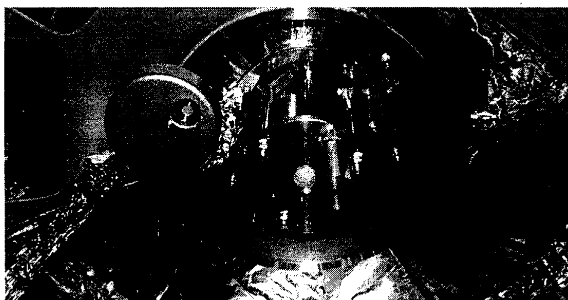
Ready

MICROSOFT ACCESS

DENTON VACUUM LLC
LambdaPro® OMS



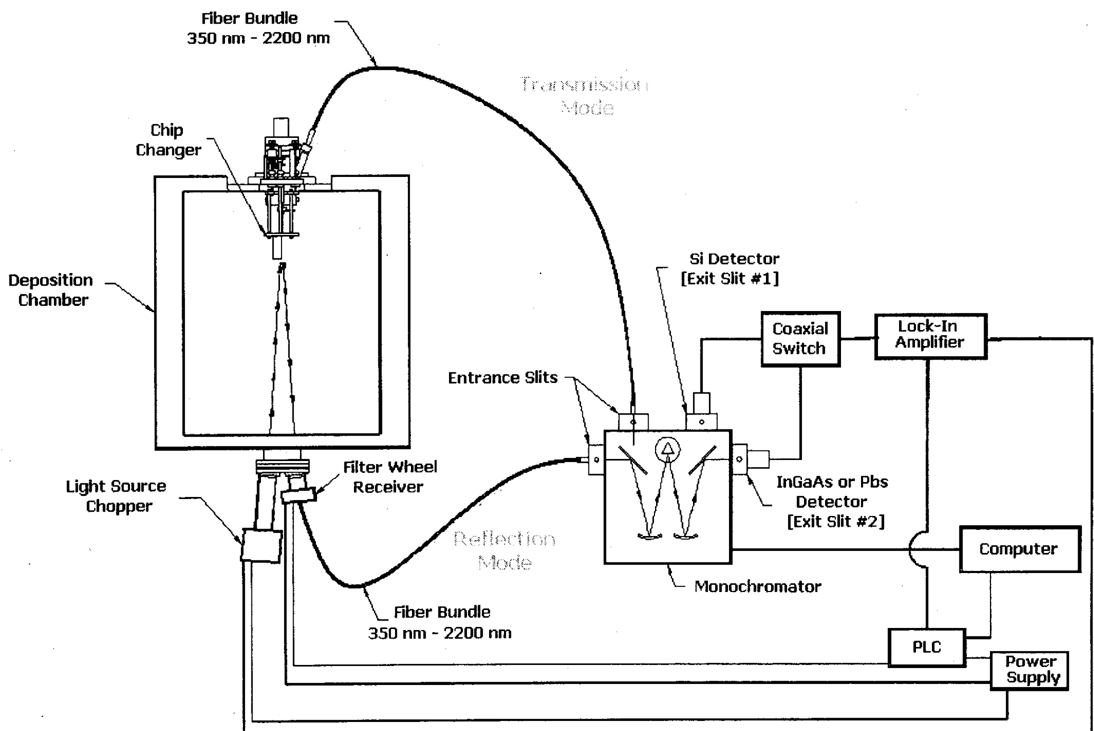




DENTON VACUUM LLC
LambdaPro® OMS

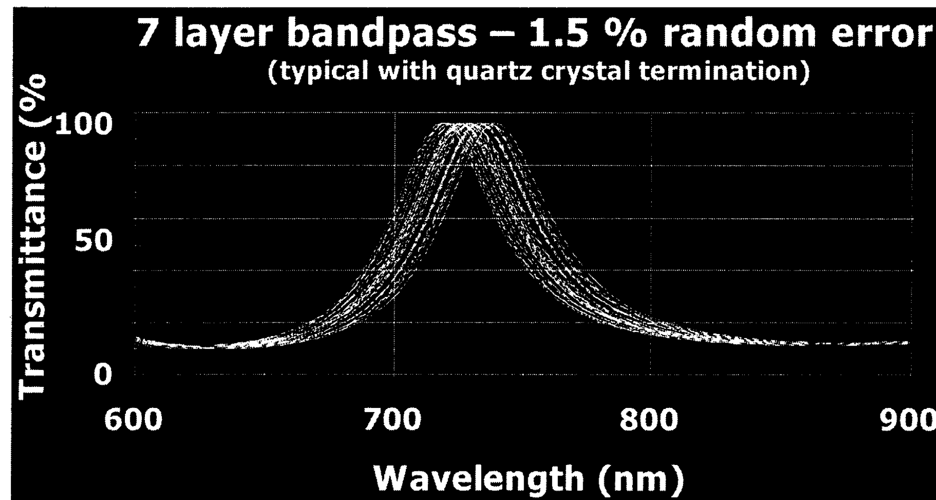
- LambdaPro® OMS:
  - 0.3/0.5 m Czernary-Turner monochromator
  - Vis and Near Ir adjustable exit slits
  - Automatic exit selection
  - 400nm to 1600 nm range
  - Si and cooled InGas detectors
  - SRS Lockin amplifier
  - Multi fiber optical cabling
  - Automatic Witness Selection
  - LabView® VII
  - Digital data logging
  - Order sorting filters

DENTON VACUUM LLC
LambdaPro® OMS

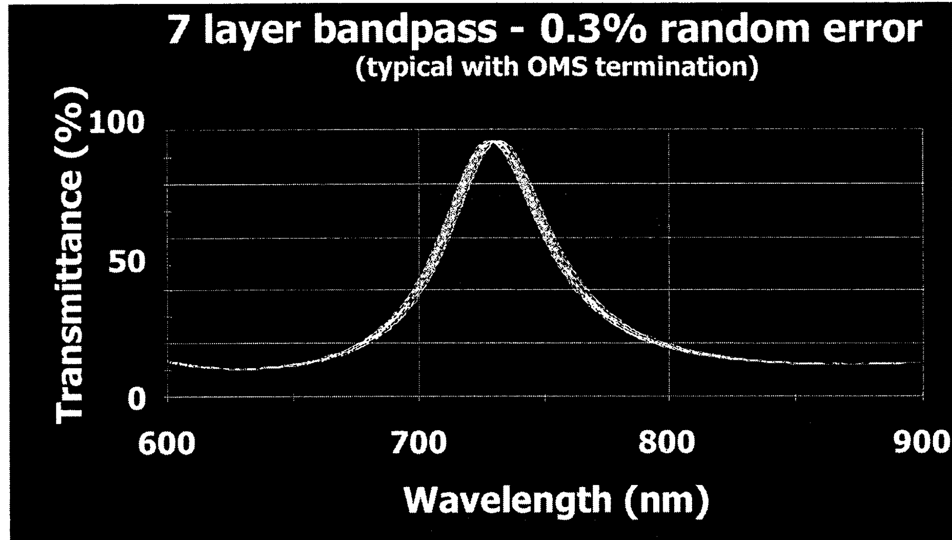


DENTON VACUUM LLC
LambdaPro® OMS

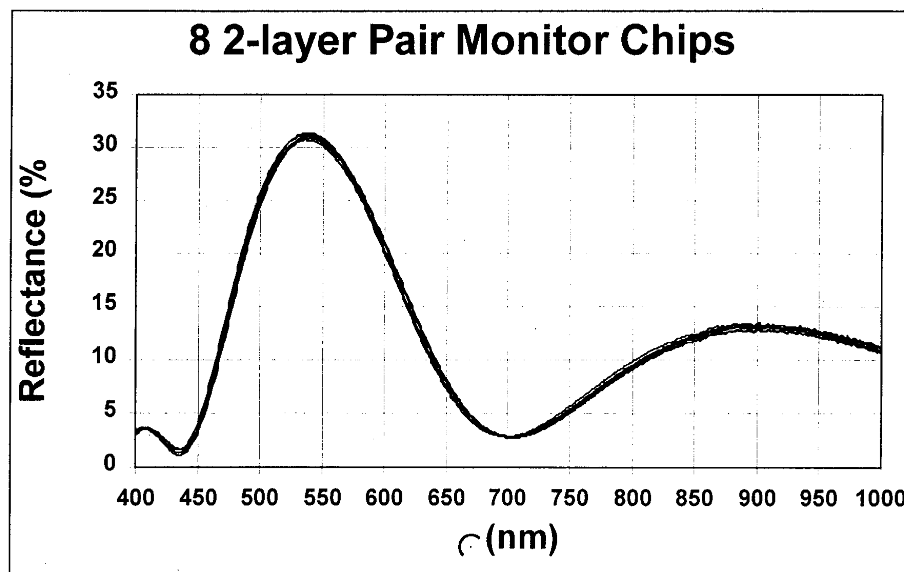
Why monitor optically?



DENTON VACUUM LLC
LambdaPro® OMS



DENTON VACUUM LLC
LambdaPro® OMS



Better than 1% Accuracy

LAMBDAPRO® OMS

Optical Monitor Manual Control

Chip Control

Chip Advance

Reset Chip Number

Current Chip Number

10

Monochromator Control

Monitor Wavelength

1500.00 350-2300nm

Grating Number

1 1 or 2

Mirror Position

IR

Chopper & Light S

Send to Monochro

Filter Wheel

Filter Position 3

STOP

Close

Manual Control

Fully Automatic Recipe Configuration Files

Optical Monitor Configuration

Monitoring Configuration

%Reflection

%Transmission

Maximum Anticipated: 40 (0-100%)

Minimum Anticipated: 1 (0-100%)

Initial Value: 4.09 (0-100%)

Final Termination Thickness

XTC/2 Final Termination Thickness: 2 (0-100)

File Options

New

Open

Save

Save As

Delete

Chip Change Select

Chip Change

Filter Wheel Select

Position 1 (0-6)

Final Desired Optical Thickness

Number of Turns: 8 (0-999)

Partial Wave: 7946 (0.000-2.000)

Monochromator Configuration

Monitor Wavelength: 1500 (800 - 1700 nm)

Grating Number: 1 (1 - 2)

Mirror Position: FRONT FRONT

Initial Direction of Waveform

Increasing

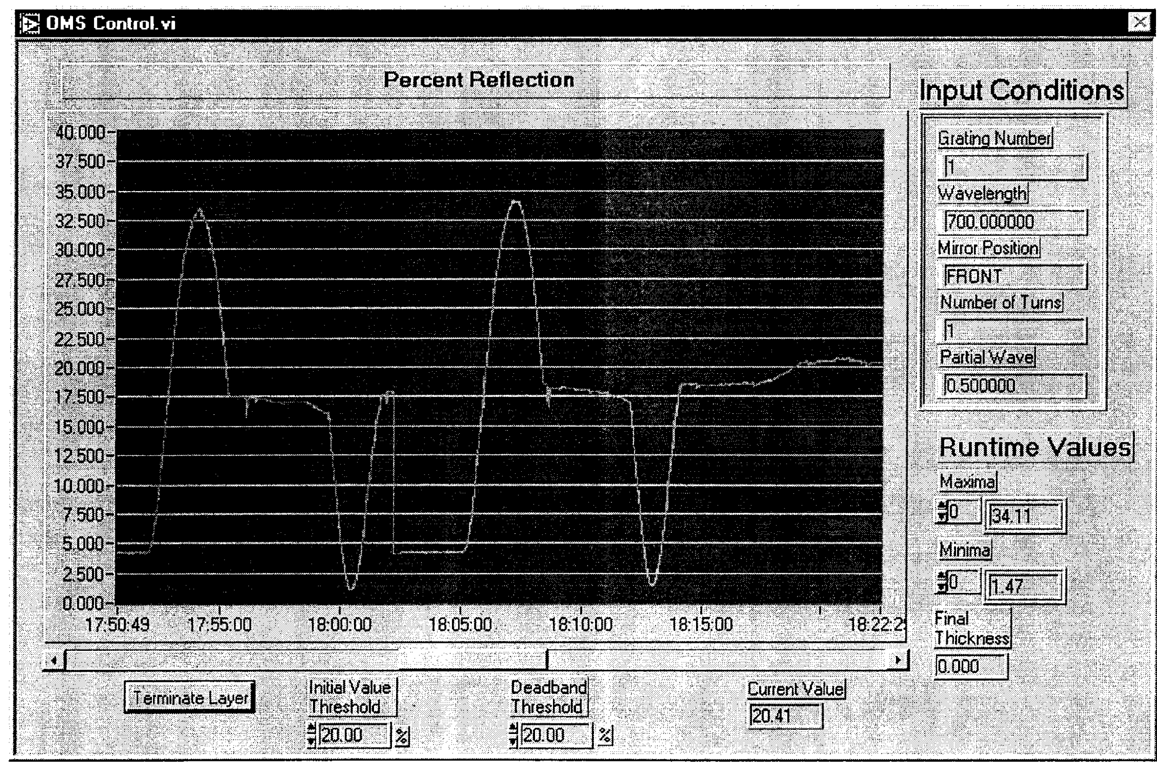
Decreasing

Close

Cancel

File Name C:\CIMPLICITY\Integrity_36\OMS\OMS001.dat

OPTICAL MONITOR GRAPHICAL DISPLAY



OMS DATA
(Microsoft Excel)

Microsoft Excel - Mplex Runs [Read-Only]

File Edit View Insert Format Tools Data Window Help

I9 =

	A	B	C	D	E
1	12/12/2001 13:07	Maxima			
2	12/12/2001 13:07	Minima			
3	12/12/2001 13:07	Starting Value	4.09		
4	12/12/2001 13:07	FinalThickness	14.35		
5	12/12/2001 13:17	Maxima	15.37	4.09	
6	12/12/2001 13:17	Minima	0.78	4.09	
7	12/12/2001 13:17	Starting Value	4.09		
8	12/12/2001 13:17	FinalThickness	12.28		
9	12/12/2001 14:09	Maxima			
10	12/12/2001 14:09	Minima			
11	12/12/2001 14:09	Starting Value	4.09		
12	12/12/2001 14:09	FinalThickness	14.35		
13	12/12/2001 14:19	Maxima	11.88	4.09	
14	12/12/2001 14:19	Minima	0.56	4.09	
15	12/12/2001 14:19	Starting Value	4.09		
16	12/12/2001 14:19	FinalThickness	9.48		
17	12/12/2001 14:24	Maxima			
18	12/12/2001 14:24	Minima			
19	12/12/2001 14:24	Starting Value	4.09		
20	12/12/2001 14:24	FinalThickness	14.35		
21	12/12/2001 14:34	Maxima	16.66	4.09	
22	12/12/2001 14:34	Minima	0.77	4.09	
23	12/12/2001 14:34	Starting Value	4.09		
24	12/12/2001 14:34	FinalThickness	13.29		

Dec 11 / Dec 12 / Dec 15 / DEC — NUM

Microsoft Excel - Mplex Runs [Read-Only]

File Edit View Insert Format Tools Data Window Help

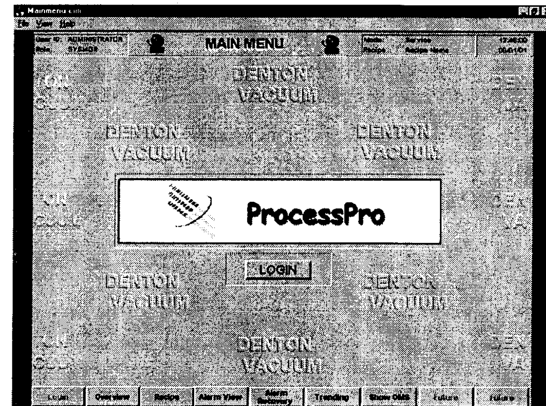
D21 =

	A	B	C	D
1	12/15/2001 9:01	Maxima	29.14	
2	12/15/2001 9:01	Minima		
3	12/15/2001 9:01	Starting Value	4.09	
4	12/15/2001 9:01	FinalThickness	16.62	
5	12/15/2001 9:15	Maxima	30.28	
6	12/15/2001 9:15	Minima		
7	12/15/2001 9:15	Starting Value	4.09	
8	12/15/2001 9:15	FinalThickness	17.18	
9	12/15/2001 10:12	Maxima	31.23	
10	12/15/2001 10:12	Minima		
11	12/15/2001 10:12	Starting Value	4.09	
12	12/15/2001 10:12	FinalThickness	17.66	
13	12/15/2001 10:23	Maxima	30.83	
14	12/15/2001 10:23	Minima		
15	12/15/2001 10:23	Starting Value	4.09	
16	12/15/2001 10:23	FinalThickness	17.46	
17	12/15/2001 10:45	Maxima	31.19	
18	12/15/2001 10:45	Minima		
19	12/15/2001 10:45	Starting Value	4.09	
20	12/15/2001 10:45	FinalThickness	17.64	
21	12/15/2001 10:56	Maxima	31.33	
22	12/15/2001 10:56	Minima		
23	12/15/2001 10:56	Starting Value	4.09	
24	12/15/2001 10:56	FinalThickness	17.71	
25				
26				

Dec 11 / Dec 12 / Dec 15 — NUM

DENTON VACUUM LLC
Remote Dial Up Support

- **ProcessPro® Remote Access:**
  - Real time support
  - Requires a dedicated telephone line
  - pcANYWHERE®
  - Real-time access to:
    - System functionality
    - Ladder logic
    - Software configuration
    - Data acquisition



PLC I/O DISPLAY

User ID: ADMINISTRATOR
Role: SYSMGR

I/O RACKS

Mode: System Mode
Recipe TEST.dat

08:22:00
08/20/02

Rack 0/Slot 1	Rack 0/Slot 2	Rack 0/Slot 3	Rack 0/Slot 4	Rack 0/Slot 5	Rack 0/Slot 6	Rack 0/Slot 7	Rack 0/Slot 8	Rack 0/Slot 9	Rack 0/Slot 10
	%I0049 A1	%I0065 A1	%Q0033 A1	%Q0049 A1	%I0073 A1	%Q0057 A1	%AI0001	%AQ0033	%AI0009
	%I0050 A2	%I0066 A2	%Q0034 A2	%Q0050 A2	%I0074 A2	%Q0058 A2	0	0	
	%I0051 A3	%I0067 A3	%Q0035 A3	%Q0051 A3	%I0075 A3	%Q0059 A3	%AI0002	%AQ0034	%AI0010
	%I0052 A4	%I0068 A4	%Q0036 A4	%Q0052 A4	%I0076 A4	%Q0060 A4			
	%I0053 A5	%I0069 A5	%Q0037 A5	%Q0053 A5	%I0077 A5	%Q0061 A5	%AI0003	%AQ0035	%AI0011
	%I0054 A6	%I0070 A6	%Q0038 A6	%Q0054 A6	%I0078 A6	%Q0062 A6			
	%I0055 A7	%I0071 A7	%Q0039 A7	%Q0055 A7	%I0079 A7	%Q0063 A7	%AI0004	%AQ0036	%AI0012
	%I0056 A8	%I0072 A8	%Q0040 A8	%Q0056 A8	%I0080 A8	%Q0064 A8			
	%I0057 B1	%I0073 B1	%Q0041 B1			%Q0065 B1	%AI0005	%AQ0037	%AI0013
	%I0058 B2	%I0074 B2	%Q0042 B2			%Q0066 B2			
	%I0059 B3	%I0075 B3	%Q0043 B3			%Q0067 B3	%AI0006	%AQ0038	%AI0014
	%I0060 B4	%I0076 B4	%Q0044 B4			%Q0068 B4			
	%I0061 B5	%I0077 B5	%Q0045 B5			%Q0069 B5	%AI0007	%AQ0039	%AI0015
	%I0062 B6	%I0078 B6	%Q0046 B6			%Q0070 B6			
	%I0063 B7	%I0079 B7	%Q0047 B7			%Q0071 B7	%AI0008	%AQ0040	%AI0016
	%I0064 B8	%I0080 B8	%Q0048 B8			%Q0072 B8			

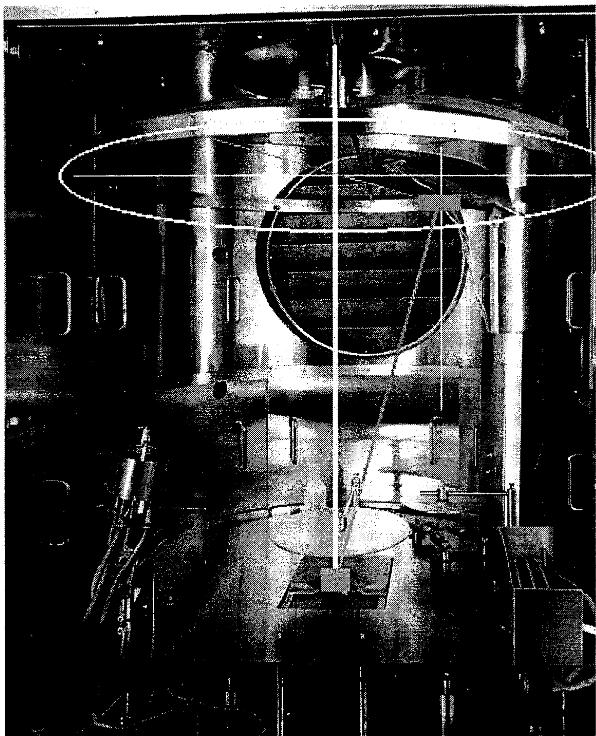
Rack 1/Slot 1	Rack 1/Slot 2	Rack 1/Slot 3	Rack 1/Slot 4	Rack 1/Slot 5	Rack 1/Slot 6	Rack 1/Slot 7	Rack 1/Slot 8	Rack 1/Slot 9	Rack 1/Slot 10
%I0001 A1	%I0017 A1	%I0137 A1	%Q0001 A1	%Q0017 A1	%Q0081 A1	%AI0009	%AI0017	%AI0025	%AQ0008
%I0002 A2	%I0018 A2	%I0138 A2	%Q0002 A2	%Q0018 A2	%Q0082 A2				0
%I0003 A3	%I0019 A3	%I0139 A3	%Q0003 A3	%Q0019 A3	%Q0083 A3	%AI0010	%AI0018	%AI0026	%AQ0009
%I0004 A4	%I0020 A4	%I0140 A4	%Q0004 A4	%Q0020 A4	%Q0084 A4				
%I0005 A5	%I0021 A5	%I0141 A5	%Q0005 A5	%Q0021 A5	%Q0085 A5	%AI0011	%AI0019	%AI0027	%AQ0010
%I0006 A6	%I0022 A6	%I0142 A6	%Q0006 A6	%Q0022 A6	%Q0086 A6				
%I0007 A7	%I0023 A7	%I0143 A7	%Q0007 A7	%Q0023 A7	%Q0087 A7	%AI0012	%AI0020	%AI0028	%AQ0011
%I0008 A8	%I0024 A8	%I0144 A8	%Q0008 A8	%Q0024 A8	%Q0088 A8				
%I0009 B1	%I0025 B1	%I0145 B1	%Q0009 B1	%Q0025 B1		%AI0013	%AI0021		%AQ0012
%I0010 B2	%I0026 B2	%I0146 B2	%Q0010 B2	%Q0026 B2					
%I0011 B3	%I0027 B3	%I0147 B3	%Q0011 B3	%Q0027 B3		%AI0014	%AI0022		%AQ0013
%I0012 B4	%I0028 B4	%I0148 B4	%Q0012 B4	%Q0028 B4					
%I0013 B5	%I0029 B5	%I0149 B5	%Q0013 B5	%Q0029 B5		%AI0015	%AI0023		%AQ0014
%I0014 B6	%I0030 B6	%I0150 B6	%Q0014 B6	%Q0030 B6					
%I0015 B7	%I0031 B7	%I0151 B7	%Q0015 B7	%Q0031 B7		%AI0016	%AI0024		%AQ0015
%I0016 B8	%I0032 B8	%I0152 B8	%Q0016 B8	%Q0032 B8					

Login | Overview | Recipe | Alarm View | Alarm Recovery | PLC Racks | Trending | Open Datalog | Future

PROCESS MODELING - UNIFORMITY

- Variables:
  - Source placement
  - Rack curvature (if any)
  - Planetary motion (if any)
  - Substrate geometry
  - Source to substrate distance
  - Source distribution characteristics, point source or linear source
  - Expected Masking Geometries

MODELING APPLICATION

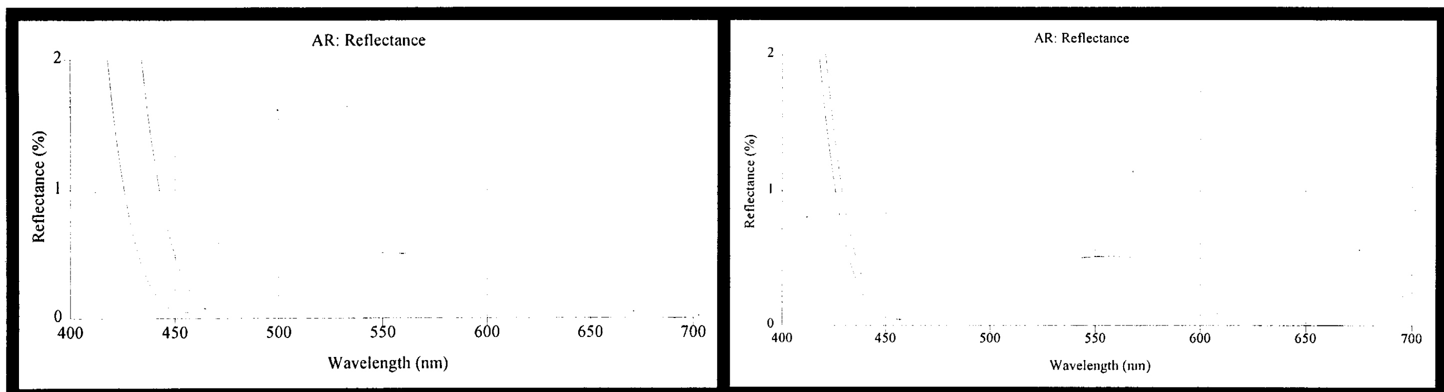


PROCESS MODELING - TOLERANCING

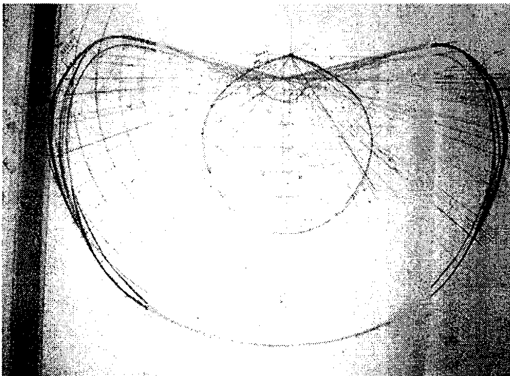
- Thickness errors cause performance deviations
- Applying expected errors to the theoretical model can predict process yield

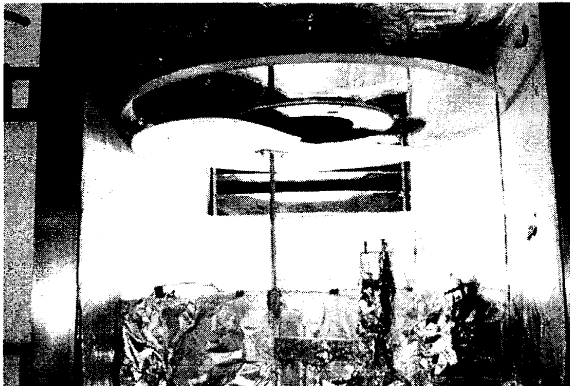
NON-UNIFORMITY

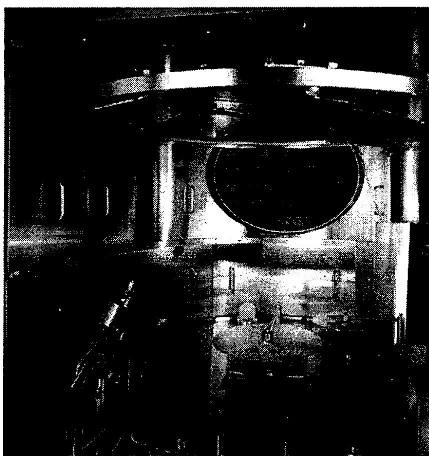
- Graphical representation of 2.0% non-uniformity (left) vs. 0.5% non-uniformity (right).



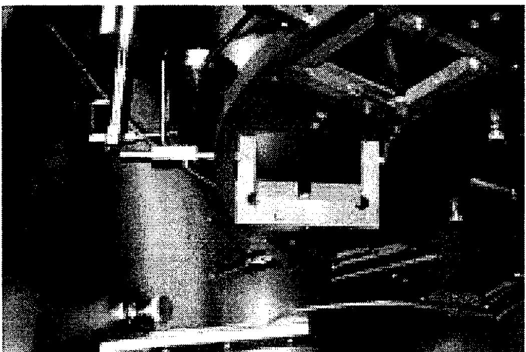
MASK DEVELOPMENT

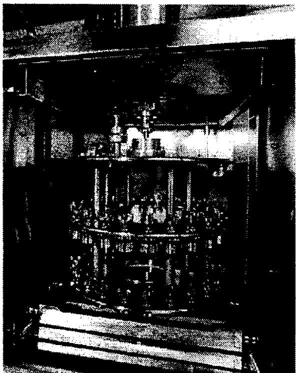


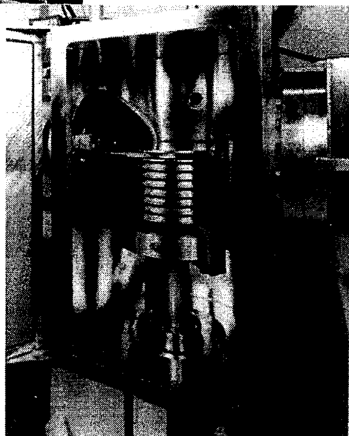




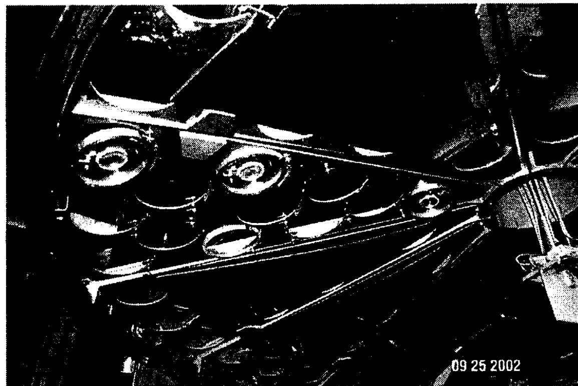
PROCESS MANIPULATION

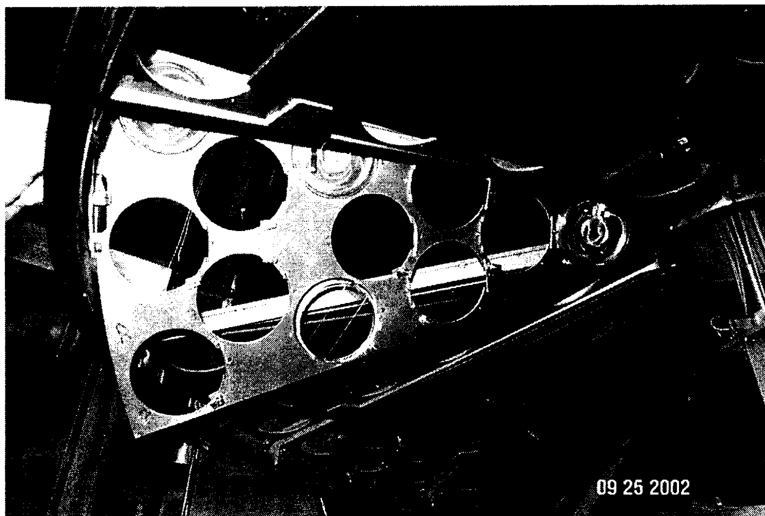




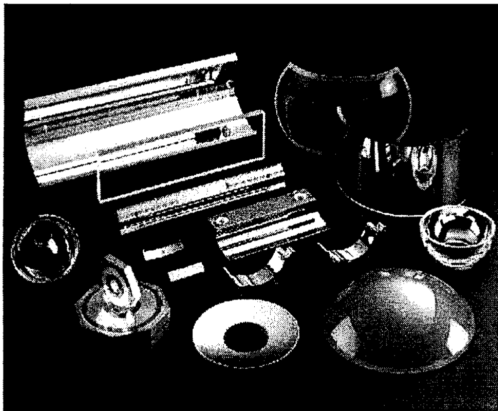


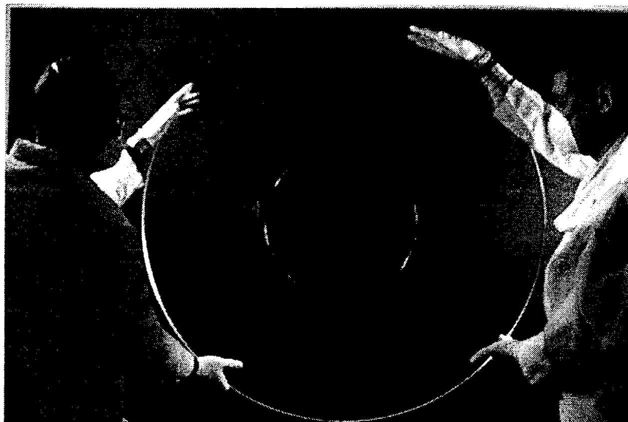
PROCESS MANIPULATION

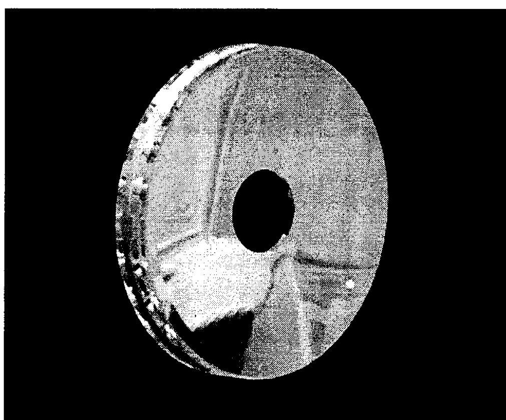




CUSTOM APPLICATION EXPERTS







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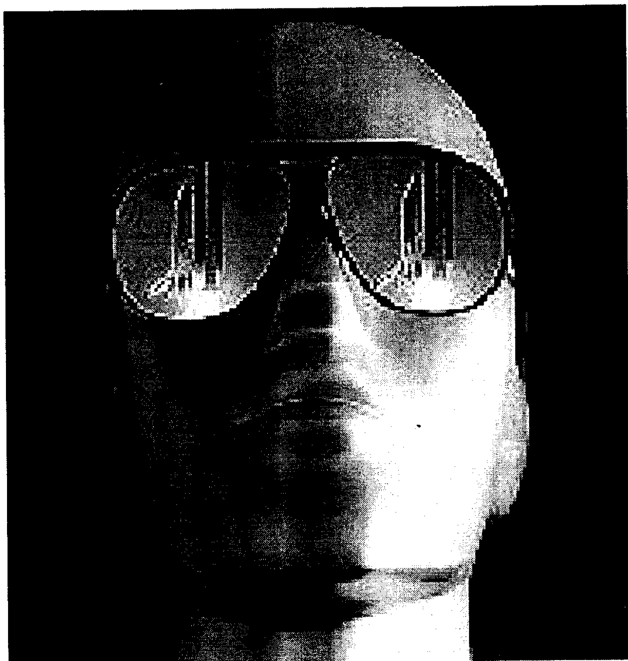


VACUUM SYSTEMS FOR INDUSTRY

Optical Coating Systems

PRECISE, REPEATABLE COATINGS

DynaVac's Optical Coating Systems set an industry standard for the production of thin films. By combining a robust machine design with state-of-the-art process control, DynaVac's equipment supports today's most complex coating processes.

Operating Features

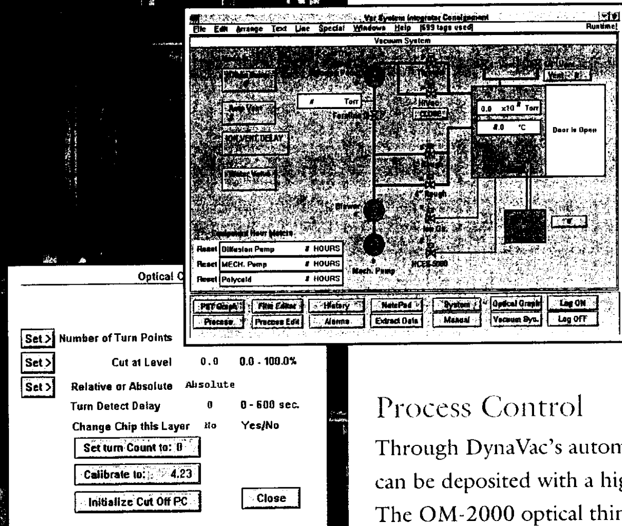
- Reliable, trouble free performance
- Quality components and instrumentation
- Supervisory control with menu-driven user interface
- Design flexibility to support unique requirements
- Spare parts and technical assistance readily available
- Minimal maintenance required

System Characteristics

- Chamber sizes 24" to 72"
- Diffusion or cryopump
- Electron beam and resistance evaporation
- Ion beam assisted deposition
- Substrate heating systems
- Single-rotation fixture w/option for substrate flipping
- Planetary mechanisms
- Two sets of internal shielding
- Fully automated supervisory control system

System Automation

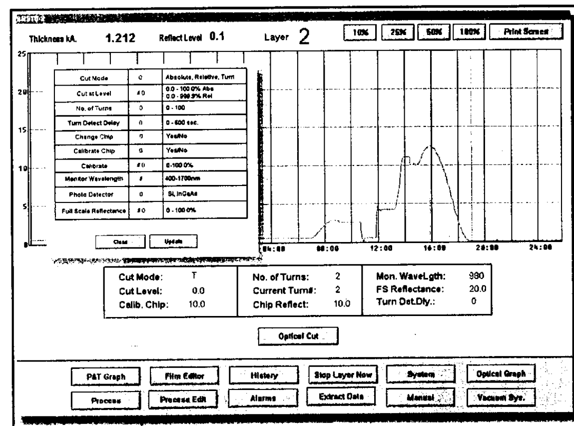
DynaVac's optical coating systems are automated through an advanced supervisory control system. A menu-driven graphical interface gives the user complete flexibility over system operating parameters and process control. Data acquisition of events and process variables provides vital data for process optimization.



Process Control

Through DynaVac's automated deposition control system, complex coatings can be deposited with a high degree of accuracy and repeatability.
The OM-2000 optical thin film monitor permits a wide range of monitoring strategies and enables a seamless interface with film design software.

The OM-2000 has an operating range of 400 to 1100nm (extended wavelength ranges are available). The operator has complete flexibility over the optical monitor through a graphical user interface. A digital signal-processing algorithm determines turning points. Real-time graphic display of reflectance curves and monitoring parameters provides an intuitive view of the process.



DynaVac
110 Industrial Park Road · Hingham, MA 02043
(781) 740-8600 · fax (781) 740-9996 · www.dynavac.com · sales@dynavac.com

CHA MARK 50

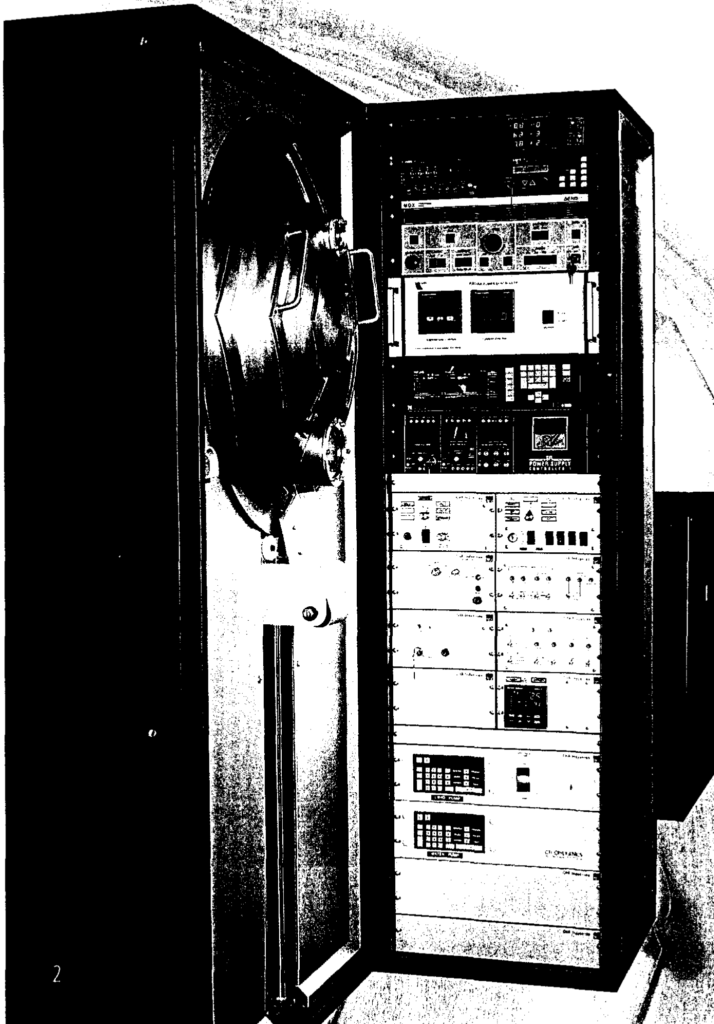
COMBINATION SPUTTERING AND EVAPORATION HIGH VACUUM DEPOSITION SYSTEMS

CHA Industries

INTRO

MARK 50-THE CLASSIC HIGH VACUUM DEPOSITION SYSTEM THAT HAS ADVANCED WITH TODAY'S TECHNOLOGY...

CHA Mark 50 Systems are available with a wide range of options covering the spectrum from full computer control to manual operation, from production runs to small R&D quantities. They are economical, feature fast loading and unloading, offer broad process flexibility, and accommodate a variety of substrate sizes, shapes, and materials. Their efficiency of design, ease of operation, and unmatched reliability make them an excellent choice for a wide range of production applications.

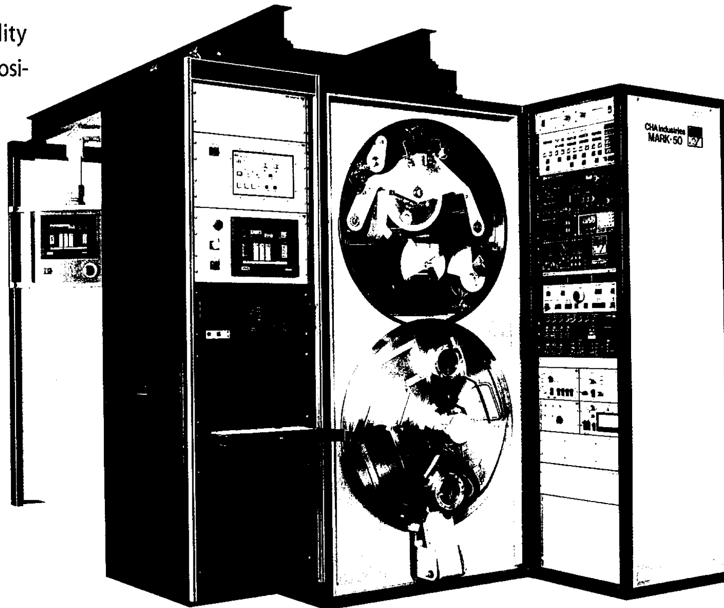


MARK 40 SYSTEM

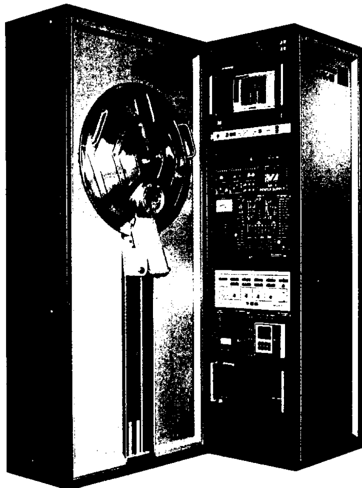
The CHA Mark 40 System is available for moderately sized production runs or R&D quantities. It is similar in design and operation to the Mark 50 System except that it is smaller in physical size. The Mark 40 System is available with virtually the same range of operating features and options as the Mark 50 System and has the same high quality of materials and construction.

)UCTION

CHA Mark 50 packs the versatility needed for special high-vacuum deposition tasks into a single, compact system. Whether your requirements are best met with sputtering or evaporation processing, the Mark 50 system offers the best of both worlds. It is equally productive in either process, and both processes can be accomplished in the same run (i.e., sputter a barrier metal (TiW) and overcoat with aluminum using an E-Beam source).

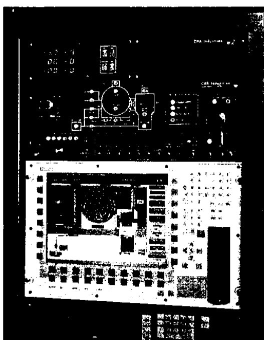


Mark 50 System shown equipped for web/roll coating applications



Mark 50 Systems can be configured for a wide range of applications. A broad selection of options from control systems to process stations to fixturing let you meet your specific requirements–without compromise. With the Mark 50, system components and controls are combined for an optimum mix of product cost, throughput and quality.

EASE OF



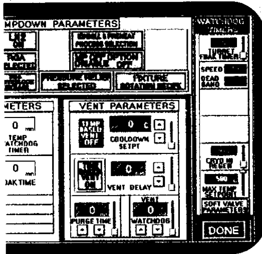
Ergonomically designed modules provide step-by-step control of deposition process.

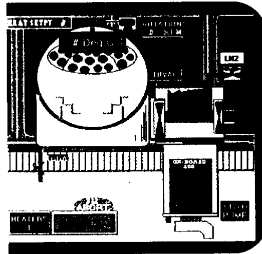
PROCESS CONTROL SYSTEM

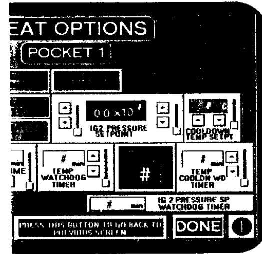
The entire air-to-air deposition process can be automatically controlled by either CHA's Siemens-based PLC/PC automation or by CHA's 1-Button Controller: both control systems permit fully-automatic cycling of the system valves, as well as providing multi-function, semi-automatic control for process development and maintenance-type functions. Separate process control and source control modules are mounted in electronic rack assemblies located in proximity to the deposition chamber. This allows process adjustments to be made as the process is observed.

The optional PLC/PC-based control system automatically controls each step in the air-to-air process, as well as providing a real-time, interactive flat panel display of system and process status. DDE (Dynamic Data Exchange) is utilized between the process controller and the flat panel display. Visual and audible "pop up" screens keep the operator aware of system or process faults and include displays of suggested corrective action. The system computer employs the widely used Windows® and Windows NT-based WonderWare and Seimens S-7 software, making operation of the system extremely user friendly.

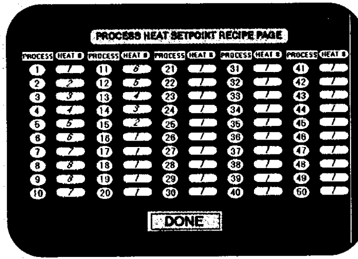
JSE







Operation and programming access levels are controlled by password security. Programming data is entered from a disk, slideout keyboard, mouse, or screen function keys. Audible voice prompts are provided during operation and troubleshooting to assist the user. The prompts can be presented in either a male or female voice, as well as in a specified language. Provision can be made for closed-circuit video monitoring of source activity, and a bar code scanner is available for data entry and tracking or data logging. Stored process data is easily called up and displayed in spreadsheet format. If trouble-shooting assistance is required, data can be sent to the factory for analysis.



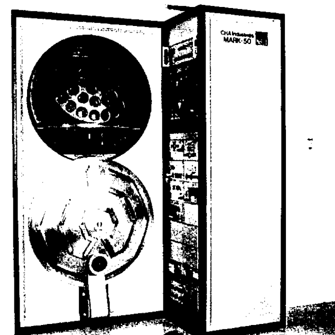
Step-by-step monitoring and control of the deposition process is facilitated by the Mark 50's user-friendly display screens.

OPERATOR CONVENIENCE

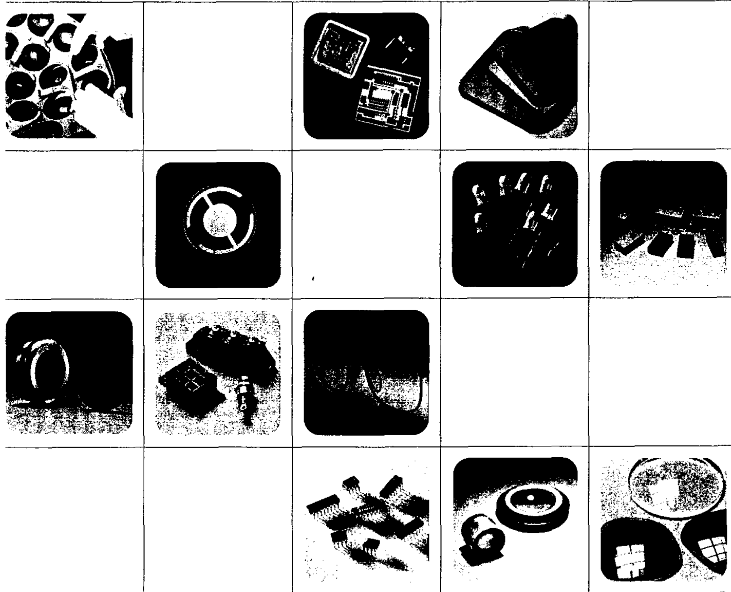
The Mark 50 System incorporates a unique, patented slide-down door on the front of the chamber to minimize floor space requirements while providing ease of access. The system's process chamber and fixturing are ergonomically designed to minimize operator fatigue while maximizing efficiency. For added convenience, wafer loading automation is available, and a rear door is provided for greater flexibility for maintenance. The two doors permit total access to sources, shutters, shielding, and other fixturing components so they may be easily serviced. Front and side view ports allow the operator to observe the deposition process in progress.

CLEANROOM INSTALLATION

The space-efficient Mark 50 System is designed for ballroom or through-the-wall mounting to meet cleanroom requirements, while conserving valuable floor space. When the system is placed inside a cleanroom, The pumping stack and other associated equipment are closed off to meet cleanliness requirements. When in a through-the-wall configuration, the pumping stack and other associated equipment are easily accessible outside of the cleanroom for maintenance. Mated pairs of systems (right and left hand) can be provided.



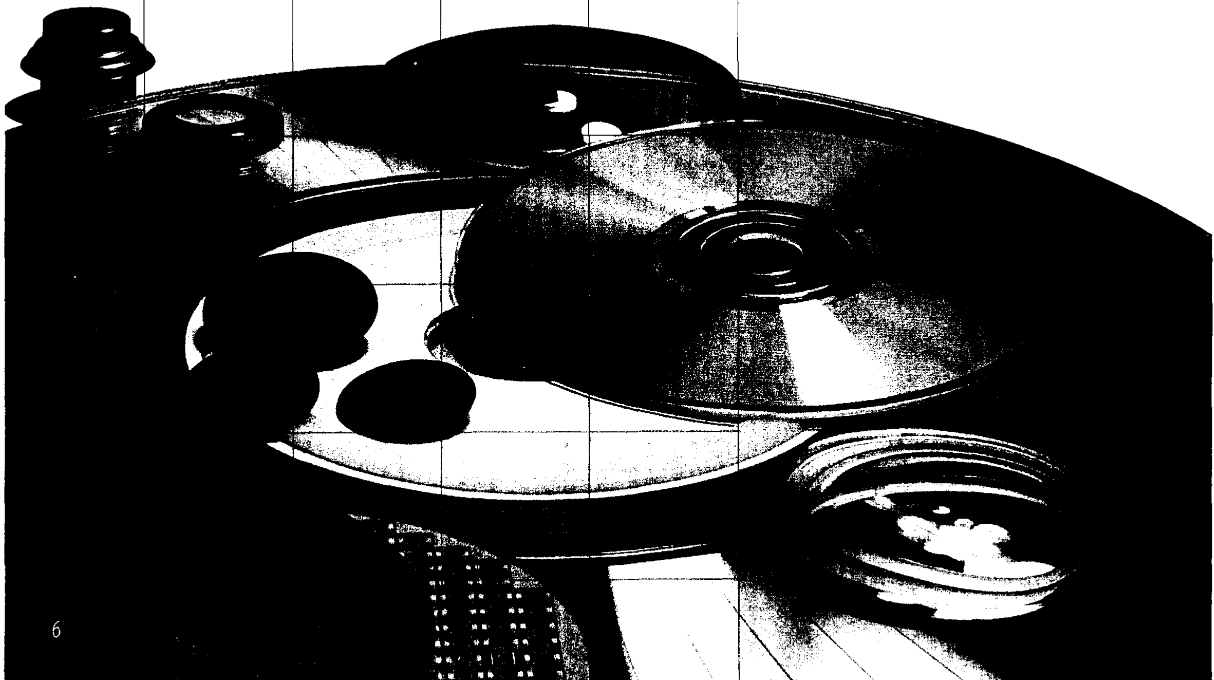
APPLICATIONS



CHA Mark 50 Systems have the versatility needed to perform in a wide range of applications. Their legendary performance has made them the system of choice in semiconductor fabrication plants around the world.

In addition to semiconductor processing, Mark 50 Systems are widely used for coating LEDs, MEMs, and MR/MGR heads, as well as a wide range of materials in the optical, ophthalmic, optical recording, magnetic media, medical, automotive, aviation, and metallurgical fields.

When configured with web roll fixturing, the system can be used for the processing of flexible substrates such as flat panel displays, solar cells, flexible printed circuits, electromagnetic shields, capacitors, and second-cell (rechargeable) batteries, as well as coating thin plastic and copper foil, ITO, AR film, magnetic tape, and consumer product packaging.

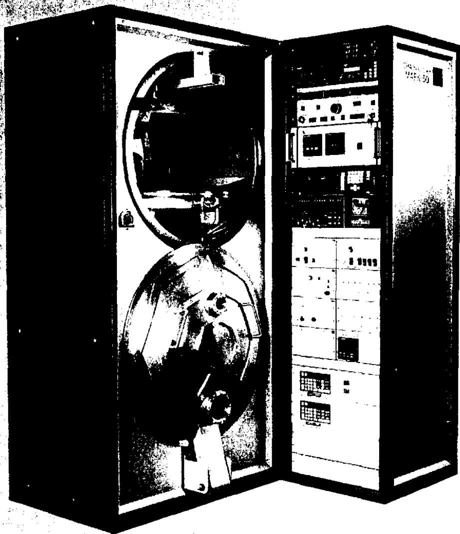


SYSTEM FUNCTIONALITY

CHA Mark 50 systems utilize moving substrates and precision process control for consistently high film uniformity, typically less than +/-5% across substrate, substrate to substrate, run to run.

For process flexibility, the Mark 50 can be used with up to three electron beam guns or any commercially available source including magnetron sputtering, thermal evaporation, Ion beam, resistance, RF induction, and diode sources. Options include substrate heat, substrate preclean, ion beam etch, RF etch, and substrate bias (DC or RF). A range of shields and shutters are provided to ensure optimized processing and to enhance uniformity.

When configured for sputtering, the system is operated in the sputter up mode. Cathode-to-substrate spacing is adjustable, and all systems can incorporate multiple cathode stations, which may be utilized for sequential or co-deposition processing.

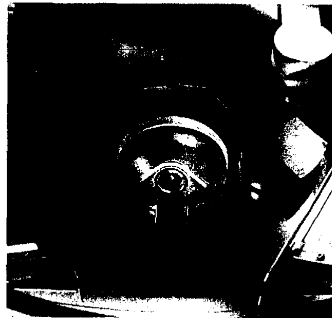


PROCESS CHAMBER

The Mark 50 system's 32 inch by 32 inch water cooled stainless steel process chamber incorporates an exclusive drop well design to accommodate a variety of deposition sources, shutters, heaters, and other process accessories.

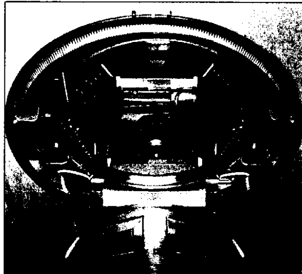
SUBSTRATE MATERIALS

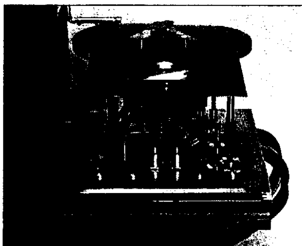
The system can accommodate a wide variety of substrate materials including silicon, ceramics, aluminae, copper, GaAs and other 3-5 compounds, polimides, Kapton, stainless steel, glass, mylar, and polyester.



EVAPORATION AND SPUTTERING SOURCES

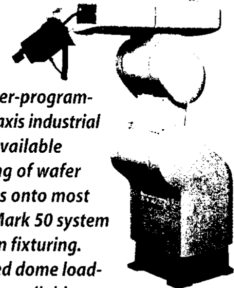
CHA's 4-, 6-, and 8-pocket Electron Beam Guns are versatile and rugged enough for any job. Crucibles can be swapped in less than 30 minutes. To avoid overheating, the coils are surrounded by a water-cooled, solid-copper block. A complete range of Ion Beam Sources and CHA Sputtering Cathodes are also available.



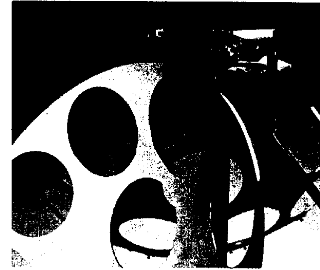


LOAD LOCK SOURCE ISOLATION

The CHA Mark 50 Systems are available with a slide-out, load lock chamber designed to isolate the source(s) from the process chambers during operation. When equipped with this feature, the deposition system's process chamber can be independently pumped before exposing the process chamber to the source chamber. Predeposition processes, such as preheat, ion beam etch, and RF etch, can be performed in the process chamber while isolated from the source(s). This eliminates exposure of the source(s) to air, a major source of oxidation. The isolated source chamber permits substrate loading and unloading while the deposition sources are maintained under high vacuum. Conversely, substrates can be independently maintained under vacuum to prevent oxidation if a source must be accessed in the middle of a run.

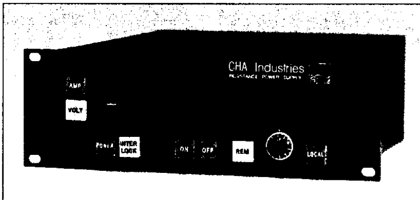


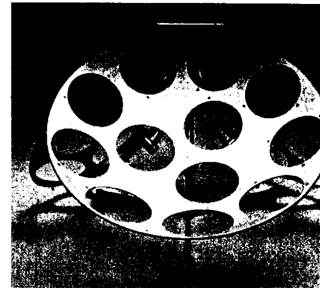
A computer-programmable, 6-axis industrial robot is available for loading of wafer substrates onto most types of Mark 50 system deposition fixturing. Automated dome loading is also available.



POWER SUPPLIES

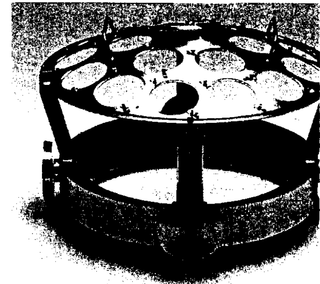
CHA's SR-Series Electron Beam Power Supplies feature superior emission current regulation, unique gun-programming capabilities, and durability. Models provide five different outputs-3-4-6-10-15 KW. The output power may be used to supply a single EB Source, simultaneously power three sources in a single chamber, or independently operate a source in each of three chambers. Power supplies are also available for Sputtering, 1-3-5-15-30 KW; Heater, 6-10-16 KW; and Thermal deposition, 1-5-10 KW.





PLANETARY AND LIFT-OFF FIXTURING

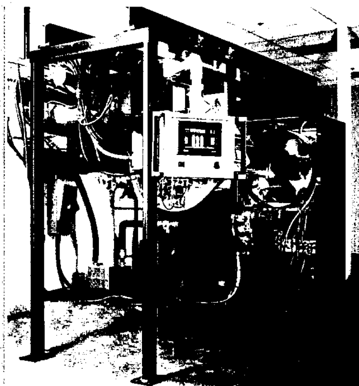
Mark 50 System features include the full range of CHA's renowned fixturing systems, including a variety of planetary (including Adjustable Angle), Lift-Off fixturing accommodating any wafer size including 6 inches is a "core" product for CHA. Replacement planetary fixturing is available for most manufacturer's types.

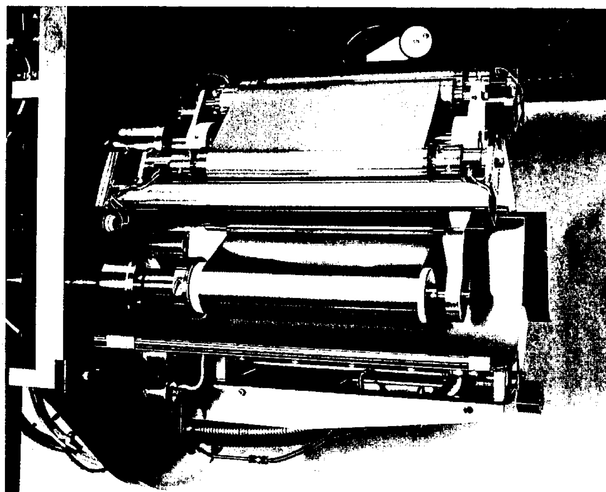


UNCTIONALITY

WEB ROLL FIXTURING

When the Mark 50 is configured for coating *flexible* substrates, a roll of the substrate material is mounted on a computer controlled motor-driven web roll fixture, which is placed in the system's high-vacuum process chamber. The material is then fed past deposition sources at a speed controlled by a precision (digital) drive system, ensuring optimum throughput in a smoothly wound roll with high film uniformity.





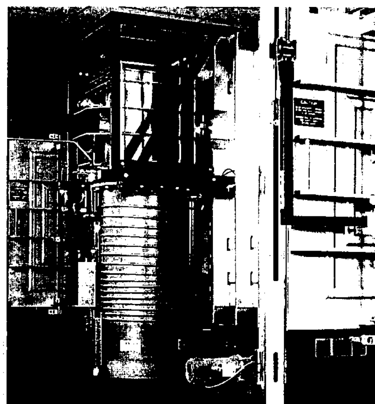
The CHA Web/roll Fixture (above) feeds flexible substrate material past the deposition sources in the Mark 50 process chamber. The Web/roll Fixture is loaded and unloaded outside of the process chamber by means of an overhead trolley (left).

PUMPING STACK

CHA's patented 16-inch pumping stack is utilized in the Mark 50 system. The pumping stack combines four components, which are mounted to maximize pumping speed. This arrangement results in four times the inlet port speed of individually mounted components and uses 75% less space with one third the number of major vacuum-to-air seals.

The simple elegance of CHA's 16-inch stainless steel, high-vacuum valve ensures quality performance. It has the least moving parts than any valve in the industry, and its *vertical sealing* plane eliminates high vacuum leaks caused by falling particles–a common problem with horizontal gate and other types of poppet valves.

Pumping options include cryo, turbo, or diffusion pumps. A 50 cfm mechanical pump is provided for roughing the process chamber and backing the high-vacuum pumping stack components. Mechanical pumps with higher cfm ratings are available. Pumps, pump fluids, and filters are available for corrosive gases if required by process parameters.



CHA's renowned right angle pumping/plumbing design provides extremely high-efficiency pumping performance in the Mark 50 and other CHA systems.

FEATURES

FOR MARK 50 AND MARK 40 SYSTEMS

Each system is individually configured to meet specific customer requirements.
System components and controls are combined for an optimum mix of product cost, throughput, and quality.

Dual operation, sputtering and evaporation

Moving substrates

Film uniformity (fixture dependent), 5%

Sputter up

Process stations

— Round cathodes, RF or DC: up to 4 stations
— Co-deposit
— Bias, RF or DC
— Substrate heating, 400°C, multi-element
— Substrate heating, station
— Electron beam
— Thermal
— Sputter etching
— Ion beam preclean/etch
— Plasma texturing/etch

Power supply options

— Electron beam, 3-6-10-15 KW
— Sputtering, 1-3-5-15-30 KW
— Heater, 6-10-16 KW
— Thermal deposition, 1-5-10 KW

Process chamber

— Insitu spectrophotometer
— Video/closed circuit monitoring of source activity
— Drop well source
— Easy access to front and rear door
— Variable source-to-substrate distance
— Variable port locations, observation port(s) and RGA port
— Source isolation
— Automatic wafer loading/unloading
— Web roll coating
— Web roll loading/unloading trolley
— Process chamber dimensions
Mark 50: 32" x 32"
Mark 40: 26" x 26"

Deposition fixturing

— Adjustable angle planet, standard
— Vertical drum with pallets, standard
— Rotating disk, optional
— Rotating dome, optional
— Flat planetary, 3 or 4, optional
— Web roll with precision drive
— Shutter(s), flag
— Trackless planetary dome
— Lift off
— Planetary dome

Pumping stack

— Dry or oil sealed roughing
— Regeneration options
— Famous right angle pumping/plumbing
— Unsurpassed pumping performance
— High vacuum valve, *vertical seal*, 16"
— Foreline and roughing valves, *vertical seal*, 3"
— Large capacity vapor pumping options
— Mechanical pump, minimum CFM
— Molecular sieve trap
— Cold trap LN2, pump trap, 25"L
— LN2 level control
— Ionization gauge control
— Gas controls

Pumping options

— Cryo
— Turbo
— Diffusion

Ultimate vacuum

— System 10^{-9} Torr
— Chamber 10^{-8} Torr
— 10^{-7} Torr in less than 25 minutes

Cryo coil

— 50,000 L/Sec. pumping speed for water vapor and other condensable gases in the process chamber.

Utilities

— Water supply, 3 GPM
— Air supply, 85-125 psig

Footprint

— Mark 50: 81.5" W x 55"D x 78.5"H (with ISO source add 21"H)
— Mark 40: 76"W x 55"D x 78.5"H (with ISO source add 21"H)

CHA THE RIGHT CHOICE...

OUR COMMITMENT

CHA Industries has been serving domestic and international customers for over 40 years. Our commitment to quality, reinforced by comprehensive testing at all stages in the manufacturing cycle, ensures that all product performance standards are consistently met.

APPLICATIONS ENGINEERING

CHA's expert staff of application engineering specialists are available to assist customers in the selection of the right equipment for their needs. Customers can draw freely on CHA's many years of experience working with a wide variety of installations around the world in various demanding, technical applications.

CUSTOMER SERVICE

Factory service personnel are available to assist in performing process functions and troubleshooting. Computer data from production runs and tests can be sent to the factory for analysis.

CHA PRODUCTS

High vacuum deposition systems, evaporation and sputtering

Production box coaters

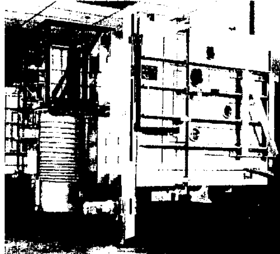
Sources

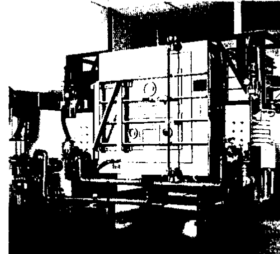
Fixturing

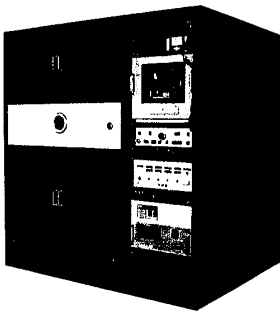
Heaters

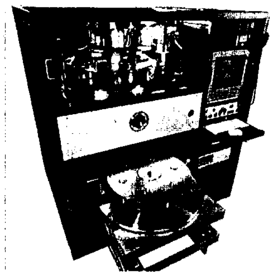
Power supplies

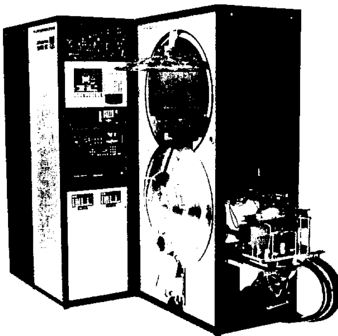
Other deposition accessories

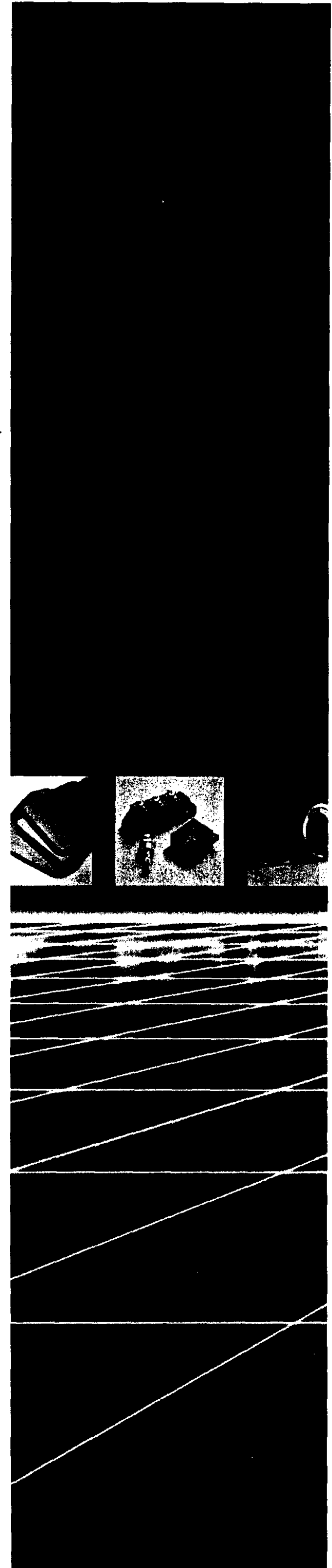


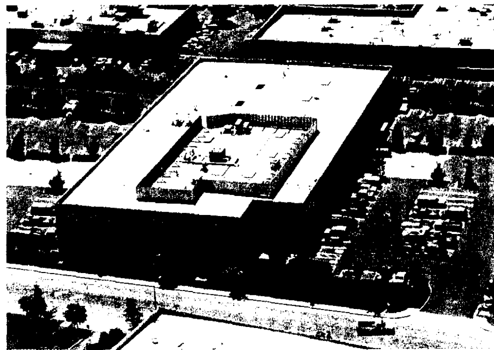












CHA Industries

4201 Business Center Drive
Fremont, CA 94538-6357
Phone: 510-683-8554
Fax: 510-683-3848
www.chaindustries.com

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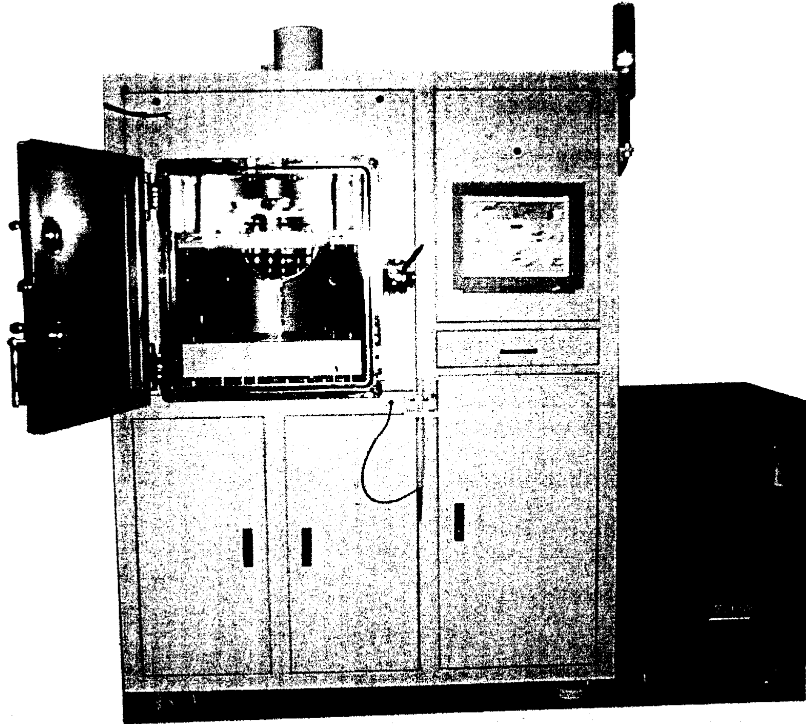
Korea Vacuum Tech., Ltd

E-Beam & Thermal Evaporation System

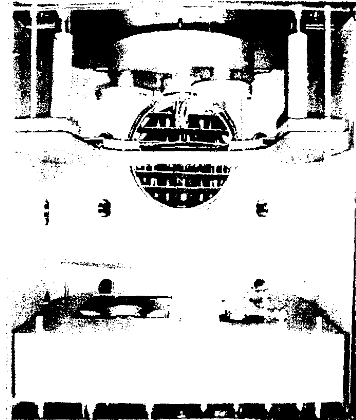


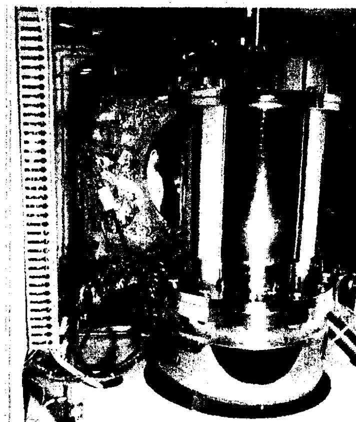
ISO 9001 CERTIFICATE

Korea Vacuum Tech., Ltd.

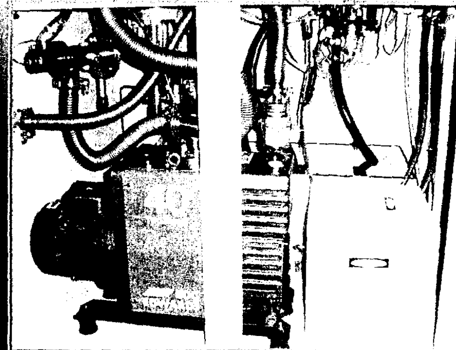
Features

- *Automated vacuum and process control system*
- *E- gun power supply & Multi-layer E-Beam deposition*
- *Precision control deposition rates*

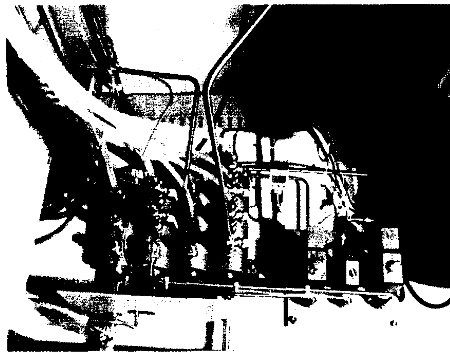


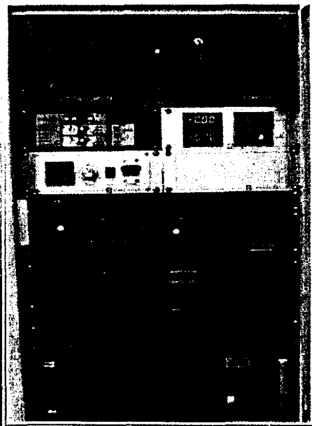


- **Substrate Assembly**
  Up to 6" substrate size
  Rotation & Revolution : RPM 0.1~20
  Throughput : Three 3" wafer for Process
- **Thickness Sensor**
- **Substrate heating Max 500℃**
- **E-Gun assembly &thermal Source**
- **Shutter are three respectively**
- **E-Gun assembly &thermal source**
- **Shutter are three respectively**
- **Shield Cover for preventing a contamination from chamber wall**
- **Chamber Baking & cooling**
- **Vacuum gauge Sensor with Cable**
- **Pneumatic CF12" right angle valve**
- **Turbo molecular pump :**
  Pumping speed 1600 l/s
- **Rotary Pump :**
  Pumping Speed 42,5m3/h
- **Oil Mist Filter**
- **NW40 Flexible Metal Hose**
- **Pneumatic NW40 angle valve :**
  Roughing & foreline valve
- **Electric safety valve for rotary venting is prevented oil back streaming from the rotary pump**



- *Refractory materials evaporation*
- *High vacuum compatible to 10^{-7} Torr by TMP & Rotary pump*
- *Quartz halogen Heating (Max : 500 ℃)*
- *Substrate Rotation & Revolution for 3"wafer or 4" wafer*





- **Electron gun : 6 pocket of 15cc crucible with rotation head**
- **Central feedthrough for crucible drive & water cooling**
- **Rotary motion cylinder for shutter**
- **Water line for chamber cooling , E-gun, thermal source & TMP**

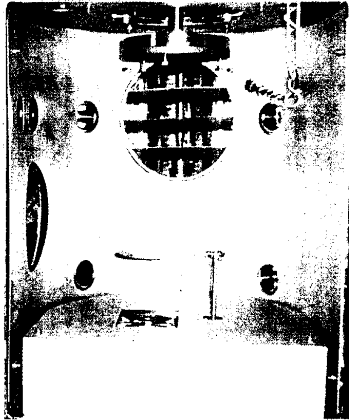
- **Auto Pumping & Auto Pressure Control with PC & TFT-LCD Monitor Using Lab View Software.**

- **Vacuum gauge controller : Digital display & set point relay**

- [illegible] **Thermal Source Electron Gun Power Supply with X-Y Sweep`**

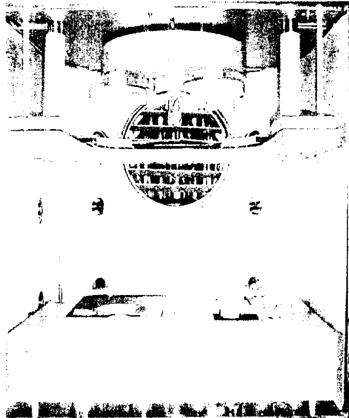
Inside of Process Chamber

Select a Specification that you want

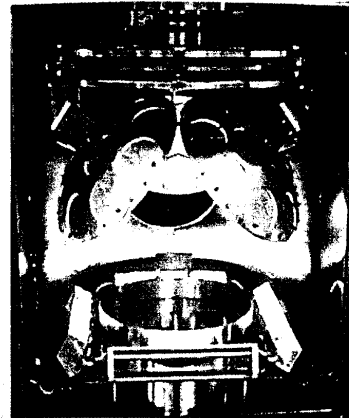


Up to 6" Substrate Size
Substrate Rotation & Cooling
Electron Gun Assembly

6" Substrate Size
Substrate Rotation & Cooling
Thermal Source & Electron Gun



Up to 4" Substrate Size
Substrate Rotation & Heating
Electron Gun Assembly & Thermal Source



2" Substrate Size : 36 wafer
Substrate Rotation & Heating
Electron Gun Assembly

EV-2001 SERIES

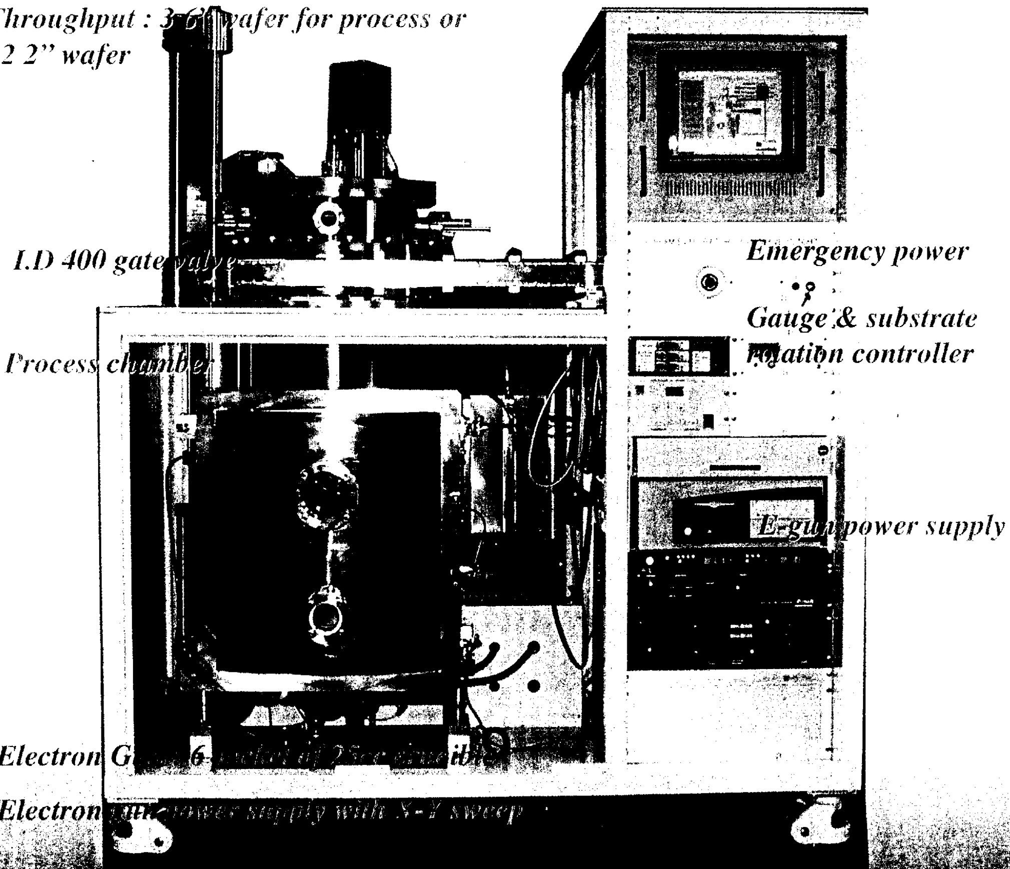
Electron Beam Evaporation

Loadlock chamber

2-6" Substrate rotation

Throughput : 3-6" wafer for process or 22 2" wafer

Auto Pumping & Auto Pressure Control with PC & TFT-LCD Monitor Using Lab View Software.



Cryo pump with compressor : pumping speed 2500l/s

Rotary vacuum pump : pumping speed 1600l/min

ANSI 10" Gate valve

Thickness monitor and controller

K.VAC EV-2000

•The best quality ever ~

• The fastest supply line ever ~

• The most affordable price ever ~

Electron beam & Thermal Evaporation

are primarily used in the optical industry.with the various plant type is offering a standardize plant the has been designed to optimize the various tasks to be accomplished by lab and production.

he most exacting demands for batch time, cleanliness, oil-free dryness and ultimate vacuum will be met.

Thin Film Application

Thin film applications requiring electron beam evaporation are continually increasing. Applications are found in the medical, metallurgical, telecommunication, micro-electronic, optical coating and semiconductor industries. Electron beam evaporation sources are employed in the conduction of a multitude of low and hi-tech products including ; sunglasses, camera lenses, optical filters, infrared detector, superconductor, corrosion resistance surfaces and many others.

Advantages

Advanced pumping system.
Easily serviced, single-wall, stainless-steel coating chambe[illegible] water-cooled/heated evaporation protection shields, easy [illegible] for maintenance).
[illegible] ure(10^{-7} torr)
[illegible] molecular pumps or cryo pump
[illegible] aterial and energy costs

Korea Vacuum Tech., Ltd.

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Web site :http://www.koreavac.co.kr E-mail : sales@koreavac.co.kr

Vacuum Process Technology, Inc.
The Key to Precision Optics

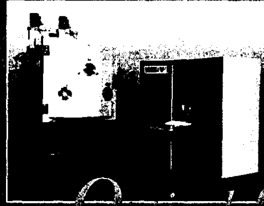
The Vision is Clear

Vacuum Process Technology, Inc. (VPT) is committed to providing comprehensive, uncompromising solutions to the challenges associated with the management of thin film deposition technology.

For over ten years, VPT has met the precision optical coating needs of a diverse customer base with both standard product lines and custom turnkey systems. Whether the need is a fully automated batch CITATION 1 precision optical coater (pre-programmed to support a wide range of coating applications), a CCS 64 in-line high production sputtering system, or a state-of-the-art flip planetary system, the solution is VPT and our results are unparalleled.

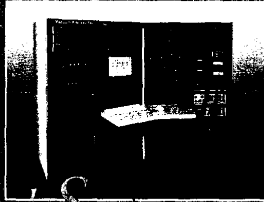
Throughout the company, from welders to engineers, system technicians to the management team, VPT takes pride in the workmanship, customer support and the professional approach with which all new challenges are met.

The mission is clear...becoming the global leader in the design and manufacture of state-of-the-art thin film deposition systems by providing customers with innovative, cost effective solutions.

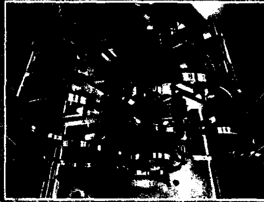


Precision Optical Coaters

Custom Solutions



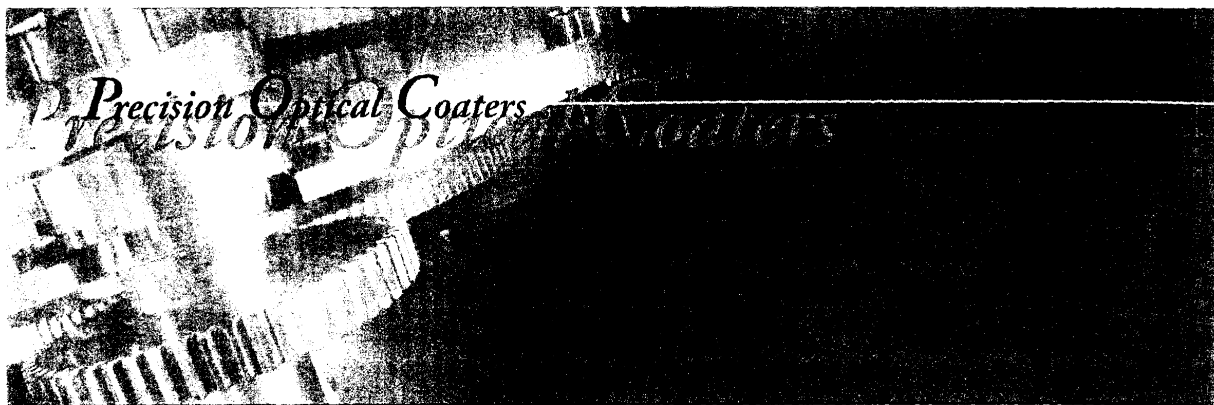
Control Systems

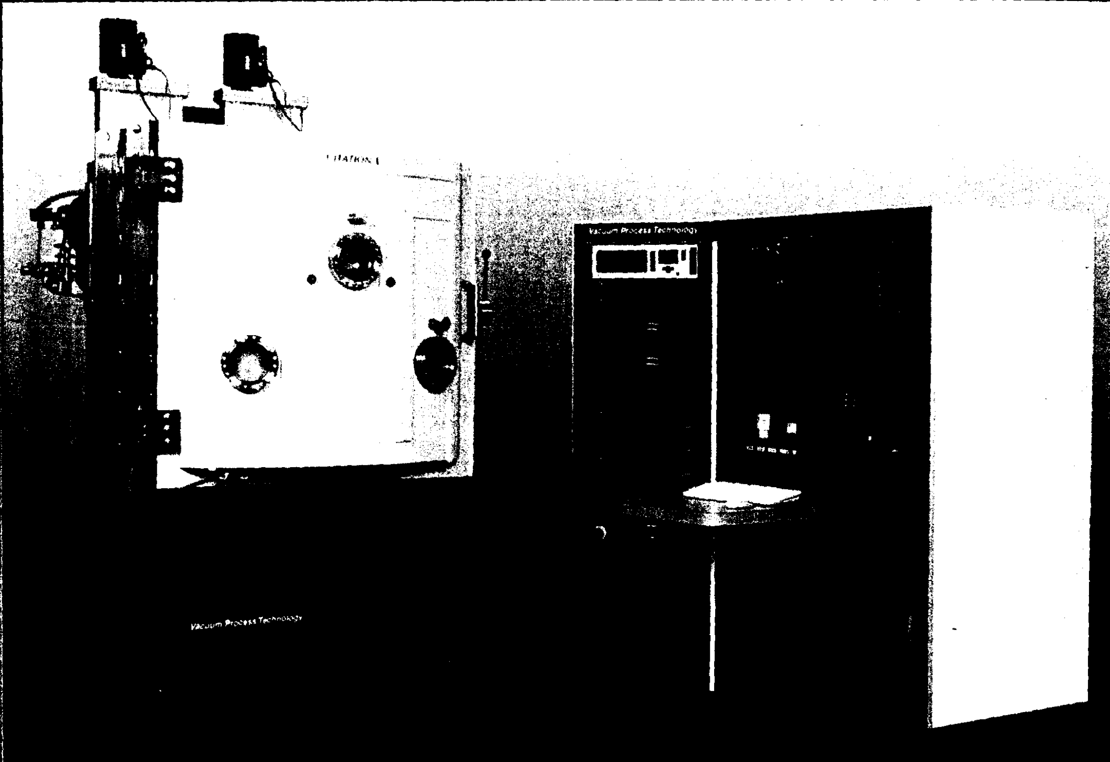


Subsystems

Capabilities

Service & Support

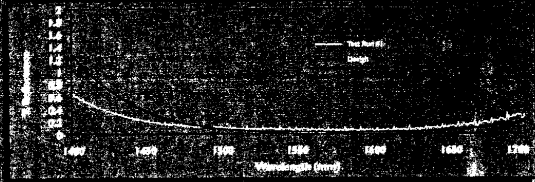


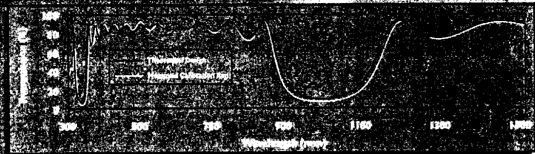


The all purpose precision optical coater delivers results that can be counted on again and again. Based on the proven technology developed for the 4500 series, the CITATION I includes process development, system calibration, film characterization, and uniformity adjustment to less than 0.5%. Delivered production ready with fully developed pre-programmed processes, this innovative approach is designed to minimize operator input and maximize run efficiencies, product quality and yield. Calibration of the process is so consistent that new designs may be programmed directly into the system from a remote site.

Precision Optical Coaters

Designed for run-to-run repeatability, the CITATION I delivers exceptional results after a minimum number of test coatings. The system lends itself to a fully automatic operation, reducing process variability and operating costs even with high layer counts and complex layer stacks.

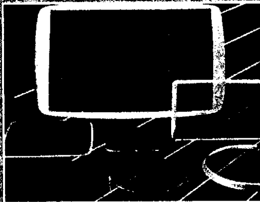


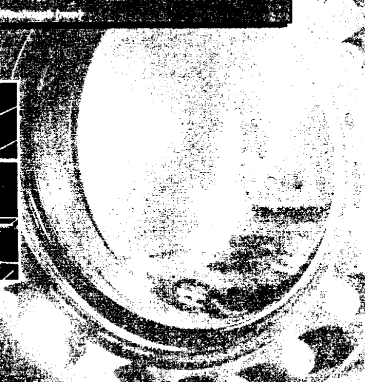


Applications

- Anti-reflective and highly reflective coatings
- Edge filters
- Beam splitters
- Laser diodes
- Polarizers
- Gain flattening filters
- Complex non-quarter wave designs including low stress [illegible] and high-laser damage
- Threshold coatings

Control System





- Based on a PLC platform with optional RSView 32 HMI operator interface package
- Optional control system based on PC and PLC platform with graphic screens on the computer indicating system status and process variables
- Multiple process recipes once developed are stored and run as required
- Manual and semiautomatic modes are included for initial process development and optimization as well as troubleshooting or maintenance

Precision Optical Coaters

The ... is an in-line optical coater created to transition an operation from batch processing to high throughput mass production.

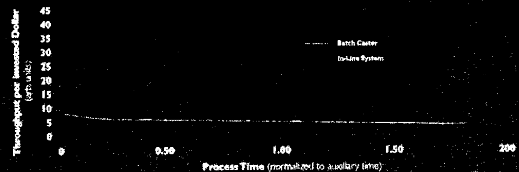
A unique feature of the CCS 64 system is its ability to transport fully loaded substrate fixtures through the system without breaking vacuum. Fixtures are transported manually into a load lock, then move automatically into the coating chamber and ultimately into the unload lock where the completed parts are removed. After programming, manual operations are limited to loading and unloading of the planetary assemblies.

The in-line configuration allows the process chamber to be maintained at high vacuum levels at all times, eliminating the detrimental effects of venting and source shutdown after each coating cycle. This fully automatic system streamlines operations and facilitates the production of high-grade optical films with fast, repeatable coating runs. Substrate planetaries are available in many size options to maximize system utilization. The CCS 64 does the work of up to four conventional batch systems.

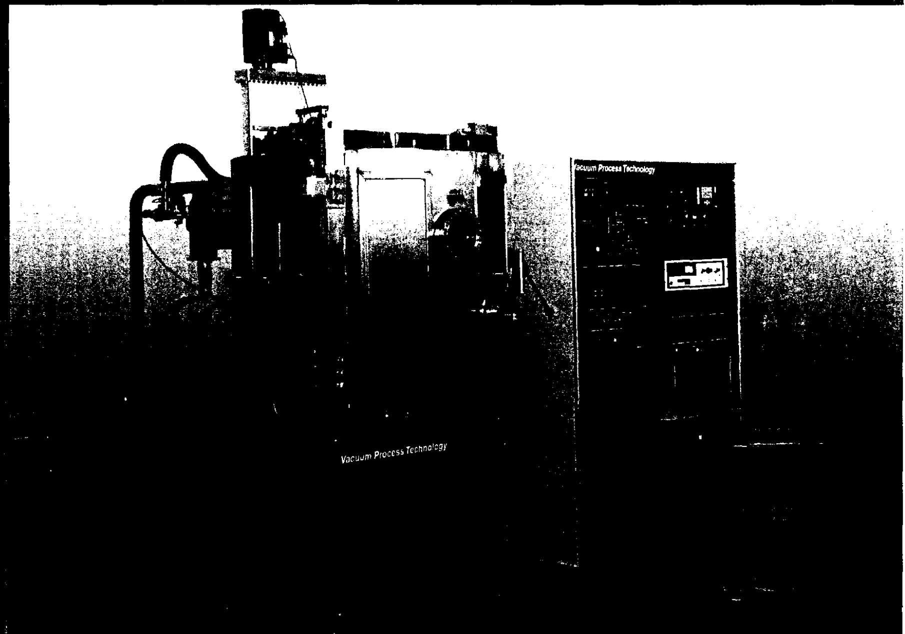
The CCS system is also available in 30-inch, 45-inch and custom sizes.

Applications

Control System

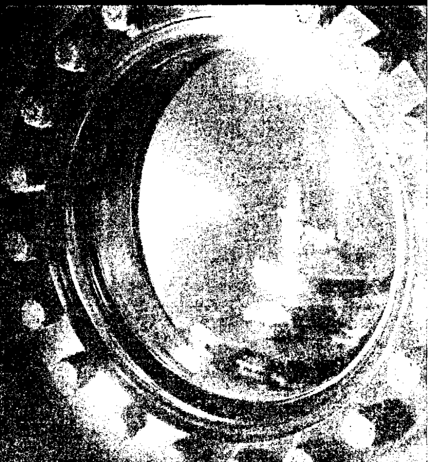


The is an economical single cryo-pumped, 30-inch stainless steel chamber that includes many of the same features that are incorporated in the 4500C series coaters. A planetary substrate holder contributes to the production of precise optical coatings along with the standard configuration of thermal and e-beam sources, ion beam source, quartz crystal monitor, substrate heating, and reactive gas control. All integrated into one control system, these components provide a reliable platform for customer-defined coatings where customization for specialty applications is necessary.



Applications

Control System



Custom Solutions

The [illegible] is [illegible] in-line multipurpose coater designed for decorative and wear resistant applications. The CCS3 utilizes a building block approach to provide a platform for multiple magnetron sources in one chamber or several chambers. This allows for the production of small lots with different processes within a single production cycle. Reconfiguration of the system can be accomplished rapidly, adding considerable flexibility to a customer's scheduling function.

Applications

Control System

Features

VPT also offers

with chambers ranging

in size from 24-inches to 100-inches.

The configuration of these systems are custom designed and manufactured in accordance with a customer's specific hardware and process requirements.

Control System

Features

VPT's

are used for cleaning, etching or surface modification of various materials. Chambers can range in size and geometry and include:

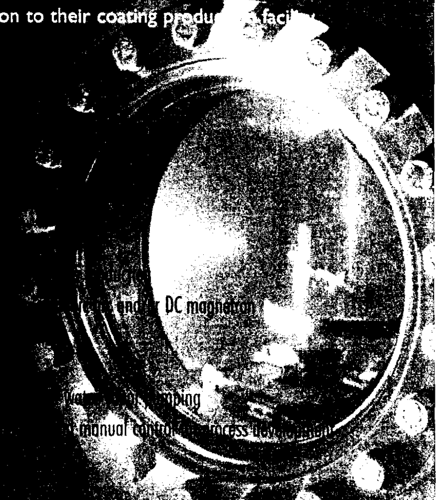
Control System

VPT's

are designed for batch and sample production of decorative and functional coatings. Companies having diverse requirements for producing one-of-a-kind samples or multiple samples along with the production runs of varying lot sizes, finishes and product size, will find this versatile machine a worthwhile addition to their coating produ[illegible] faci[illegible]

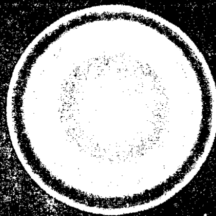
Control System

Features



Custom Solutions

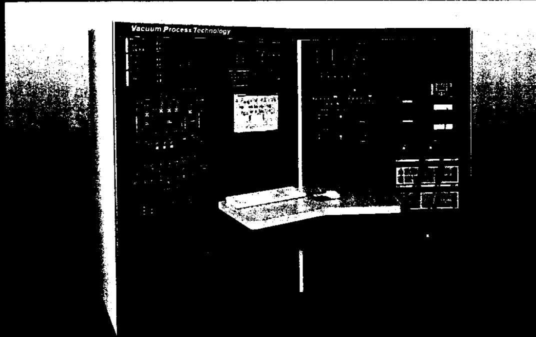
With today's emphasis on lean manufacturing and just-in-time delivery, reducing turn-around time is important in any business. The , manufactured by VPT for Isoflux, Inc., is a unique rapid-cycle coater for high quality hard and decorative coating applications. Now it is possible for tool manufacturers and distributors, as well as coating service centers, to economically provide coatings in hours rather than days. The ICM 10 uses proprietary cylindrical magnetron technology to coat batches of parts quickly with outstanding reliability. As an example, up to three microns of titanium nitride is deposited in one hour and the entire coating cycle from pumpdown to vent is just ninety minutes!



With its exclusive hollow cylinder cathode, the ICM 10 positions all of the parts all of the time, in an area of high, even temperature and flux density right inside the cylindrical target. The target actually surrounds the parts. Furthermore, proprietary Isoflux designs produce very high ionization densities within the coating volume, resulting in extremely tough coatings. Other technical advantages also include the AC-powered, dual target sputtering system that lets a customer coat with dielectric materials, such as aluminum oxide, as well as conducting materials.

The ICM 10 is fully automated and is based on a PLC platform and RSView 32 HMI interface. It comes with pre-loaded recipes for the most popular hard and decorative materials, including titanium nitride, titanium-aluminum nitride, titanium-carbo nitride, zirconium nitride and chromium nitride. Unique recipes to meet customers specific needs can also be added. A single button starts the process and the machine automatically takes the parts through the plasma heating and cleaning, preconditioning, deposition, and cooling steps.

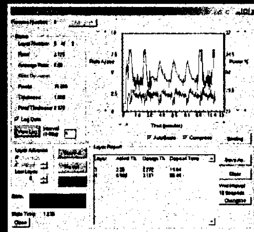
ICM 10 Advantages for Hard and Decorative Coating Applications



VPT's are well known for their proven reliability in a multitude of custom vacuum equipment applications. System options cover a wide range of control complexity from simple, manual operation to fully automatic, PC based packages. VPT also designs and manufactures dedicated, self-contained control units for specific applications such as pumping sequencers, regeneration controls and planetary drive systems.

The standard VPT Control System is PLC (programmable logic controller) based and provides manual and semiautomatic operation. The PLC is the key component of the control system, interfacing with all system components and providing vital sequencing and interlocking capabilities. An optional PC control system utilizes the PLC platform and HMI operator interface package to provide graphic screens on the computer for system control and process variable input.

Multiple process *recipes* can be developed, stored and run as dictated by production requirements. Manual and automatic modes are included for initial process development and optimization. The PC also includes data logging capability as well as a historical database for alarms and operator induced functions. Real time trending of various system variables is also a feature of this software package.



Subsystems

VPT's [illegible] incorporate wide faced gear drives fabricated entirely of 304 series stainless steel. The main bearings are of an advanced aerospace design, utilizing a Micro-Seal® bearing treatment designed for operation in excess of 350°C.

VPT also designs and manufactures specialized fixture configurations, including modified single rotation, counter rotation, dual drive, and a planetary fixture with the capability to *flip* each substrate planet for second-side coating.

This unique, proprietary flipping assembly eliminates the need for a second complete coating cycle when there is a requirement to coat both sides of the substrate.

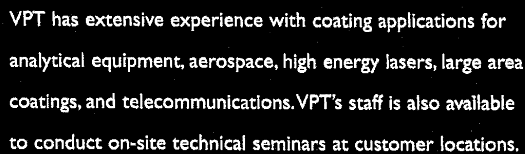
The VPT Flip-Pro can be adapted for virtually any size chamber and process. The design features a low profile to maximize the throw distance and is available in configurations that allow heat of up to 300°C. Use of irrational gear ratios is maintained for optimum uniformity of coating. The Flip-Pro may be ordered with any of our line of optical coating systems and is also available for retrofit applications.

Housed in a cleanroom environment, the CDL has an aqueous-based cleaning facility to prepare substrates prior to coating. The close proximity of substrate cleaning, coating and measurement facilities allow deposition of low defect films for critical applications such as laser damage and low scatter optics. The lab is also equipped with a research-grade UV-VIS-IR spectrophotometer, an optical profilometer and a Nomarski microscope. By utilizing the CDL's capabilities, all aspects of the coating process can be incorporated in customer training, including substrate preparation, coating design, coating process, automation, tooling design, and measurement methods.

In development is VPT's new, state-of-the-art

that has fully automated coating capabilities to demonstrate or develop coatings for its customer base. The lab includes a CITATION 1 (45") optical coater that can be configured for different deposition methods and monitoring techniques. The coater is capable of resistance or e-beam evaporation and sputtering deposition. A planetary rotation system allows the coater to be used for limited production runs and also to demonstrate the high level of film thickness uniformity that can be achieved. All processes may be completed with the option of ion-assist, supplied by an end-hall type ion source. Other ion sources may easily be installed for testing as required. The CDL coater has state-of-the-art film thickness monitoring including a quartz-crystal monitor, a witness optical monitor, and the capability to monitor through the center of each planetary. The coater is fully automated with one-button coating using VPT's Designlink software.

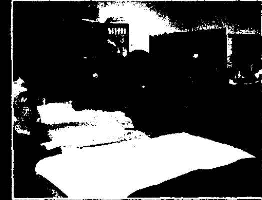
VPT has extensive experience with coating applications for analytical equipment, aerospace, high energy lasers, large area coatings, and telecommunications. VPT's staff is also available to conduct on-site technical seminars at customer locations.



Capabilities

Technical disciplines include:

Engineering



Coating Development

Manufacturing

Service & Technical Support

VPT's expertise is the practical implementation of concepts and ideas in the engineering, design and manufacture of precision thin film deposition equipment and products for the most demanding process requirements.

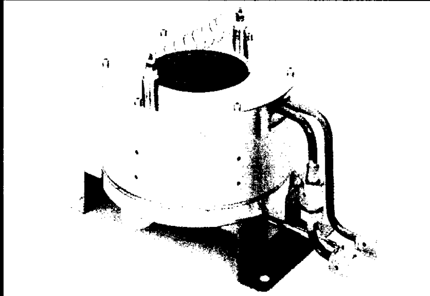
Service & Support

VPT takes pride in the given to customers. When customers buy a VPT system, VPT gives them the attention, support and service they expect and deserve. Both VPT's field service and in-house teams are available to assist customers at all times. With VPT, customers get it all—a team of quality people who know the business and a proven line of highly versatile products. VPT makes it easy to specify, order, inventory and install coating systems and components, and also provides the best technical support in the business. Customer satisfaction before, during and, most importantly, after the purchase is VPT's goal. Time is money. VPT manufactures and stocks many spare parts to ensure that customers are operating with minimal downtime.

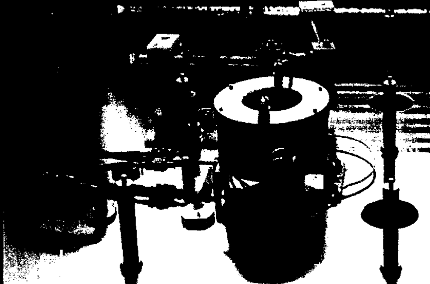
DynaVac IS-1000 Ion/Plasma Source

All The Power And Reliability You Need In Every Run

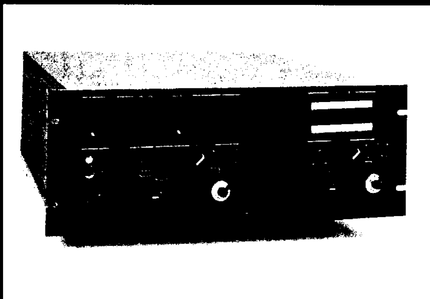
No stopping. No delaying. No problem.



Ion-assisted deposition that's reliable, powerful, simple.



Easy to maintain, built to last.



Stable control, on-line or off-line

If you've ever experienced ion source failure during ion-assisted deposition, you know how serious the results can be. You can end up with damaged substrates, and a loss of time and money. The costs can be in the hundreds-of-thousands of dollars.

Is it possible to minimize, even eliminate these problems during your optical coating run? Definitely. All you need is DynaVac's IS-1000 Ion/Plasma Source.

A Reliable Performer

The IS-1000 Ion/Plasma Source gives you reliable high-quality performance, time and time again. You'll find its advanced design provides for a smooth run each time you power up.

The reason? Simplicity.

DynaVac's source is designed with fewer parts to substantially reduce arcing and shorting, which minimizes ion source failure! In fact, overall, the IS-1000 employs fewer parts than other sources for easier usage and maintenance, and long-term durability.

It also works with oxygen and other gases on a continual basis for minimal arcing, comes with an easy-to-change, long-lasting tungsten filament, and has a broad beam with an enhanced 60 degree angle.

With the IS-1000 you'll:

- Increase the yield and reliability of your coating process
- Reduce downtime
- Minimize substrate damage and coating failure

A Powerful Partner

Rest assured when you have an IS-1000, you're getting all the power you need each time you use it. The reason is the Advanced Energy power supply.

By incorporating this power supply into the IS-1000, DynaVac gives you three to five times the drive power of competing ion/plasma sources. Its high-beam capability operates from 150 to 600eV with a drive power of up to 1200 watts. A powerful energy supply such as this allows you to lower the voltage and increase the current during your deposition process, further reducing substrate damage.

More drive power enables you to:

- Increase your deposition rates
- Eliminate the need for additional ion sources
- Handle high-powered applications more efficiently

Another benefit is that the IS-1000 is robust and bulletproof, providing superior arc suppression and therefore, a more stable coating.

A Precision Controller

Whether you choose the local or remote feature, DynaVac's ion/plasma source gives you a stable controller that's simple, convenient, and easy to operate.

It allows you to:

- Control the neutralizer filament and gas flow through steady, stable output
- Monitor your process with sharp, easy-to-read LED meters for precision control and accuracy
- Take advantage of remote control with RS232 protocol

DynaVac IS-1000
Specifications

Ion/Plasma Source

Source Diameter:	6.25"
Height:	6.25"
Aperture:	3"
Weight:	12 lbs.

Gas/Neutralizer Control and Power Supply System

Dimensions:	7"H x 19"W x 20.5"D
Neutralizer:	16" x .020 tungsten wire
Weight:	40 lbs.
Input Power:	208V, 1Ø, 10A, 50 or 60 Hz
Water:	1-2 gpm
Gas:	50 sccm maximum

High Voltage Power Supply Advanced Energy MDX-5

Load Power:	5000W
Output Maximum:	625 VDC, 10A
Input power:	208V, 3, 19A, 50 or 60 Hz, 5 wire
Dimensions:	7"H x 19"W x 19"D
Weight:	75 lbs.

Operational

Drive Power:	0-1200W
Drive Energy:	150-600eV
Drive Current:	.5-7A
Cone Angle:	60°
Minimum Pumping:	10,000 l/s

Feedthroughs

Gas and Water:	(1) 1" diameter or Conflat
Electrical:	(1) 4-pin 1" diameter or Conflat

Designed With Your Needs In Mind

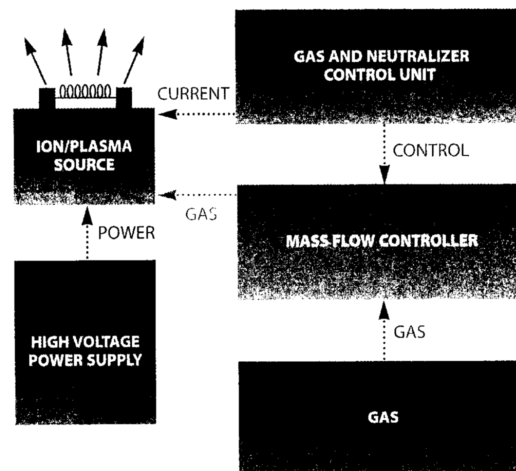
If you're looking for an ion/plasma source that's extremely reliable, powerful and low-maintenance, you've found it. The IS-1000 from DynaVac.

To find out more, simply call 617-740-9995.

The IS-1000 is one of many vacuum technology products and systems for thin-film deposition that's manufactured and designed by DynaVac. Our capabilities cover a wide range of optical coating, sputtering, and process applications and are always created to help customers cut costs while increasing productivity.

Every system, every innovation, is based on customer needs. *Your* needs. All you have to do is tell us what they are.

See How The IS-1000 Works With Your System



Visit our web site at http://www.dynavac.com

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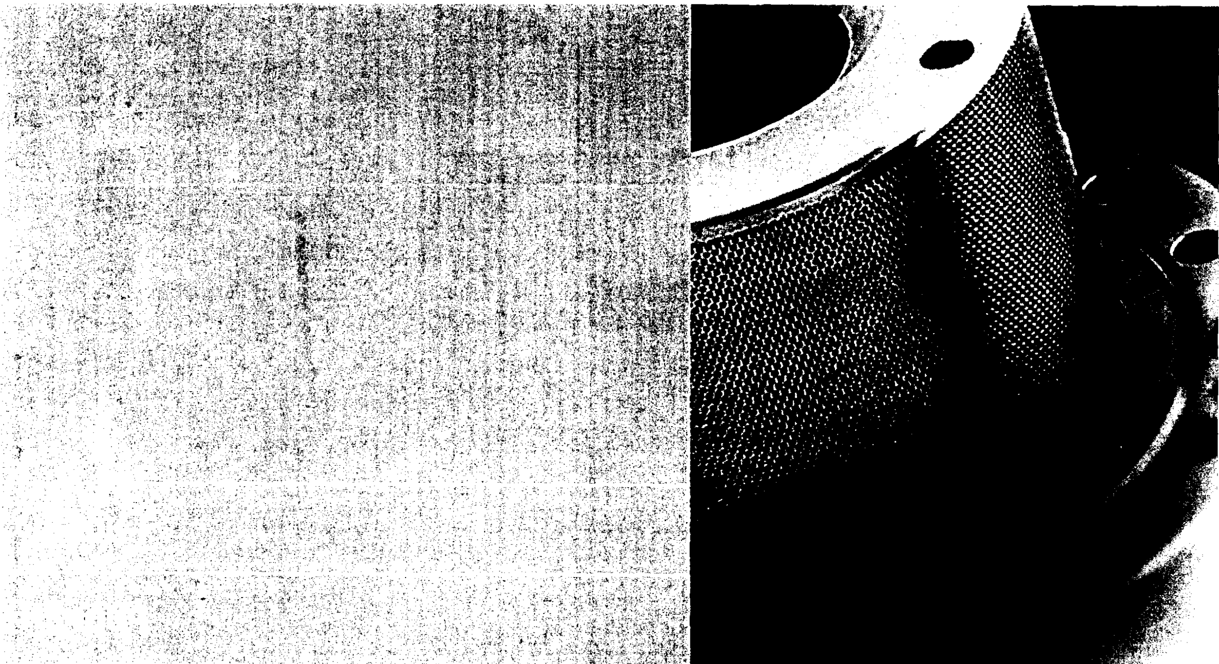
Hot Filament
Ion Beam Sources



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4 cm Hot Filament Ion Beam Source

The ion beam sources model IS40K have been designed to provide compact, easy-to-install and easy-to-operate ion beam sources for both research and production environments. IS40K are sources of Kaufman type using a low pressure arc discharge with hot filament for plasma excitation. An uniform plasma distribution is obtained by a multipolar magnet field configuration surrounding the plasma chamber. The ion sources operate on all inert and many reactive gases. With a high degree of ionisation, operation is performed at low gas flow rates and in low pressure range. Because of their wide energy range of 50 - 2000 eV the sources are ideal for many technologies like:

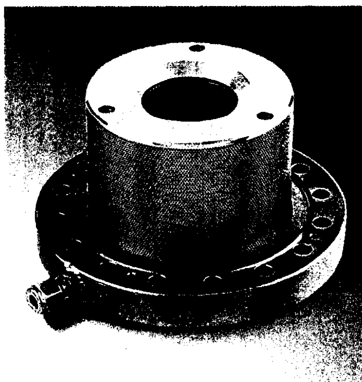
- Ion Beam Etching
- Reactive Ion Beam Etching
- Substrate Pre-cleaning
- Ion Beam Assisted Deposition
- Ion Beam Sputtering and Dual Ion Beam Sputtering

Several grid pattern (plane focussing, divergent) allow optimum adaptation of the beam profile to the process requirements and guarantee minimum beam pollution.

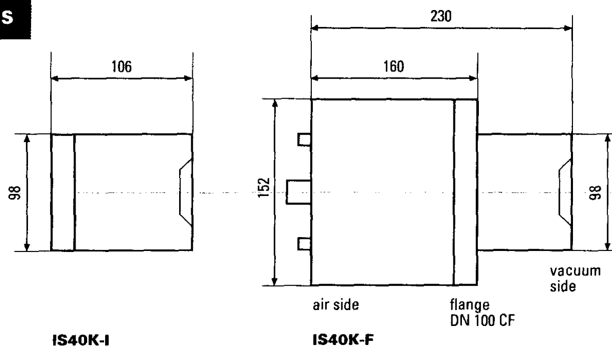
Features

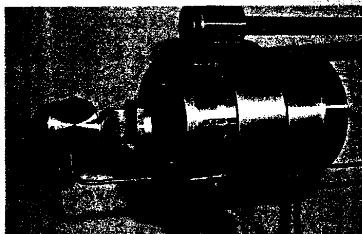
- minimum maintenance, simple change of filament cathode
- self alligning grid system and several grid shapes
- no cooling required
- UHV-compatible

IS40K-F



Dimensions





IS40K-I with Plasma Brigde Neutralizer

Technical data

		IS40K-F		IS40K-I
Mounting	flanges	flange mounted DN 100 CF or DN 160 CF		internally mounted 3x DN 40 CF for media feedthroughs
Materials	discharge chamber		Al_2O_3 ceramics	
	filament		tungsten	
	grids		graphite or molybdenum	
	housing		stainless steel	
Grid types	standard		plane 2-grid graphite grids	
	on request		3-grid systems, focussing or divergent grid shape, customised solutions on request	
Weight		~ 1,8 kg		~ 1,0kg
Operation parameters	discharge		1 A max., 100 V max., 100 W max.	
	ion current		50 mA max.	
	Ion energy		50 to 2000 eV	
	Accelerator voltage		0 to -1000 V	
Facilities	process gas flow		1 to 10 sccm	
	gas fitting	Swagelok 6 mm		Swagelok 1/8"
	electric connections	BNC		BNC on air side, power push-on on vacuum side
Neutralizer		Plasma Bridge Neutralizer Filament Neutralizer Beam Switch		

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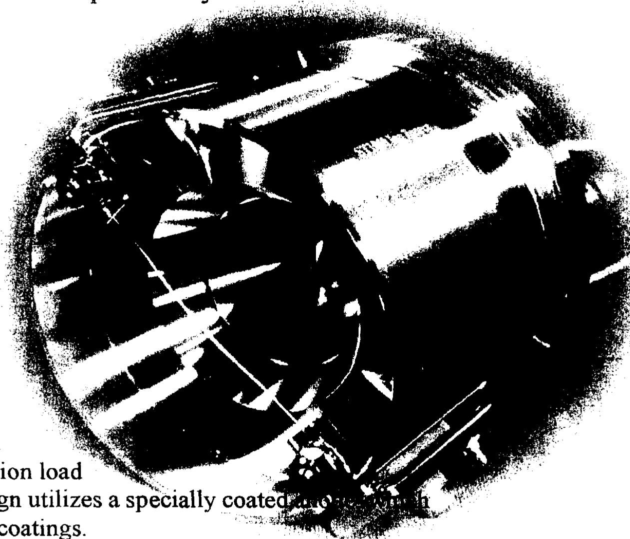
SAINTECH ION SYSTEMS

Introducing the ST3000 ion source system for Physical Vapor Deposition processes

The **SainTech ST3000 Ion System** has been specially developed to provide an extremely reliable and maintenance-free facility for many applications in physical vapour deposition processes. The compact design and rugged construction allows easy installation to both new and existing vacuum deposition systems.



The ST3000 and Ion Assisted Deposition
The IAD of thin film growth is a proven technique that provides dense and highly stable films without need of additional substrate heating.
The **ST3000** has further enhanced the IAD process to include deposition onto a wide variety of glasses, plastics and metals.
The **ST3000** provides unparalleled film adhesion for both metal and non-metal films.

ST3000 Features:
- Ion beam energies up to 300eV
- Ion beam currents to 13 amps max
- Full-time use of high purity oxygen.
- Highly efficient design greatly reduces gas load
- Water-cooled to reduce maintenance and radiation load
- Extremely low maintenance. The patented design utilizes a specially coate[illegible]h resists build-up of electrically insulating oxide coatings.
- Extremely stable operation in IAD processes due to patented electrode design
- Broad - beam divergence for large area coverage with a uniform ion flux.
- *Pulse*-mode operation for ion-assistance of radiation-sensitive film materials such as many commonly used infrared and UV thin film materials eg MgF_2 & LaF_2. For further information please refer to separate information sheets.
- Remote Control - a front panel switch toggles control from local operator to remote master control and monitoring of all operational parameters

Optional Features Available –
Dual Filament. Electronic system detects filament failure and auto switches to second filament.

For further information please contact the SainTech Sales Office or US Representative below:

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Tel 415 884 2322 Fax 415 884 0309
Email: info@vacufilm.com
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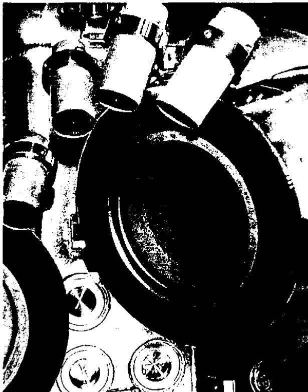
Ion Beam Deposition of Thin Film

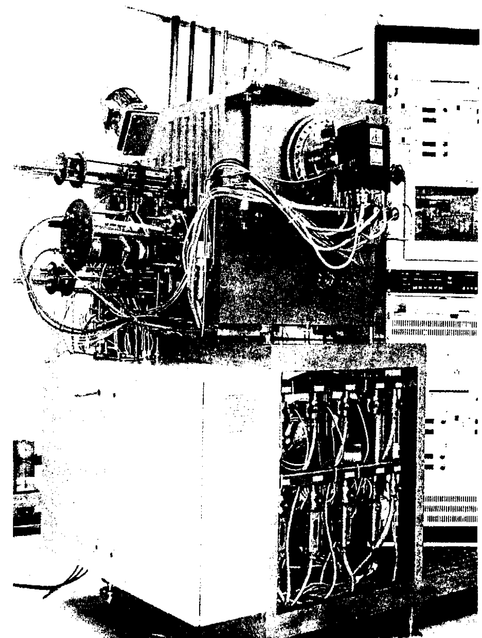
RR-ISQ 125 ECR with triple arrangement of plasma bridge neutralizers



Increasing requirements in thin film quality, precision in film thickness control and reproducibility have led to a wider use of ion beam deposition techniques.

The advantages of ion beam deposition especially for deposition of very thin layers are excellent process control (in the range of a few Angstrom) and low contamination from residual and sputter gases because of low process pressure.

Using ECR ion beam sources with alignment capability and special grid design an optimum adaptation of the equipment to special process requirements is possible.



Ion beam deposition chamber for multilayers for optical applications

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ROTH &RAU

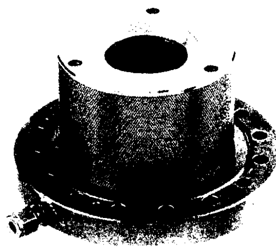
Member of the Rohwedder Group

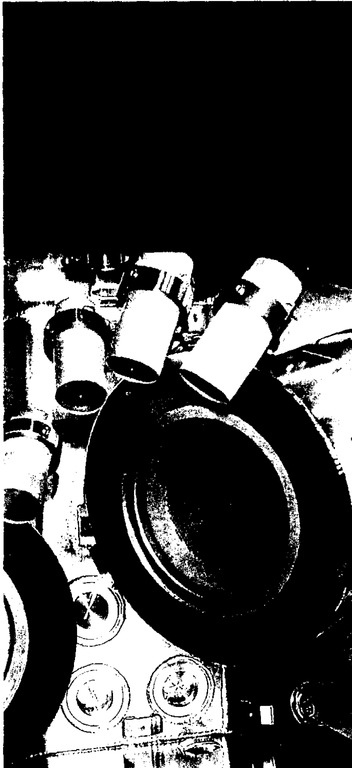
Solutions for Ion Beam Processing

Our series of filamentless broad beam ion sources are the optimum solution for a wide variety of ion beam processes at simultaneously easy operation and long time stability. They are equally suited for ion beam deposition processes as well as reactive ion beam etching, surface modification and assist operation.

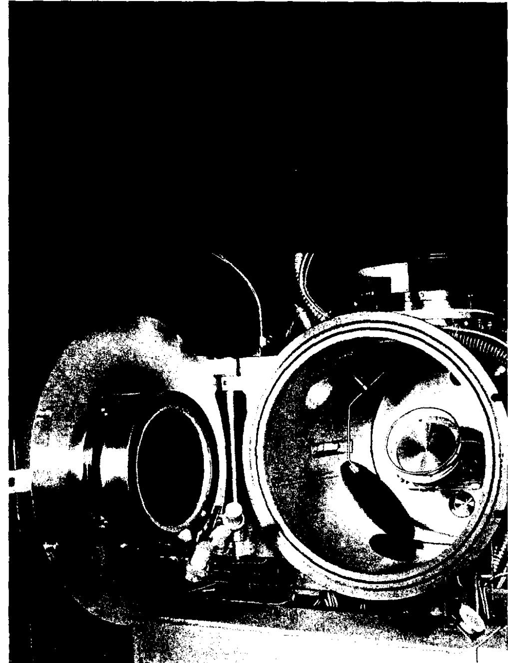
- 4 cm compact ion beam source
- inductively coupled RF plasma excitation
- fully noble and reactive gas capability
- compact, integrated matching network
- self-aligning grid systems from different shape and material for optimum process adaptation
- flange mounted and internal mounting configurations

ISQ40RF





ISQ125ECR



ISQ250ECR

- ECR excited plasma
- compact microwave generator head with fully automatic tuning system
- beam diameter 12,5 cm or 22 cm respectively
- well suited for RIBE and CAIBE
- special adjustable configuration and grid shape for ion beam sputtering application

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