Vakuum NYTT

nr 51 december 1990

Innehåll sid.

Från Redaktionen

Birgitta Gelin

Dead-line för Vakuum Nytt nr 52 utgår 1 maj 1991 !!

Vakuum Nytt behöver artiklar på svenska. Färdiga artiklar, tips om artiklar, önskemål om artiklar mm mottages tacksamt.

Allt material till tidningen skickas till Birgitta Gelin, Teknikum, Box 534, 751 21 Uppsala. Tel. 018 - 183118.

OBS !

Glöm inte att betala medlemsavgiften. Matrikel på våra medlemmar kommer att bifogas Vakuum Nytt nr 52, maj 1991.

Betalas inte årsavgiften så missar du detta !!

Stödjande medlemmar

Som ordförande i Svenska Vakuumsällskapet har jag fått ett brev där delar av innehållet lyder - "I am wondering if you can assist me in providing a list of possible agents in Sweden whom I could approach regarding interest in MOCVD equipment." - intresserade företag ombedes kontakta Birgitta Gelin, 018-183118 för mera information.

LÄSTIPS

1)En artikel om en kombinationspump för UHV. En Jonpump med "NEG"-material.

A new ultrahigh vacuum combination pump -

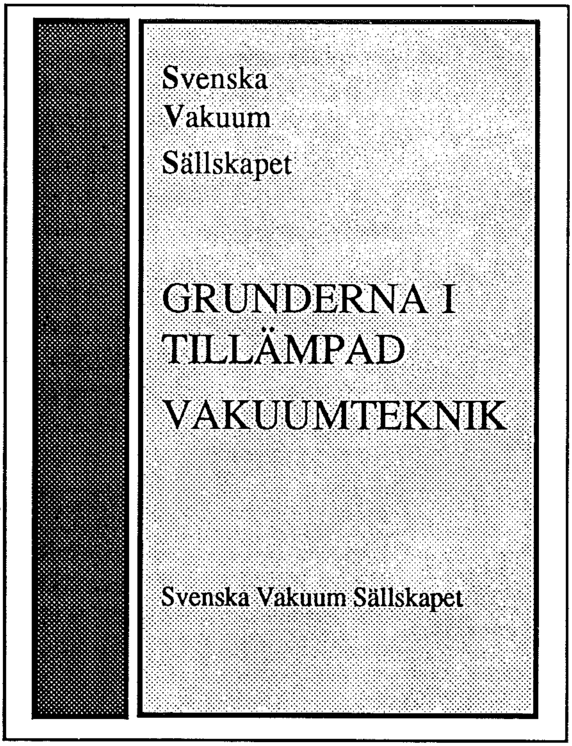
M.Audi and L.Dolcino (Varian, Italy) and F.Doni and B.Ferrario (Saes Getters, Italy).
Artikeln är publicerad i J. Vac. Sci. Technol. A5(4), Jul/Aug 1987, sid 2587 - 2590.
Kontakta gärna red. eller Peter Nydahl, tel 013-140174, om du har problem med att få tag i en kopia.

2) En artikel där kalifornienbaserade Terranova Scientific Inc. presenterar en metod att med ett jonisatrionsmätrör av standardtyp mäta tryck upp till 1 Torr. Jonisationsmätröret kan i många fall ersätta en kapacitansmanometer som klarar från 10 Torr ned till 2*10E-11 Torr.

New Controller Extends the Range of BA Ion Gages -

Ron Paitich (Terrovova Scientific Inc.)
Artikeln är publicerad i Research & Development, December 1989, sid. 65-68.
Kontakta gärna red. eller Henrik Frederiksen, tel 040-437270, om du har problem med att få tag i en kopia.

"Grunderna i Tillämpad Vakuumteknik"



Svenska Vakuumsällskapet har låtit översätta och trycka en amerikansk bok om vakuumteknik (orginalets titel "Basic Vacuum Practice", by Varian Associates).
Boken är främst riktad till personer verksamma inom industrin och olika läroanstalter som praktisk använder vakuumteknik i en eller annan form. Den är vidare avsedd huvudsakligen för nykomlingar i branschen eller för personer som vill ha en repetition av gamla kunskaper i mer modern form.
Boken innehåller ca 270 sidor och en stor mängd illustrationer, den lägger sin betoning på tillämpningar men även enkel teori ingår. Innehållet omfattar bl a Vakuum - Dess Grunder Vakuumpumpar, Mätare, Vakuummaterial och komponenter, System, Felsökning, Läcksökning Litteraturlista och Vakuumteknisk Ordlista.
Denna bok var avsedd att användas helt inom Svenska Vakuumsällskapets egen kursverksamhet, men efter påtryckningar har vi låtit nytrycka ytterligare 500 ex för försäljning Deltagarna i Svenska Vakuumsällskapets kurser erhåller dock sina böcker till rent självkostnadspris.

Pris : 500:- per bok + porto.

Boken kan beställas genom Leif Thånell, MAX-Lab, Box 118, 221 00 Lund. Tel. 046-107691. FAX 046-104710.

Vakuum! Varför ?

Svenska vakuumsällskapet har i ett åratal varit ett forum för utbyte av praktiska erfarenheter. Eftersom artiklar av teknisk natur har ofta publiserats i medlemstidningen, kan det vara ett läge för en annan vinkling av dessa frågor. Det som följer här är ett ombearbetat avsnitt ur en avhandling som publiserades tidigare i år. Om det är nyttigt att behandla detta ämne på detta sätt, låter jag vara obesvarat, men förhoppningsvis roar detta avsnitt någon och stimulerar till vidare funderingar om det flesta betraktar som en självklarhet, riktigheten av vår varseblivning.

Avhandlingen kan vara av visst intresse för dom som arbetar med UHV teknik, och om det är någon som är intresserad kan underteknad trolla fram extra exemplar.

INTRODUCTION

In science, problem formulation is often simplified to an ideal situation. An example of this is a sample in otherwise empty space with no exchange of energy with the environment. The crucial point is that this is not only *a practical impossibility*, it is even *logically impossible*. The smallest interaction we can think of is a single photon interacting with the sample and which is detected with probability equal to one by a *demon* detector. Even here there is an exchange of energy with the environment. If the photon carries some information about the sample, there has been an energy-transfer. On the other hand if the photon does not carry any information about the sample, we do not even know if the sample exists. Furthermore, as the photon travels 'through' the 'otherwise empty space' it is not empty anymore (those of you who are familiar with the concept of spacetime, suppress that knowledge for some time, it does not affect the argument in any way. The same is valid for the μ-vacuum.). We are led to the following conclusion, *we can never perceive an empty space, to perceive is to interact, therefore it is impossible to achieve a measurement on a sample in an otherwise empty space.*

As we have come to the conclusion that it is impossible to measure without any interaction, we have to define and take into account the perturbation induced by the measuring procedure. This problem is twofold, first of all, there is the noninformative interaction of the sample with its 'chemical' surrounding which should be minimized. This is the basic idea of vacuum-systems. The interaction is minimized by removing the main part of the atmospheric pressure from the chamber in which the sample is located. The degree of removal is determined by the budget and vigorousness of the people involved in the research project. Secondly there is the informative interaction, the measurement, which cannot be minimized on a simple basis.

To clarify this problem assume that we have an isolated single molecule in a trap. If we are interested in properties which can be inferred by photon scattering, e.g. (γ,γ) or (χ,χ), the measuring procedure can, in most cases, be considered to be nondestructive. A simple picture of this is an operator which operates on the wavefunction of the trapped atom and leaves it in an excited state which will deexcite by emitting e.g. a photon. To detect the interaction we assume an all-purpose detector system with an efficiency equal to η. The interaction can be formulated in the following way:

$$O\Psi \rightarrow \Psi^* \qquad (1)$$

where O is the interaction operator, Ψ is the wavefunction of the system before the interaction, and Ψ^* is the wavefunction of the excited state. The perturbation is controllable as the measuring procedure can be repeated on the same sample after deexitation. In a destructive measurement[1], the interaction wipes out the original system and creates a completely new state:

$$O\Psi \rightarrow \Pi \qquad (2)$$

This procedure demands a new sample (molecule) for every measurement, *and therefore it is impossible to follow the time evolution of the system by using destructive methods.* Let us now expand the argument to a system containing N particles. For the nondestructive procedure this does not involve any fundamental changes but for the destructive method the situation is completely different. It is now possible to define a quantity $\Delta N_{max}/N = \Delta_{max}$ which determines the acceptable change in N. Although parts of the system are destroyed, the sample as whole remains *almost* the same and thus the intrinsically destructive method can now be defined as 'nondestructive'.

To generalize the discussion consider a branched reaction path:

$$O\Psi \begin{array}{l} \rightarrow \Pi \\ \rightarrow \Pi^+ \end{array} \qquad (3)$$

The probability for creation of Π, is k, according to:

$$k = \frac{[\Pi]}{[\Pi] + [\Pi^+]} \qquad (4)$$

Here the brackets are used to represent the number of created particles. Denote the number of created information-carriers (Π) by m, and the probability of detection by η. Thus the number of information carriers which it is possible to detect prior to 'destruction' is given by the following formula:

1 Destructive measurement, read nuclear reactions

$$m_{max} = \Delta_{max} N k \eta \tag{5}$$

In general it can be stated that the definition of nondestructive methods is somewhat ambiguous. This argument can be applied e.g. to a nuclear reaction analysis and other related fields of research.

EXPERIMENTAL EQUIPMENTS.

There is no sample without a surface !

During the last two decades, enormous progress has been made within the framework of surface science. The reason for this is partly the importance of surfaces for chemical reactions. Not only are there interesting physical phenomena taking place on surfaces, there is also an economical interest involved. Catalytic reactions, the absorption of hydrogen and the epitaxial growth of thin films are examples of important physical / economical processes on surfaces. But this is merely a part of the explanation. This is where low pressure physics enters the arena.

Prior to designing and constructing low pressure systems, several considerations have to be taken into account. First of all, what pressure is needed? The cost of lowering the pressure increases for each decade of decreasing pressure, thus a compromise is often required. If a residual gas component X is to be minimized (e.g. carbon or oxygen) this must be taken into account when selecting the construction material and pumping units. To maintain the low pressure, the construction material must withstand the mechanical constraints and the permeation induced by the pressure difference must be minimized. The solubilities and diffusion rates of most gases are low compared to that of hydrogen, therefore special attention must be given to the permeation and outgassing of hydrogen............!

I nästa nummer kommer jag att fokusera på H växelverkan med metaller och behandla fysiken bakom "Vacuum Firing" och andra metoder ämnade för att minimera flödet av vätgas in i vakuumsystem.

Björgvin Hjörvarsson
Uppsala Universitet
Box 530
751 21 Uppsala

UTFÖRSÄLJNING AV BEGAGNAD VAKUUMTEKNISK UTRUSTNING

Magnetron-sputtering-komponenter.

1) Kraftaggregat fabr. Plasma Therm modell MDS 5000D, 5 kW DC. .... pris: 20.000:-

2) Magnetronkatod fabr. VAC-TEC Systems ø8" .... pris: 4.000:-

3) Vakuumkammare i rostfritt stål ø 500 mm x 600 mm hög, inkl. stativ, topp- och bottenplatta, flänsar, etc. .... pris: 6.000:-

4) Pumpställ NW 150, bestående av diff.-pump, vattenkyld fälla, regleringsventil, gate-ventil och Meissner-fälla. (passande kammare enl. ovan) .... pris: 4.000:-

Övrig utrustning.

5) Vakuumkammare i rostfritt stål ø 350 mm x 150 mm hög, för lödning; inkl. förvakuumpump, temp.rgl. .... pris: 3.000:-

6) Läcksökare, helium masspektrometer; Veeco modell MS-9. .... pris: 2.000:-

7) Rörugn, 1200°C ø 60 mm x 750 mm, inkl. temp.rgl. och tbh. .... pris: 1.500:-

8) Pumpställ 6", inkl. diff.-pump och komb. vatten- LN_2 fälla. .... pris: 1.000:-

9) Kraftaggregat för elektronstråle-förångning. Varian modell 922-0020, inkl. beam-adjust. .... pris: 2.000:-

10) Kraftaggregat för resistansförångning. 2 kW Veeco modell VES-770 Evapatrol. .... pris: 1.000:-

11) Diverse vakuumkopplingar, ventiler, genomföringar, etc. .... pris: 3.000:-

12) RF-aggregat 2 kW, 13.56 MHz. Fabrikat Plasma-Therm modell HFS-2000, inkl. anpassning .... pris: 30.000:-

Var god kontakta Jan-Erik Boström på telefon 08 - 7158537 under vecka 9102 - 03, vardagar mellan 9^{00} - 16^{00}. Eller skriv till : Mats Widoff, Birkagatan 31, 113 39 STOCKHOLM.

Försäljningen sker exkl.moms, emballage och frakt från lager i Nacka. Samtlig utrustning är funktionsduglig och säljes i befintligt skick. Avsyn kan ske före leverans eller hos kund. Betalning kontant efter leverans.

Svenska Vakuumsällskapet arrangerar kurs i

Grundläggande Vakuumteknologi

91.01.22

Svenska Vakuumsällskapet arrangerar den 22 Januari 1991 åter igen en kurs i grundläggande Vakuumteknologi. Introduktionskursen som årligen arrangeras av sällskapet vänder sig till tekniker och forskare inom Svenskt näringsliv och inom våra Universitet och Högskolor.

Programmet inkluderar en full dags föreläsningar om;

* **Grundläggande vakuum teori**
* **Pumpar och mätinstrument**
* **Material för vakuumsystem och systemuppbygnad**
* **Läck- och felsökning**

I samband med kursen kommer också några av våra Vakuumfirmor att arrangera en mindre utställning.

Plats Collegium, Mjärdevi forskningsby, Linköping

Anmälan (se bifogad talong) skickas senast 91.01.15 till Ingrid Nyman, Teknik Centrum, Linköpings Universitet, 581 83 Linköping, Tfn: 013 - 28 11 48, Fax: 013 - 12 22 99.

Upplysning kan fås genom Jan-Eric Sundgren, 013 - 281277.

Priset vilket inkluderar kaffe, lunch och boken "Grunderna i Tillämpad Vakuumteknologi" är 1000:-.

Svenska Vakuumsällskapet arrangerar en Temadag i

Materialanalys mha Elektronmikroskopi.

91.01.23

Kunskap om framställning, struktur och egenskaper hos material är av central betydelse för de flesta teknologiska utvecklingar. Ett mycket viktigt steg i denna kunskapsutveckling är analys av materialens mikrostruktur och mikrokemi. Ett av de väsentligaste redskapen inom detta område är utan tvekan elektronmikroskopi. Avsikten med denna temadag är att belysa elektronmikroskopins möjligheter och begränsningar vid analys av både oorganiska och organiska material. Tonvikten kommer att ligga på transmissionselektronmikroskopi, TEM.

Program.

09^{00} - 10^{00}	Registrering och kaffe.
10^{00} - 10^{15}	Inledning. Prof. Jan-Eric Sundgren, Linköpings Univ.
10^{15} - 11^{00}	*Transmissions elektron mikroskopi (TEM), en överblick.* Prof. Hans Nordén, CTH, Göteborg.
11^{15} - 12^{00}	*Högupplösande TEM,* Docent Jan-Olof Bovin, Kemicentrum, Lunds Univ.
12^{00} - 12^{30}	*Provberedning för TEM.* Tekn. Dr. Lars Hultman, Linköpings Universitet.
12^{30} - 13^{30}	Lunch
13^{30} - 14^{15}	*Elektronmikroskopi och mikroanalys inom oorganisk kemi - några exempel.* Prof. Lars Kihlborg, Oorganisk kemi, Stockholms Univ.
14^{15} - 14^{45}	*TEM och STEM analys av struktur och kemisk sammansättning i gränsytan mellan stål substrat och TiN filmer.* Tekn. Lic. Greger Håkansson, Linköpings Univ.
14^{45} - 15^{15}	Kaffe paus.
15^{15} - 15^{45}	*Elektron mikroskopi studier (TEM och SEM) av biologiskt material,* Med.Dr Margareta Lindroth, Linköpings Univ.
15^{45} - 16^{15}	*Svepelektronmikroskopi studier inom kriminaltekniken.* 1st Fo Ing. Jan Andrasko, Statens kriminaltekniska Laboratorium, Linköping
16^{15} - 16^{45}	Avslutande diskussion.

Plats Collegium, Mjärdevi forskningsby, Linköping

Anmälan (se bifogad talong) skickas senast 91.01.15 till Ingrid Nyman, Teknik Centrum, Linköpings Universitet, 581 83 Linköping, Tfn: 013 - 28 11 48, Fax: 013 - 12 22 99.

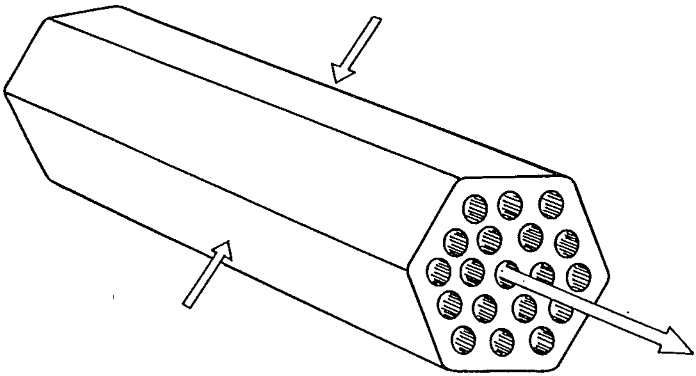
Upplysning kan fås genom Jan-Eric Sundgren, 013 - 28127 eller Lars Hultman 013 - 281284.

Priset vilket inkluderar kaffe och lunch är 800:-

Användning av aluminiumoxid som gas- och vätskefilter för partikelfiltrering ned till 0.01 μm

Anders Johnsson, Anders Edström
Crysis Technology AB
Forskarbyn Ideon, 223 70 Lund

De keramiska materialen är världens mest avancerade filtermedia. Keramiska filter har primärt utvecklats för separering av uranisotoper (diffusion av uranhexaflorid) men har också ett brett användningsområde inom annan industri och forskning. Exempel på andra speciella högteknologitillämpningar är filtrering av vätskor inom biotekniken samt för processgaser inom halvledartillverkning där membranmaterialet är kompatibelt med de allra flesta av dessa[1]. Som exempel kan nänmas: Cl_2, NH_3, N_2O, SiH_4, PH_3, AsH_3, HCl, SF_6, HBr, B_2H_6 och BCl_3.



Materialet är ultra-ren, sintrad aluminiumoxid vilken p.g.a sin struktur med fördel kan användas för gasfiltrering och filtrering av vätskor. Materialet bearbetas till lämplig form för att passa som ett "in line" filter. Filterinsatsen består utav ett stycke extruderad aluminiumoxid (fig) formad med nitton kanaler som löper längs flödesriktningen. I var och en av de nitton kanalerna samt på gavelytorna har man deponerat flera lager aluminiumoxid med varierande porstorlek från 0,2 till 5 μm för mikrofiltrering samt från 4 till 100 nm för ultrafiltrering.

Denna struktur kan arbeta under höga temperaturer och högt tryck samtidigt som den effektivt filtrerar bort partiklar ned till 0,01 µm i storlek.

Filterinsatsen är kapslad i en invändigt elektropolerad (Ra, 0,2µm) behållare tillverkad i SS2353 (kiseltätat, syrafast stål med låg kolhalt). Tätning mellan filterinsats och behållare är gjord i PTFE. Montering och kapsling utföres i klass 100 renrum.

Fördelarna med att använda aluminiumoxid som filtermedia är många och viktiga. Materialet har extremt hög filtrerings och upptagningsförmåga. Under normala förhållanden filtreras 99,999% av alla partiklar över 0,01 mikrometer. Man har också funnit att det ej sker någon utfällning av filtrerade partiklar tillbaka till mediat, (detta gäller även vid pulsade flöden) samt att ingen korrosion av det keramiska materialet sker vid kontakt med korrosiva och aggressiva processgaser. Aluminiumoxiden har dessutom mycket låg urgasningsfaktor.

Maximal driftstemperatur är normalt 120°C, intermitent kan dock filter och behållare värmas till 200°C i det fall detta skulle vara nödvändigt för vissa tillämpningar. Ingångs- respektive utgångstryck är maximalt 200 bar, differenstryck maximalt 100 bar och samtliga filter är tryckprovade till 600 bar samt heliumtestade till $<1 \times 10^{-8}$ atm. std. cm^3/sek. med VCR- och Swagelock-kompatibla anslutningar. Den aktiva filterytan varierar med modell mellan 15 och 450 cm^2 vilket kan filtrera 1 - 500 liter gas/min.

Vid användning av keramiska material som partikelfilter i processer med gastillförsel eller för vätskor, kan vi konstatera att man uppnår en hög grad av filtrering av partiklar ned till 0,01 mikrometer p.g.a materialets speciella struktur och tillverkningsmetoder. Strukturen kvarhåller partiklar även vid pulsade flöden, till skillnad mot PTFE-filter, vilka har en tendens att utfälla partiklar och fukt tillbaka till mediat vid pulsade flöden.(1).

Referenser

1. Société des Céramiques Techniques, Bazet, Frankrike

Pressrelease

Rymdkammare till SAAB SPACE

Svensk rymdindustri får ökad kapacitet med en ny rymdkammare hos SAAB SPACE i Göteborg.
Rymdkammare används för att simulera rymdens förhållanden. Innan apparater och komponenter till raketer och satelliter kan skjutas upp, måste de testas noggrant här nere på jorden: i en rymdkammare. Där utsätts de dels för synnerligen lågt tryck, vakuum, och dels för extrema temperaturer, medan deras funktioner provas igenom av många olika, datorstyrda instrument.
Jämfört med SAAB:s 20 år gamla kammare, ger den nya möjlighet att prova betydligt större apparater, flera åt gången under större och snabbare temperaturvariationer, samtidigt som tio gånger så många mätfunktioner kan kopplas in.
Anläggningen är byggd enligt SAAB:s egna specifikationer och har levererats av Elsi-Tech AB i Helsingborg med underleverantörerna Löwener Vacuumservice AB i Göteborg/Stockholm och Chipzobits Digitalteknik AB i Ängelholm.

Kammaren

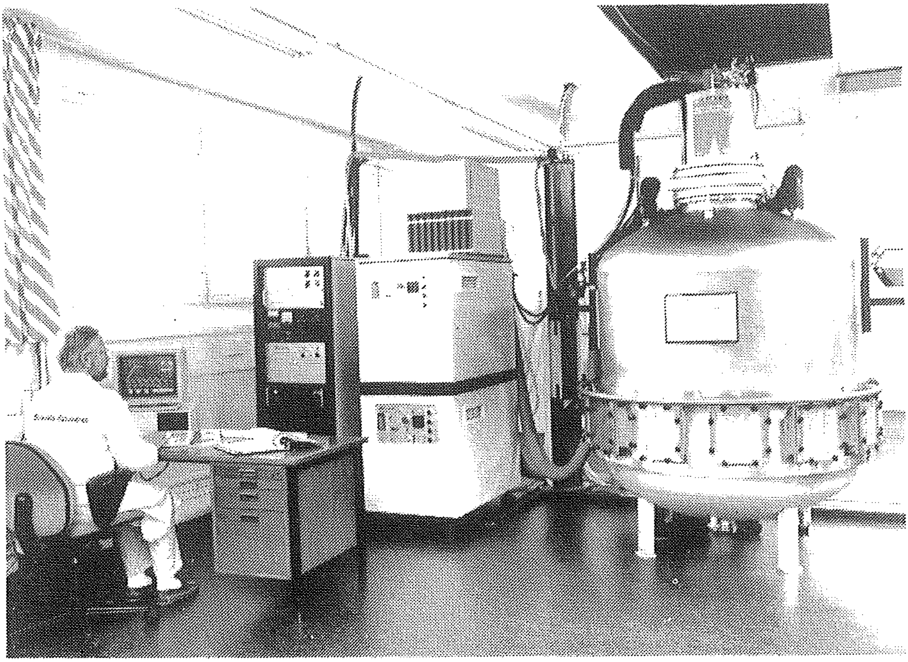
Själva kammaren utgöres av en stående behållare i två delar. Den öppnas genom att övre delen lyftes. I undre delen ligger en metallplatta, på vilken provföremålen monteras. I övre delen hänger en metallhuv eller "termisk mantel" som omger föremålen under provningen.
Temperaturen på platta och mantel regleras oberoende av varandra från - 60° till + 100° C. Utrymmet för provföremålen är 850 x 850 x 450 mm.

Vakuumsystem

Kammaren är ansluten dels till en lamellpump för grovvakuum, dels till en molekylär turbopump för mellanregistret. På kammarens topp sitter en kryopump med kapaciteten 5 000 l/s vid testtrycket 1 mPa. Det är en hundra-miljondel av atmosfärstryck. Dit når man inom en timme med tom kammare.
Kryopumpen skapar en temperatur ner emot - 263° C, vilket är så nära absoluta nollpunkten, att alla gasmolekyler (utom väte och helium) fryser fast på dess ytor. Den låga temperaturen åstadkommes genom kompression av helium i en vanlig kolvkompressor och senare expansion av gasen i ett särskilt system av värmeväxlare.
SAAB:s kryopump är en av de allra största i Skandinavien. Den stora kapaciteten motiveras av att det omfattande kablaget för provningen kan avge gaser vid så lågt tryck.

Temperering

Plattan och manteln har kanaler, genom vilka en vätska pumpas runt av en "Temperator" för vardera. Vätskan värms respektive kyls, för att ge de temperaturer som krävs för provningens olika faser. Temperatorernas kapacitet är tillräcklig för att ändra temperaturerna med hastigheten 60°/h med full last i kammaren.
Temperatorerna står ovanpå varandra intill kammaren med en heliumkompressor för kryopumpen placerad överst. Alla tre är anslutna till kammaren med slangar.



Datautrustning

För anslutning av mät- och kontrollutrustning har kammaren mer än 5 000 vakuumtäta genomföringar i en serie kvadratiska portar omedelbart nedanför delningsplanet. De innehåller kontaktdon av D-subtyp och olika koaxialtyper. Temperaturen kan mätas i 24 punkter och loggas med önskade intervall.

Tryck, temperaturer och andra provningsförlopp loggas med programmet CombiLab i en PC. En annan program-modul styr de två Temperatorernas temperatur enligt uppgjort testschema och övervakar alla väsentliga funktioner, så att driften kan löpa helt automatiskt.

Figurtext

Ny rymdkammare hos SAAB SPACE. Fr.v. ses operatörsplatsen med styr- och loggdator, central kontrollpanel, två Elsi-Tech Temperatorer på varandra med kompressorenhet för kryopump överst, samt t.h. kammaren med kryopump upptill och portar med vakuumtäta kontaktdon nertill. Därbakom ses en av de två pelare med lyftkonsoler, som höjer kammarens överdel vid öppning.

Ytterligare upplysningar lämnas av:

SAAB SPACE AB	031-37 00 00	Ernst Blixt
Elsi-Tech AB	042-28 10 25	Sture Åström
Löwener Vacuumservice AB	08-744 29 85	Göran Lockner
Chipzobits Digitalteknik AB	0431-162 99	Alf Karlsson

SO 181.01.02

Production of ultra-high vacuum using refrigerator-cooled cryopumps

LEYBOLD AG
Vacuum Technology
Bonner Straße 498 / P.O.B. 51 07 60
D-5000 Cologne 51
Tel. (02 21) 3 47 - 0
Telex 888 481 - 0 lh d
Telefax (02 21) 3 47 - 12 50

LEYBOLD

Introduction

Due to the principle they are based on, refrigerator-cooled cryopumps are eminently suitable for producing ultimate pressures lower than 10^{-10} mbar. This can be seen very clearly from **Fig. 1**, which shows the vapor pressure curves of those gases that are most relevant for UHV-production. Note, that the curve for H_2 is not the vapor pressure but the adsorption equilibrium pressure of hydrogen on charcoal. Today usual cryopumps attain temperatures of about 10 K at their second stages. Therefore, ultimate pressures below 10^{-11} mbar are possible, in principle. Furthermore one can see, that for higher operation pressures, which are present during the bake-out phase of a chamber, even higher operation temperatures of the cryopump could be tolerated. For example, at pressures in the order of 10^{-6} mbar it is sufficient that the second stage operates around 20 K; for the first stage, which has to pump (= to condensate) water vapor, even 160 K could be tolerated instead of the "normal" final temperature of around 50 K.

In practice, however, plants conceived for ultra-high vacuum must be baked out at temperatures higher than 200 °C. At such high temperatures, the use of refrigerator-cooled cryopumps can cause problems:

The refrigerator cold head itself cannot be baked out, as the maximum admissible temperature for the temperature-sensitive parts such as the displacer, the seals, etc. is only 60 °C. In order to visualize the thermal conditions for the operation of such a pump

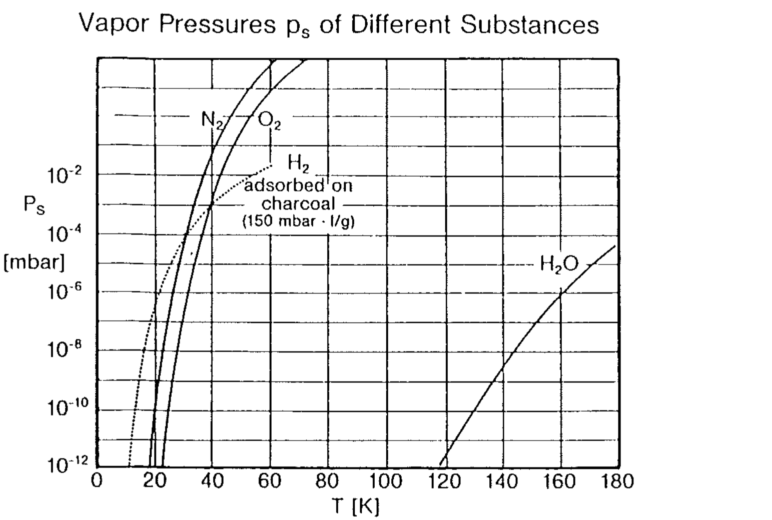


Fig. 1

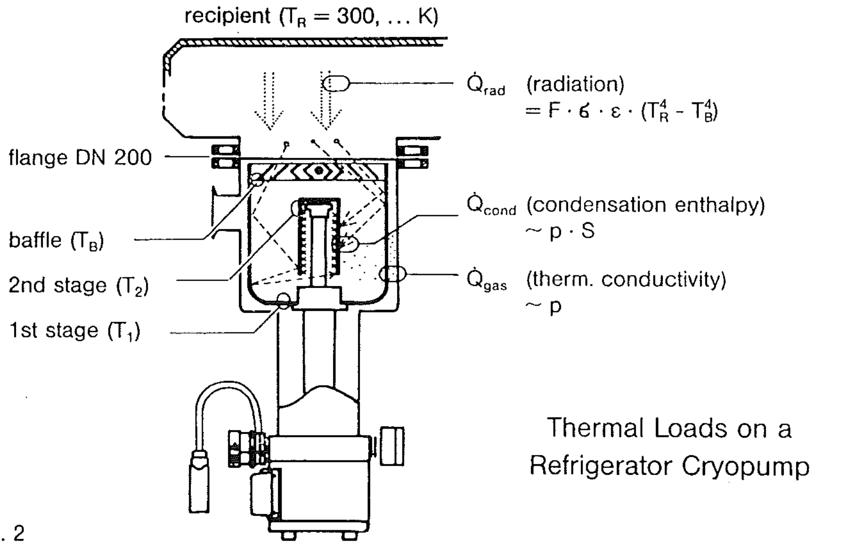


Fig. 2

Fig. 2 shows a typical two-stage refrigerator cryopump with 200 mm inlet flange. The colder 2nd stage is equipped with a cryopanel for condensation/adsorption of gases like N_2, O_2 and H_2, and is surrounded by a slightly warmer radiation shield and inlet baffle, which are both thermally connected to the first stage of the refrigerator cold head. Both stages have only a limited refrigeration capacity and are both subjected to different thermal loads, the most important of which are:

a) the **thermal radiation $\dot{Q}$ (rad)** from the warm surface, at temperature T_R to the colder surface at temperature T_B. This radiation load is proportional to the area of the surface (F), proportional to the relative emissivity and proportional to $(T_R^4 - T_B^4)$ and is therefore extremely temperature dependent. A small thermal radiation load also hits the 2nd stage.

b) the **enthalpy needed for condensing** the gases which have to be pumped, consisting of the amount of heat needed for cooling down the gas from its normal temperature to low temperature and the condensation enthalpy itself. Dependent on the type of gas first or/and second stage are affected from its load, which increases with increasing gas throughput $p \cdot S$.

c) loads $\dot{Q}$ (gas) resulting from the thermal conductivity of the gas, which are negligible for low pressures, but have to be taken into account at the latest at pressures above 10^{-3} mbar.

Dependent on the application of the cryopump the main loads can be very different. This is roughly shown in **Fig. 3** for the case of a typical DN 200 cryopump. Column 1 shows values for a typical sputter-application, the most important application for cryopumps of that size. Dependent on the emissivity of the baffle the thermal load of the 300 K room temperature radiation is 4 - 8 W and therefore, the thermal load is the dominant load on that stage. The sum of all loads will normally not rise above 10 W, so that a cold head with a relatively small cooling capacity at the first stage (around 12 W usually) is required. On the other hand a high cooling capacity of around 5 W is necessary for the second stage, which is mainly due to the high capacity needed for condensation of gases in the high pressure = high throughput phase.

The requirements for a UHV vacuum cryopump of the same HV-flange dimension are completely different. A really "high throughput" of gases never appears, therefore less then 1 W is required for condensation on the

Typical thermal loads on a DN 200 (8")-Cryopump

		Sputter-Process Conditions	Typical Refrig. Capacity	UHV-bakeout Conditions	Suitable Refrig. Capacity
1st stage	$\dot{Q}_1$ (rad)	(300 K → 80 K) 4 – 8 W		(500 K → 80 K) 30 – 60 W	
	$\dot{Q}_1$ (gas)	0 – 4 W		< 1 W	
	$\dot{Q}_1$ (cond)	< 1 W		< 1 W	
	$\dot{Q}_1$	5 – 10 W	12 W	≧ 30 W	30 W
2nd stage	$\dot{Q}_2$ (rad)	0.1 – 0.4 W		1 – 2 W	
	$\dot{Q}_2$ (gas)	≦ 1 W		< 1 W	
	$\dot{Q}_2$ (cond)	~ 4 W		< 1 W	
	$\dot{Q}_2$	5 W	5 W	3 W	3 W

coldhead RGD 510 ——— coldhead RGD 330
operated by 1,8 kW compressor unit RW 2

Fig. 3

second stage. On the other hand the radiation load on the first stage increases enormously, when a chamber is heated to, for example, 150 °C during the bakeout phase. Dependent on the amount of water vapor condensed on the baffle and with this varying emissivity factor a heat load of 30 - 60 W will be present. A small amount of that radiation may even hit the 2nd stage with 1 to 2 W. From this all one can see, that a cold head has to be used whose cooling capacity is more concentrated on the first stage, just in contrast to the sputter application, where it is more important to have a powerful second stage. There is a cold head in our program, which generally meets these requirements for use in a UHV-cryopump; it is called RGD 330.

The demands for the construction of this pump originally came from manufacturers of MBE[1]-plants, who wished to use the cryopump during the bake-out phase of the UHV-chamber as well as for evacuating the chamber to ultimate pressure afterwards, i. e. the cryopump should be the only pump installed to produce the required high and ultra-high vacuum. Particularly, there was the requirement that during the bake-out phase the operation of the cryopump shouldn't be affected by temperatures of about 150 °C[2] at the inlet flange.

The tests we report on in the following have been performed without this limitation, i.e., we looked for optimized bake-out conditions with temperatures at the inlet flange as high as possible. In all our tests we didn't use a gate valve in order to keep the test conditions as simple as possible.

It has been our intention to compare the UHV-pumping method mentioned above with the commonly used methods using cryopumps in combination with turbomolecular pumps or turbomolecular pumps alone.

[1] Molecular beam epitaxy

[2] This is the normal temperature limit resulting from the properties of the elastomer sealings of UHV-gate valves.

Test Equipment (shown in **Fig. 4**)

To be able to carry out different measurements for comparison purposes, a test apparatus was built up as shown in Fig. 4. The RPK 1500 U 3 is mounted directly on a test dome

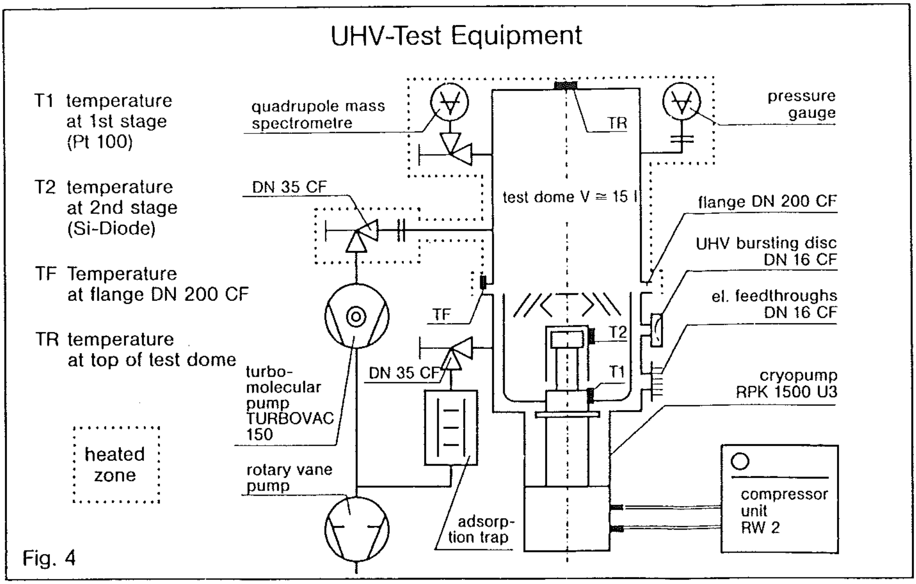


Fig. 4

with a volume of approx. 15 l and approx. 3500 cm^2 inner surface.

The equipment of the chamber includes the following:

- Pressure measuring gauge head for the range 10^{-12} mbar $< p <$ 10^{-5} mbar (extractor measuring system)
- Quadrupole mass spectrometer gauge head with multiplier
- Evacuating ports with a DN 35 CF full metal valve (to permit the optional connection of a small turbomolecular pump TURBOVAC 150 with a pumping speed of S = 150 l/s).

The entire test chamber is completely enclosed in a heating jacket, up to the DN 200 CF high vacuum flange, to permit bake out. The heating temperature is measured by means of Pt 100 resistors placed at the uppermost point of the chamber (- T_R) and at the DN 200 CF flange (- T_F).

At the cryopump, temperature sensors are provided at the two cold head stages:

- T_1 (Pt 100): 1st stage (radiation shield)
- T_2 (Si diode): 2nd stage (cryopanel)

All the flange connections at the cryopump and at the chamber are suitable for ultra-high vacuum operation and are provided with copper seals.

Aside from the thermal behaviour of the cryopump during bake-out of the chamber, the attainable ultimate pressure and the composition of the residual gas were studied in particular, under the following test conditions **(Fig. 5):**

A. The RPK 1500 U 3 was used as the only high-vacuum pump both during bake-out and to produce the ultimate pressure (i. e., the valve to the turbomolecular pump was closed; the turbomolecular pump was not in operation).

B. At bake-out temperatures that were higher than mentioned under "A" above, the cryo-cold head was operating somewhat below ambient temperature only to protect heat-sensitive pump parts. The cryopump itself did not contribute to the production of vacuum. The only high-vacuum pump used during bake-out was the turbomolecular pump connected to the DN 35 CF flange. After bake-out and recooling of the chamber, to ambient temperature the valve to the TMP was closed and the cryopump pumped down toward ultimate pressure. With this commonly used method, the cryopump is yet not loaded with condensate or adsorbate, when it starts pumping.

C. Comparison measurements
Instead of using a cryopump, a turbomolecular pump of comparable capacity (DN 200 CF, S = 1000 l/s) was used as the only high-vacuum pump during bake-out and to produce the ultimate pressure.

UHV-Test-Conditions

	BAKE-OUT PHASE		FINAL PRESSURE PUMPDOWN
	high-vacuum pump	remarks	high-vacuum pump
TEST A	Cryopump RPK 1500 U3	bake-out temperature controlled to avoid rise of 2nd stage temp. T_2 to above 20 K	Cryopump RPK 1500 U3
TEST B	Small turbomolecular pump DN 63 CF	only "countercooling" of cryopump bake-out temperatures higher than in Test A	Cryopump RPK 1500 U3
TEST C	Turbomolecular pump DN 200 CF	bake-out temperatures controlled	Turbomolecular pump DN 200 CF

Fig. 5

Test A: RPK 1500 U3 used as the only HV-pump (during bake-out and for ultimate pressure)

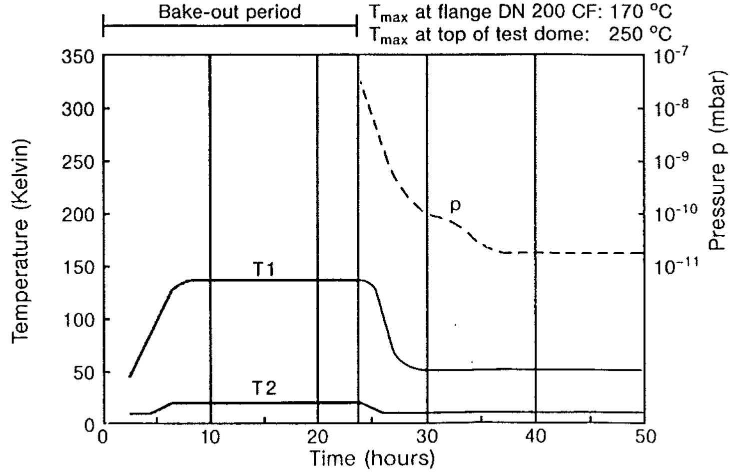


Fig. 6

Results

Test A

The temperature and pressure measurements obtained during this test are summarized in **Fig. 6.** First, the chamber, which was still at ambient temperature, was evacuated with the rotary vane pump down to a pressure of approx. $p = 1 \times 10^{-2}$ mbar. The cryopump was then switched on and a waiting period followed to permit the cryopump to reach its normal operating final temperature. During this time, the pump already evacuated the chamber down to a pressure of about 10^{-6} mbar. Subsequently, the chamber was baked out for a period of 24 hours. Because of the headt that was radiated from the chamber into the cryopump, the temperature at both cold head stages increased, particularly the temperature of the shielding 1st stage (T_1). Since the temperature of the 2nd stage must not rise above 20 K while the pump is in operation, the switching contact of the corresponding temperature measuring instrument (LEYBOLD LTI 10) was used to interrupt the supply voltage of the chamber heating whenever the temperature T_2 of the 2nd stage approached this value. Thus the bake-out temperatures T_R and T_F were automatically maintained at the highest possible level but preventing T_2 from reaching inadmissible values above 20 K. In equilibrium, a temperature T_F = 170 °C was measured at the pump flange; at the upper end of the chamber, the temperature T_R actually reached a value of 250 °C.

After the bake-out process, the operating temperatures T_1 and T_2 of the cryopump decreased again down to final temperature while the chamber cooled down to ambient temperature and the cryopump then evacuated the chamber down to the ultimate pressure of $p = 2 \times 10^{-11}$ mbar.

Fig. 7 shows the residual gas spectrum taken at this ultimate pressure. It merely shows a small trace of hydrogen at mass 2; other components, particularly water vapor and hydrocarbons could not be detected neither in the range shown nor at masses over 40.

Test B **(Fig. 8)**

After pumping down the chamber with the rotary vane pump and the turbomolecular pump, the chamber was baked out at the maximum possible temperature. At the same time, it continued to be evacuated by the turbomolecular pump. T_R = 300 °C was attained at the top of the test dome and T_F = 200 °C at the DN 200 CF flange. The heat radiating into the cryopump was so high that in spite of

Test A: RPK 1500 U3 used as the only HV-pump
(during bake-out and for ultimate pressure)

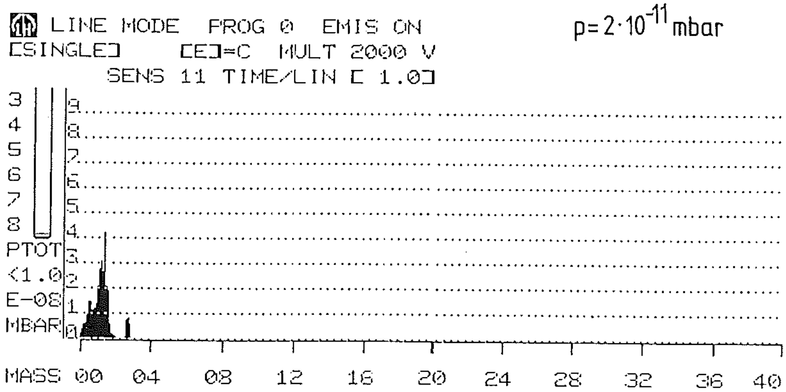


Fig. 7

continuous operation by the cold head, a temperature of $T_1 = 280$ K was measured at the 1st stage; the 2nd stage showed a temperature of $T_2 = 190$ K. These temperatures are considerably higher than the low operating temperatures required by a cryopump to pump off permanent gases.

After the bake-out process, the cryopump reached operating temperature, i. e. T_2 lower than 20 K after 5 hours; then the valve to the turbomolecular pump was closed and the cryopump pumped down to ultimate pressure. At a value of $p = 8 \times 10^{-11}$ mbar the same ultimate pressure as in Test A was not quite reached. The residual gas spectrum **(Fig. 9)** was taken at the same sensitivity as in Test A. It shows a clearly higher hydrogen peak and small but still detectable traces of hydrocarbons, particularly in the range at masses from 38 to 48.

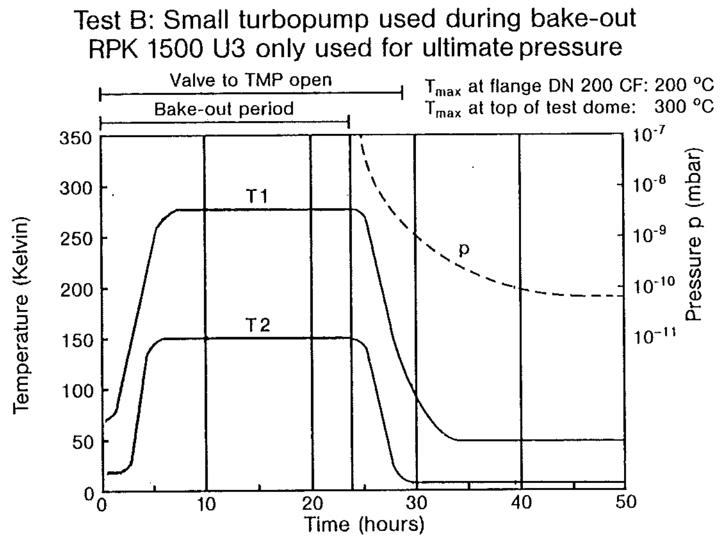


Fig. 8

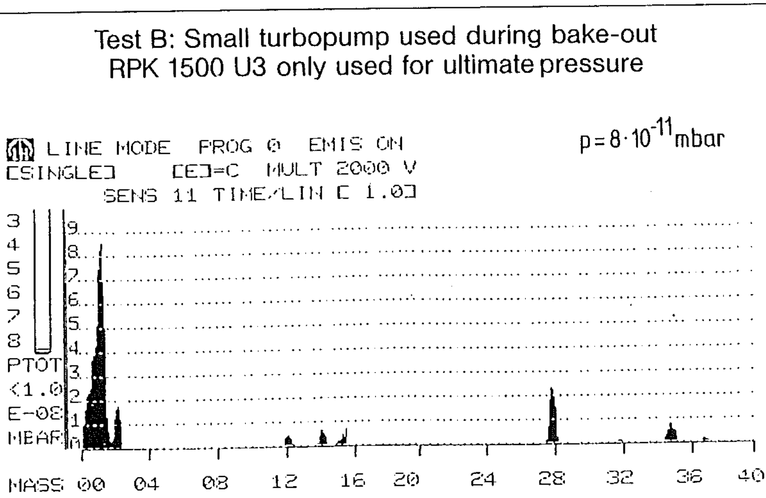


Fig. 9

Test C **(Fig. 10)**

In this test, the RPK 1500 U 3 was replaced by a correspondingly large (DN 200 CF) turbomolecular pump type LEYBOLD TURBOVAC 1000, which is an oil-lubricated pump. This turbomolecular pump had already been in operation previously for long periods of time, but it was specially cleaned for the Ultra-high vacuum test. The backing pump used was a rotary vane pump with a pumping speed of $S = 16\ m^3/h$. The bake-out process, during which the TURBOVAC 1000 evacuated the chamber, lasted again 24 hours and was carried out at the maximum temperature the pump could tolerate (T_R = 280 °C). After bake-out and after a further 24 hour pumping period, an ultimate pressure of $p = 2 \times 10^{-9}$ mbar was reached. The residual gas spectrum shows a structure similar to the one obtained in Test B; i. e. a clear hydrogen peak, small traces of hydrocarbons and an additional amount of water vapor.

Discussion

The lowest pressure with the cleanest residual gas spectra was attained by the cryopump on its own (test A). This result is surprising, as higher bake-out temperatures were reached with turbo pump plus cryopump in test B.
Two explanations are on hand:

1) Due to the low conductance (DN 35) to the TMP during the bake-out, the released gases have not effectively been pumped out of the recipient.
2) The released water was able to block the activated charcoal panels (190 K cold during bake-out).

This could be an explanation for the higher H_2-share in the residual gas spectrum. In order to reduce this effect, the temperature of the cold surface should be adjust to 300 K during the bake-out by an adjustable heating.

The ultimate pressure which was attained during the same time with the turbo pump of the same flange nominal-width was one power of ten higher; this is mainly caused by the lower effective pumping speed, especially for hydrogen and water.

Summary

Cryopumps are eminently suitable for producing ultimate pressures lower than 10^{-10} mbar.

The lowest ultimate pressure as well as the best UHV-conditions have been obtained when the cryopump alone was used during the bake-out phase and for evacuating the UHV-chamber to ultimate pressure. To be able to perform this pumping method the cryopump must be fitted with a cold head which has a high cooling capacity at the first stage. The LEYBOLD RPK 1500 U3 meets this requirement and insures that the user can reap the benefits of this UHV-pumping method.

Test C: Turbomolecular pump used as the only HV-pump (during bake-out and for ultimate pressure)

Turbomolecular pump:	TURBOVAC 1000, DN 200 CF oil-lubricated previously already operated for longer period specially cleaned for this test
bake-out period:	24 h
max. bake-out temperatures:	T_R = 280 °C T_F = 100 °C
ultimate pressure:	$2 \cdot 10^{-9}$ mbar
residual gas spectrum:	Hydrogen (higher than in Test A) Water Traces of M = 28; 44

Fig. 10

Pressinformation

Crysis Technology AB i Lund, har nyligen skrivit kontrakt med Huntington Mechanical Laboratories Inc. USA som innebär att Crysis Technology AB i fortsättningen ansvarar för försäljning, distribution och service av Huntingtons hela produktsortiment i Norden.

I detta ingår positioneringsutrustningar, genomföringar, motorer, bälgar, ventiler och standardkomponenter för hög- och ultrahög-vakuumteknologi.

Crysis Technology AB har sedan tidigare också liknande kontrakt med Tylan General Inc, DCA-Instruments Oy, Alcoa Corporation, SAES Getters SpA and Advanced Vacuum Technology Inc.

Crysis Technology AB, Forskarbyn Ideon, 223 70 Lund.
Tel: 046-182300, Fax: 046-168975, Telex 33709 IDEON S.

PRESSRELEASE

Thermionics Laboratory Inc

Fr o m oktober 1990 representerar Nordiska Balzers AB Thermionics i Sverige, Norge, Danmark och Finland.

Thermionics har bl a följande produkter:

- Jonpumpar
- Manipulatorer
- Differentialpumpade, roterande tätningar
- Gate-ventiler

Polycold Systems Inc

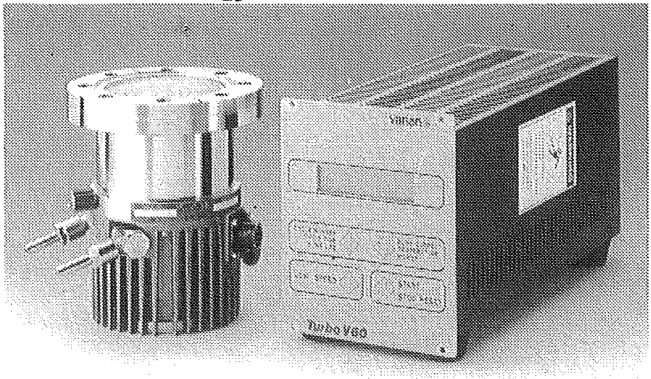
Fr o m november 1990 representerar Nordiska Balzers AB Polycold i Norden.

Polycold har alla storlekar av slutna system för nedkylning till -500°C för nedpumpning av vakuumkammare och för att hindra back-streaming från diffpumpar. Polycold-systemen har mycket lägre driftskostnader än motsvarande LN_2-system och är mindre arbetskrävande. En återbetalning på 1 år är ej ovanligt.

För ytterligare information - kontakta något av våra försäljningskontor.

NORDISKA BALZERS AB

news release



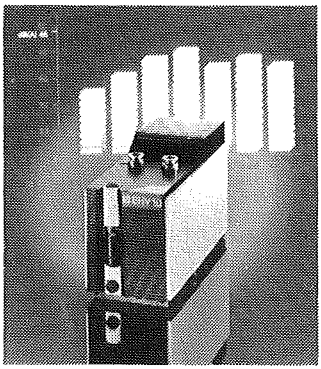
NY 60 L/s TURBO från VARIAN

Varians nya TURBO-V60 har väckt ett stort intresse. Med en ny design, patenterad rotor och stator och keramiska kullager har många fördelar kunnat tillföras denna pump.

* Ett lågt bastryck, 8x10E-10 Torr
* En lätt rotor, tillverkad i ett enda stycke, ger stor driftsäkerhet och en extremt låg vibrationsnivå.
* Keramiska kullager ger lång livslängd utan att något underhåll är nödvändigt.
* Det är den minsta pumpen i sin pumpkapacitetsklass.
* Montering kan ske i alla riktningar och i många applikationer behövs ingen kylning.
* Det nya kraftaggregatet tar liten plats (1/4 rack), är mycket enkelt att använda, och ger en överskådlig bild av pumpens status.

För mera information om Varians Turbo-V60 kontakta:
VSW Scientific Instruments Svenska AB, 013-140174

PRESSRELEASE



LEYBOLD lanserar
ny kompakt förvakuumpump med ytterst låg ljudvolym och med sor sugkapacitet.
Den nya förvakuumpumpen finns i två storlekar: 5 och 10 m^3/h.
TRIVAC D5BHV och D10BHV är en tvåstegs oljetätad lamellpump.
Pumpen är speciellt framtagen för rena gaser, där den arbetar mot slutvakuum.
Tänkta arbetsområden är olika applikationer vid institut och universitetslaboratorier, vid lamp- och rörtillverkning, i mass-spektrometersystem samt i elektronmikroskop och högvakuumpumpstånd.

Västra Frölunda i oktober. Leybold AB. Kontakta Christer Begtsson.

Press release for immediate publication

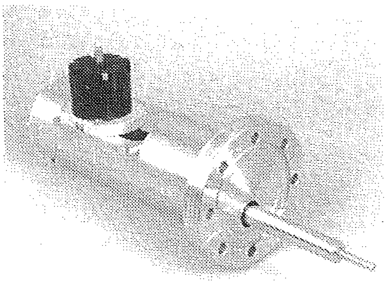
DATAQUAD STILL GOING STRONG

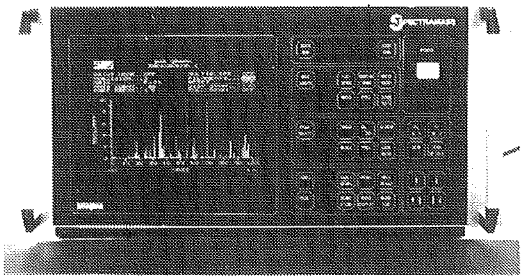
Spectramass Ltd, the UK based specialist gas analysis company, have recently announced record sales of their well established DATAQUAD RGA (residual gas analyser).

When first introduced in the early 80's, the DATAQUAD, with its built in VDU, membrane panels and on-board microprocessor, was certainly innovative and could claim to have set the trend towards more sophisticated residual gas analysis.

The current DATAQUAD model, designed for the more demanding needs of the 90's technology, still represents excellent value for money including as standard such features as 3-decade log scans, split screen display, background store and subtract, automatic library search, leak detection, alarm outputs, printer port and an RS232 interface for data logging and full remote control.

For more information on Spectramass's evergreen DATAQUAD contact the local distributor, VSW Scientific Instruments Svenska AB 013-140174. Your contact is Peter Nydahl.





VSW introduces

THIN FILM SYSTEMS AND COMPONENTS

VSW Technology Ltd manufactures a range of systems for thin film growth including MBE, evaporation and sputter deposition, in both UHV and high vacuum environments. All systems incorporate multisample cassette loading facilities for high throughput.

The unique thin film components have been designed to fulfill the most advanced requirements of those involved in MBE and thin film deposition. Main components are the Wafer heating and rotation stage and the Smart motion evaporation shutter.

VSW Technology Ltd have a wide range of products like thin film and MBE components and systems, atomic hydrogen sources, pulsed fast atom bombardment source and a range of mechanical vacuum components.

For further information contact the local distributor, VSW Scientific Instruments Svenska AB, 013-140174. Your contact is Peter Nydahl.

PRESS RELEASE

The Abar Group U.S.A. to Establish World Class Centers for Engineering Excellence in Thermal Processing

Feasterville, PA. -- The Abar Group U.S.A., consisting of Centorr Furnaces, Vacuum Industries, and Abar Ipsen Industries has just announced its plans to establish world class engineering centers for thermal processing excellence, by mid fall. This restructuring will include combining Centorr and Vacuum Industries engineering resources and redefining the role of Abar Ipsen engineering.

Movement toward a center for engineering excellence is a logical evolution for The Abar Group. It will enable the group to fully leverage the technological synergy between Centorrs high-temperature high-vacuum expertise and Vacuum Industries ability to brigade the gap between laboratory and batch production for leading edge technology. Abar Ipsen Industries´ability to convert new thermal processing technologies into full-scale production systems completes the product development life cycle for the group. The identity of the Centorr, Vacuum Industries, and Abar Ipsen product lines will be maintained within the centers. The mission of the centers will be to establish customer paretnerships to anticipate needs and provide solutions to meet the world´s dynamic thermal processing challenges. The engineering center will be fully equipped with the latest in automated CAD/CAM engineering equipment. Additionally, Abar Group engineering and client computers can be linked for interactive technology exchange.

Furthermore, the single manufacturing facility will house three separate manufacturing operations: small, high temperature, high vacuum units; large vacuum systems, and atmosphere systems. Just-In-Time and Total Quality Programs will make it the most avanced furnace system manufacturing center in the world.

"The objective of the market focused engineering centers is to strengthen the link between customers and the very extensive engineering resources of the group", said George Scherff, president of the Abar Group. "This will result in greater product innovation and quality, as well as shorter product and process development cycles", Mr Scherff added.

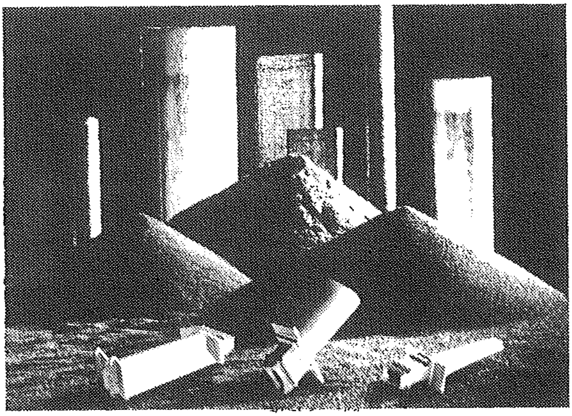
Contact Ms. Debbie Hewitt / The Abar Group U.S.A. 905 Pennsylvania Blvd./ Feasterville, PA 19047 / (215) 355-4900, ext 369.

NEWS from Vacuum Industries, INC.

Vacuum Industries Awarded Patent for High Pressure Furnace with Convection-Free Hot Zone

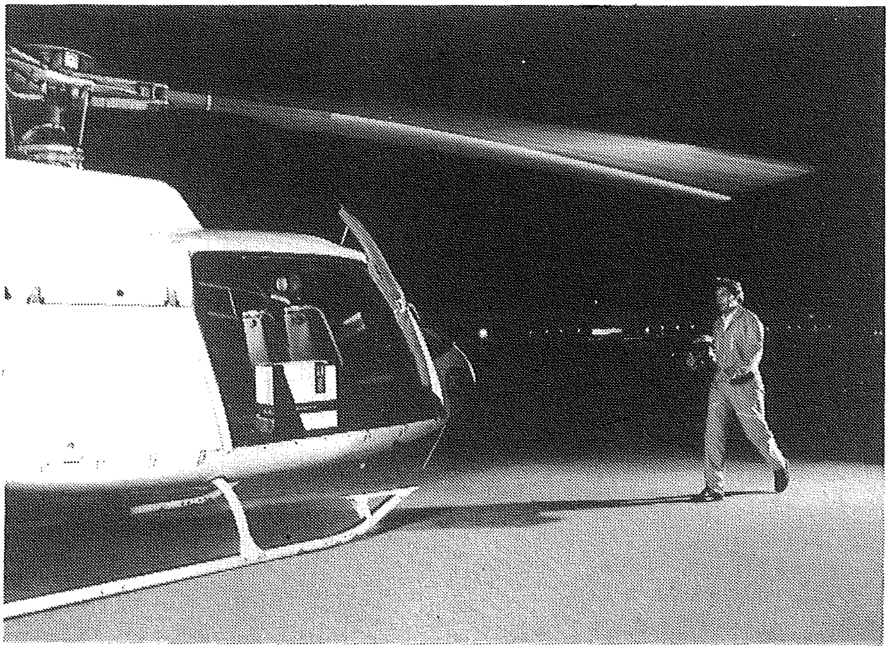
A patent has been issued to Vacuum Industries Inc, for its design of a convection-free hot zone for high pressure furnaces. The new design eliminates convection currents between the inside and outside of the hot zone, allowing for better temperature uniformity, a longer zone life and higher efficiency.

For more information on Vacuum Industries'high permormance furnaces and process development services, call or write to Vacuum Industries, 5 Middlesex Ave., Sommerville, Mass., 02145. Tel. 617-666-5450. FAX 617-776-8605.



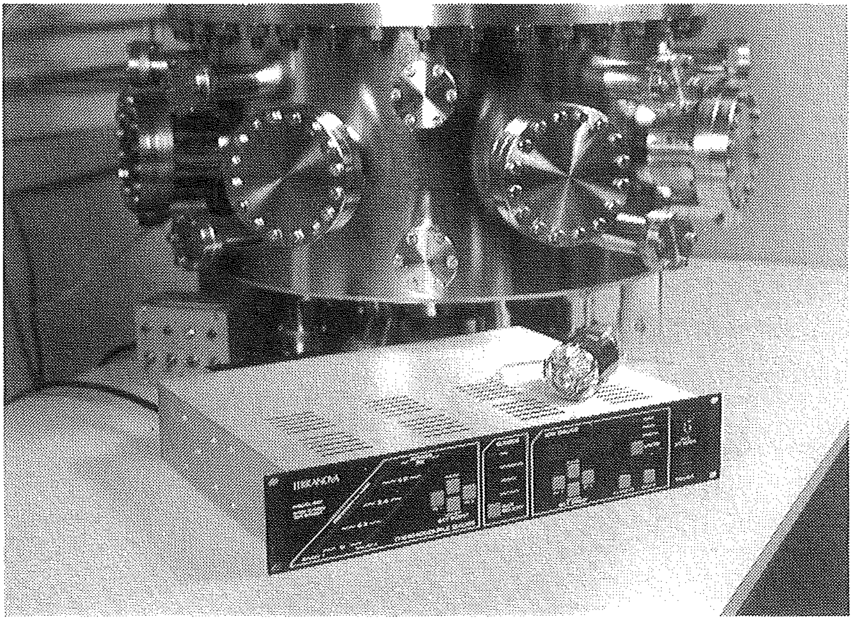
HIGH-VALUE AND COSTLY: The raw materials and end products of modern metallurgy are capable of meeting the most stringent demands. Their physical properties (such as their resistances to high termperatures, their strengths, their hardnesses, their wearing behaviors, and their densities) can even be "tailored" to meet requirements. Such efforts have their price, but can result in innovative advances. The entire market for "new materials" (including advanced types of plastics, engineering ceramics, and composite materials) reached $ 8.4 billion just four years ago, but is expected to grow to reach more than $ 25 billion by 1995. Almost half (48%) of this fell to the electronics industry, while 17% went for industrial applications, and 16% was accounted for by the aerospace industry. The latter's market share is predicted to increase to 27% due to general market growth, while that of the electronics industry will decline (to 34%). Vacuum metallurgy accounts for a major portion of the field of metallurgy. Leybold AG, Hanau, FRG, the leader in vacuum metallurgy, covers the full spectrum of metallurgical research and processing technologies. From twelve basic processing methods arise numerous processing variations that can be applied to meeting the needs of the world of high-technology for high added-value products.

FREEDOM OF MOVEMENT IS EVERYTHING. Mobility can promote environmental protection. Rapid location of gas leaks is one example of this. This why, e.g. specialists carrying leak detectors are flown in helicopters to the remotest drilling platforms. Leaks can occur in virtually all gas storage and gas transport systems, including processing systems, tanks, and pipelines. Gas leakage is a problem in all branches of industry and in all fields of engineering. What are the consequences? Just to mention one example, 20% of all emissions of fluorohydrocarbons (FHC) (totalling about 100.000 tons annually) entering the atmosphere come from leaks. These leaks thus make about a 20-% contribution to artificially produced climatic changes and other atmospheric effects. These losses not only have wide-ranging impacts on our environment, they also affect the efficiency of industrial processes and processing and the quality of industrial products. The key to preventing leaks is their prompt detection. Compact, portable, leak detectors are needed for on-site checking of all potential sources of leaks. One such instrument, the ULTRATEST [R] UL 100 PLUS, has been developed by Leybold AG, of Cologne, FRG. It not only speeds up leak detection a more efficient operation, it also makes a contribution to environmental protection.



Model 904
Wide Range Vacuum Gauge Controller

Ionization Gauge Controller
Covers 10^{-10} to 1 torr



TERRANOVA SCIENTIFIC, USA:

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* Modell 904-UHV - mäter $2*10^{-11}$ till 10 torr (12 dekader) med konventionellt UHV-mätrör!

* Kan ersätta kapacitansmanometer i många fall

* Modell 914 - Digital termokorskontroll som ger linjär respons upp till atmosfär med standardrör

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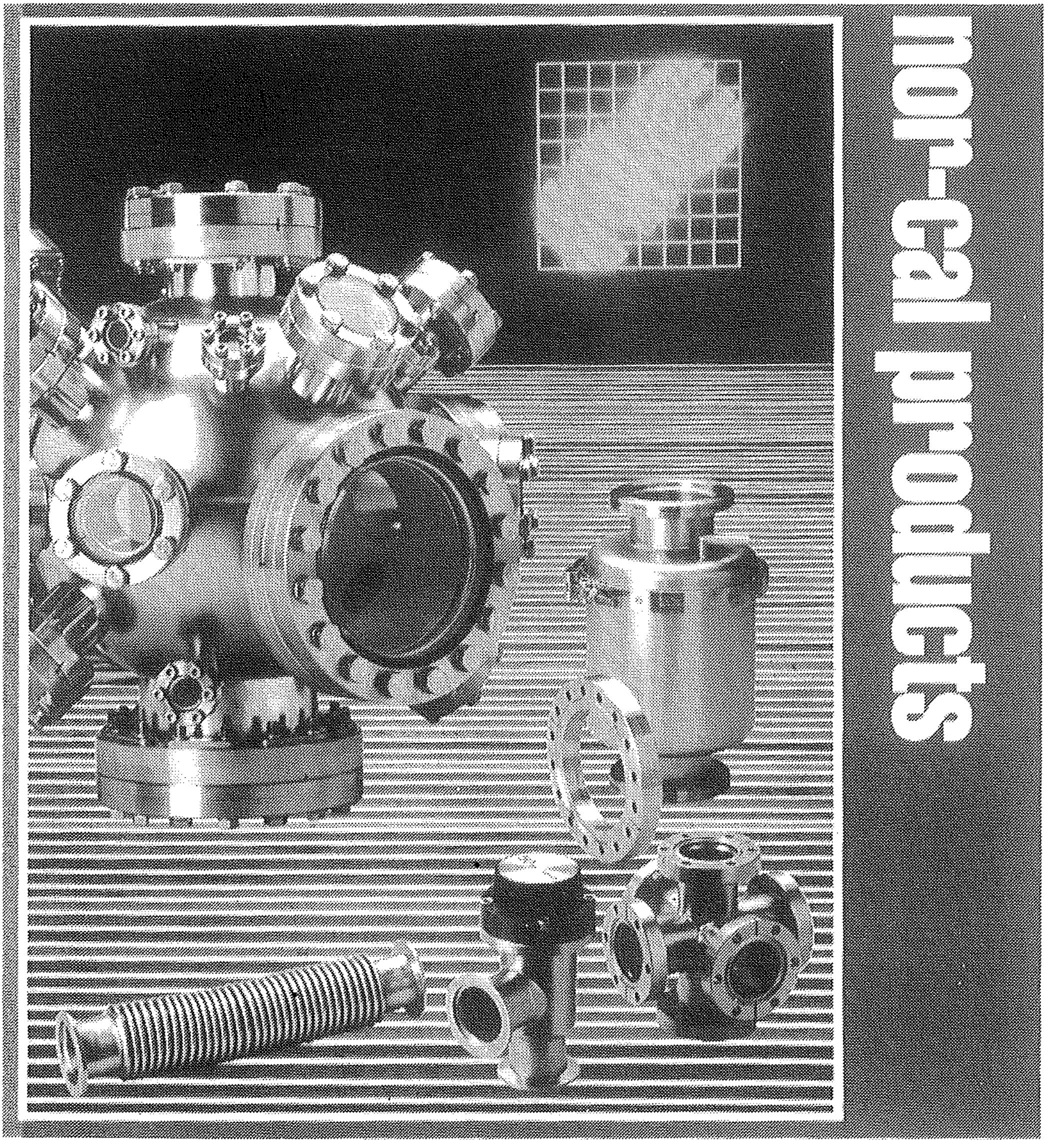

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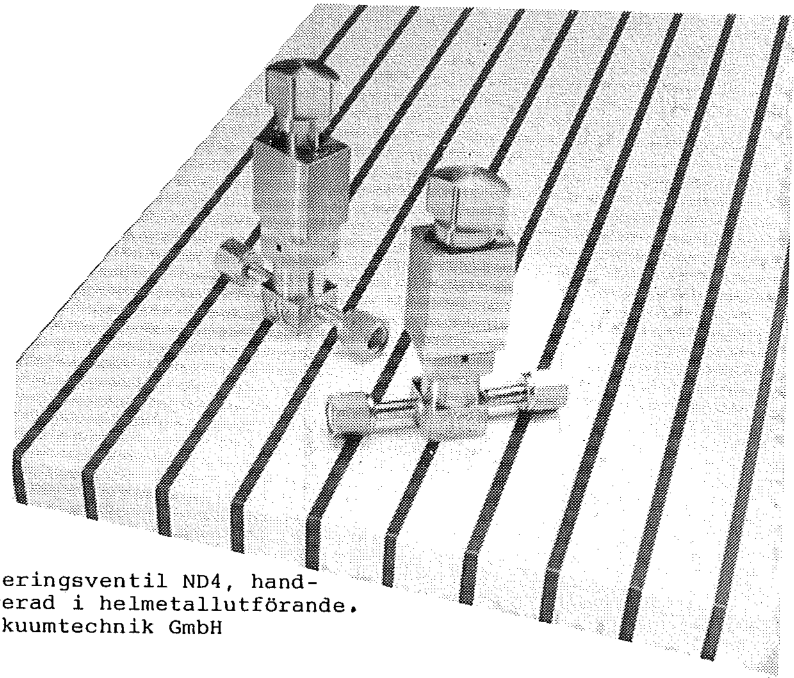

Gasdoseringsventil ND4, handmanövrerad i helmetallutförande.
vse Vakuumtechnik GmbH

Vi marknadsför bl.a.:

- Ventiler för vakuum och övertryck, CF-flänsar, ISO-flänsar, tätningar, vakuumkammare och andra vakuumtillbehör från vse Vakuumtechnik GmbH.

- Optiska filter, speglar och andra optiska komponenter från Filtrop AG.

Ni är alltid välkomna att ta kontakt med oss och diskutera Era tekniska problem och Ert behov av ovan angivna produkter.

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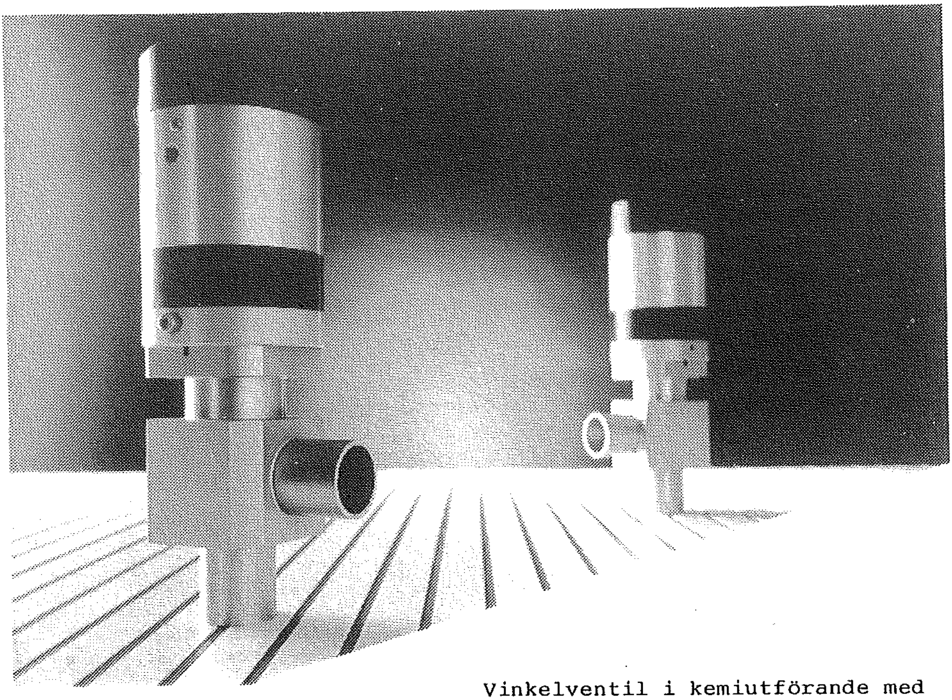

Vinkelventil i kemiutförande med plastomere-tätning (teflon-nickel) på ventiltallriken.
vse Vakuumtechnik GmbH

Vi marknadsför bl.a.:

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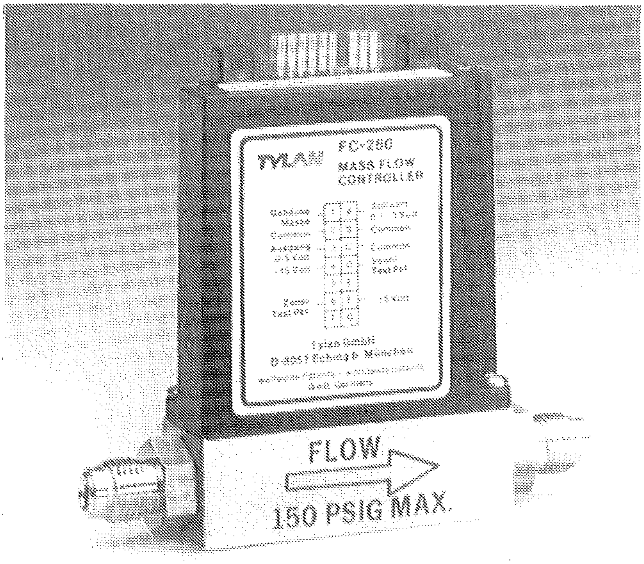
Massflödesreglering, gasrening med getter och keramik -våra andra specialområden



Vi har rättat vårt gashanteringsprogram efter de krav som finns inom halvledareindustrin och tunnfilmsforskningen. Efter högtrycksregulatorn klarar vi det mesta - mätning, reglering, filtrering, gettring, snabbdosering och spolning.

crysis technology ab

Forskarbyn Ideon, 223 70 Lund. Tel: 046-182300, Fax: 046-168975


The all new ceramic bearing turbomolecular pump

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FONDATION WELCH / BOURSE
WELCH FOUNDATION / SCHOLARSHIP
WELCH-STIFTUNG / STIPENDIUM

Administrator:
Dr. W.D. Westwood
Advanced Technology Laboratory
BNR
Box 3511, Station C
Ottawa, Canada K1Y 4H7
Telephone: (613) 763-3248
Fax: (613) 763-2404

WELCH FOUNDATION SCHOLARSHIP 1992

Announcement

A scholarship is offered to a promising scholar who wishes to contribute to the study of vacuum science techniques or their application in any field.

Conditions of the scholarship

This scholarship is offered for a one-year period starting September 1, 1991. If for some reason, the candidate cannot begin his work as scheduled, he can begin within three months after September 1, 1991. In the case of a delay of more than three months, another candidate will be chosen. The laboratory where the candidate wishes to work must approve any delay in the commencement of work.

The scholarship holder is encouraged to seek funds in addition to the scholarship but should obtain the authorization of the Chairman of the Welch Committee of the IUVSTA before accepting any additional funds. Traditionally, this authorization has been granted.

The amount of the Scholarship will be approximately $12,500 US.

The scholarship money is paid in three installments — one of $6,000 at the beginning, another of $6,000 six months after he/she has started work and a third of $500 upon delivery of a final report after completion of work. A brief mid-term report is required before payment of the second installment.

Applicants are asked to make arrangements for the proposed research program with a laboratory of their choice. Because of the international nature of the scholarship, strong preference will be given to applicants who propose to study in a foreign lab in which they have not yet studied. A form outlining the research program and signed by the supervisor in the laboratory where the research is to be carried out must be submitted with the application to indicate the agreement of the laboratory and the proposed supervisor to your studies.

Candidates for the scholarship should have at least a Bachelor's degree; a Doctor's degree is preferred.

Application procedure

Candidates can obtain the necessary forms for the scholarship from the IUVSTA Welch Foundation Administrative Office:

Dr. W.D. Westwood
Advanced Technology Laboratory
BNR
Box 3511, Station C
Ottawa, Canada K1Y 4H7

Candidates for the Welch Scholarship are invited to send their applications to the above-noted address **before** 15 April 1991.

Each candidate's application should include the following:

- A curriculum vitae.
- A photocopy of, or attestation of, all diplomas.
- Name and address of laboratory chosen; a 200-word abstract describing the research he/she proposes to perform; and a letter indicating that the facilities of the host laboratory will be available.
- A declaration that the candidate will not violate any laws of his own country during his/her tenure of scholarship.
- A declaration that the candidate will not violate any laws or engage in any political activity in the country where he/she intends working.
- Two recommendations from present or past professors, or research directors.

Candidates will be informed of the results of their applications as soon as possible but probably before the beginning of August 1991.

The successful candidate must produce satisfactory evidence (preferably in the form of examination certificates, etc.) of reasonable fluency either in the language of the country where he/she will work during the tenure of his/her scholarship **or** in English.

Note:

Researchers who applied unsuccessfully for previous Welch Scholarships may apply again for the 1992 grant.

Applications for renewal of the Scholarship are not accepted.

AKTUELLA KURSER OCH KONFERENSER

1991 **22 januari. Linköping.** Svenska Vakuumsällskapet arrangerar kurs i **Grundläggande Vakuumteknologi.**
23 januari. Linköping. Svenska Vakuumsällskapet arrangerar temadag om **Materialanalys mha Elektronmikroskopi.** Se sid. 8-9 denna tidning.

29/1-1/2. Long Beach, CA, USA. PCSI-18 (Eighteenth Annual Conf.on Physics & Chemistry of Semiconductor Interfaces). Inf. från R.W.Grant, Rockwell Int. Science Center, P.O.Box 1085, Thousand Oaks, CA 91358, USA.

11-15/3. The Hague, The Netherlands. The Int.Congress on **Optical Science and Engineering.** Inf. från Europtica-Services I.C. 16, avenue Bugeaud, 75116 Paris, France. Tel. (33.1) 45.53.26.67.

17-22/3. Philadelphia. Society of Vacuum Coaters 34th Annual Technical Conference.

8-12/4. Castelvecchio - Pisa. Italy. Kurser i **VLSI Lithography, Plasma Etching for VLSI, Cemical Vapour Deposition for VLSI, CMOS/BiCMOS Process Integration and Engineering, MOS DEvices for Advanced VLSI.** Inf.från CEI-Europe/Elsevier. Box 910, 612 25 Finspång. Tel. 0122-17570.

21-24/4. Tampere, Finland. 6th Europ. Conf. on **Molecular Beam Epitaxy and Related Growth Methods.** Inf. från Marcus Pessa, Tampere Univ. of Technology, P.O.Box 527, SF-33101 Tampere, Finland. Tel. 358 31-162548.

22-26/4. San Diego, CA, USA. ICMCTF 1991.
(Int. conf. on Metallurgical Coatings and Thin Films). General Chairman Bruce D.Sartwell, Naval Research Lab.,Code 4675, Washington D.C. 20375, USA. Tel. 202-767-4800. FAX (202) 767-5301.

21-24/5. Brussels. IPAT 91 (8th Int.Conf. on Ion & Plasma AssistedTechn.) Inf. från IPAT Secretariat, CEP Consultants Ltd, 26-28 Albany Street, Edinburgh EH1 3QH, UK. Tel. 031-557 2478. FAX 031-557 5749.

21-26/7. San Diego, CA, USA. SPIE´s Int.Symp. on **Optical Applied Science and Eng** Inf. SPIE, Lennéstrasse 55, D-5300 Bonn 1. Tel.49-228-219062.

30/7 - 2/8. VACUUM 1991. Salford, UK. Inf. från The Meetings Office, Institute of Physics, 47 Belgrave Square, London SW1X 8QX, U.K.

2-6/9. London. 10th Symp. on **Ptotoelectronic Image Devices.** Inf. från B.L.Morgan, The Blackett Lab.,Imperial College, Prince Consort Road, London SW7 2BZ, UK. Tel. 01-589 5111 ext.6609. FAX 01-589 9463.

9-12/9. Stockholm - Uppsala. ECOSS - 12. (12th Int. Conf. on SurfaceScien-ce) Inf. från Nils Mårtensson, Fysikum, Box 530, 751 21 Uppsala 018-183620.

23-27/9. Wien, Austria. EVC-3. (3rd Europ.Vacuum Conf.) Inf. från Wolfgang Husinsky, Inst für Allgemeine Physik, Techn. Univ.Wien, Wiedner Hauptstraße 8-10, A-1040 Wien. Tel. (43)(1)-58801-5591. FAX (43)(1)-564203

30/9-4/10. Darmstadt, FRG. Int.Conf. on **Ion Sources.** (AVS topical conf.) Inf. från Ian Brown, Barnes Berkeley Lab., Blgd. 53, Berkeley, CA 94720, USA. Tel. (415) 486-4174.

11-15/11. Seattle, WA, USA. 38th National Symp. of the AVS. Inf. från Marion Churchill, AVS, 335 East 45th Street, New York, NY 10017. Tel. (212) 661-9404.

1992 **12-16/10. The Hague, Netherlands. 12th Int. Vacuum Congress, 8th Int. Conf. on Solid Surfaces.** In. från Anthony J. van Oostrom, Phillips Research Lab., POBox 80000, 5600 J.E. Eindhoven, The Netherlands. Tel.31-40-742853.

PRESS RELEASE - TILLQUIST ANALYS AB, Vakuumprodukter

Nya klamrar för vakuumkopplingar har introducerats av
EDWARDS HIGH VACUUM.

Klamrarna är tillverkade av slagtålig polymer och är billigare än sina föregångare i aluminium.

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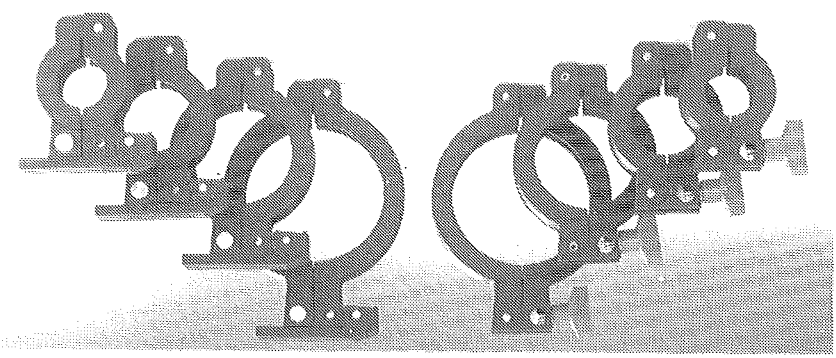
Ring Jan Josefsson på tel 08 - 750 05 00.



VAKUUM NYTT är ett medlemsorgan för SVENSKA VAKUUMSÄLLSKAPET

Adresser till styrelsefunktionärer:

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Vice ordförande.	**Sten Norrman** Inst f Fasta Tillståndets Elektronik, CTH 412 96 Göteborg Tel. 031-721867
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Skattmästare.	**Leif Thånell** MAX-lab, Box 118, 221 00 Lund Tel. 046-107691
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Ledamöter	**Roland Jacobsson** Spectrogon AB, Box 2976 183 02 Täby Tel. 08-7680980
	Ulf Karlsson MAX-lab, Box 118, 221 00 Lund Tel. 046-107364
	Lars Westerberg The Svedberg Laboratoriet, Box 533 751 21 Uppsala Tel. 018-183060