Dr Clive H Burton
112 Bahama Reef
Novato, CA 94949
Tel: 415 884 2322
Fax: 415 884 0309
clive.burton@comcast.net

Resumé and Publications List: Clive H Burton (PhD)

Relevant Capabilities

For the past eighteen years I have been involved, both personally and as Research Manager, in engineering research and development for two large international companies. Prior to that I was involved as a scientist and Research Manager in a large quasi-government R&D organization (CSIRO). All my recent work has been directed towards production and marketing support directed towards improvement in the efficiency of R&D and of the bottom line of the company in each case.

I have:-

- excellent written and verbal communication skills and ability to interact effectively, both personally and professionally, with people at all levels within and external to a corporation especially with technically knowledgeable and demanding customers
- a wide yet deep knowledge of a large variety of engineering processes and the methods of the development and improvement
- a good knowledge of intellectual property matters and a high level ability to write, patent applications, interpret and compare patent claims and relate them to complex products, machines or processes.

Experience

September 2008 – present

- Consulting for a number of technology companies – one a major player in the magnetron sputter coating of float glass.
- Design and prototype a consumer appliance involving electrics, glass, 3D printed ABS plastic parts, metal parts and modeling with SolidWorks 3D CAD application

June 2005 – August 2008 AFG/AGC (Asahi Glass Company) R&D Group Petaluma, CA
Senior Research Scientist

.

- Designing and reverse engineering complex multi-layer Low-e optical thin film coating stacks for large scale production. Innovation and implementation of novel and powerful means of design and analysis of complex multilayer optical thin film stacks.
- Development of sophisticated control systems for large scale magnetron sputter coating of float glass
- Critical and strategic assessment of a large number of sputter patents relevant to AGC.
- Designing and implementing various instruments for characterizing architectural Low-e coatings. Applying very sophisticated neural image recognition systems to industrial problems.
- Note: AGC Closed their Petaluma R&D facility in August 2008

February 2003 – June 2005

- Consulting for a number of technology companies
- Marketing ion beam and electron beam systems for three companies

November 2002 – February 2003

- **Acting as Trade Secret Inspector for Deposition Sciences Inc., Santa Rosa, CA** in a matter related to magnetron sputter deposition of optical thin films for telecommunications and US government purposes

1997 – December 2002 SOLA Optical USA R&D , Petaluma, CA

Principal Research Scientist/Internal Consultant

- Developed significantly improved processes for reactive magnetron sputter deposition of optical thin films by innovative patentable techniques. These techniques involved statistical and fuzzy-logic process control and yielded production cost reductions worth $3M per year for two machines in full production.
- Contributed to the solution of long-standing problems in bonding Matrix^{TM} ophthalmic lens wafers and generated a number of other ideas for new products and processes
- Transferred two production e-beam AR coaters to a SOLA plant in Guang Zhou, China. Tutored and assisted novice staff in Guang Zhou to enable production. Prepared training videos and manuals.
- Assisted SOLA Technologies, Kentucky when they experienced difficulties with the innovation of a new and company-critical "Teflon" AR coating system.
- Note: SOLA Optical USA closed their Petaluma R&D facility in early 2002 – I was "the last man standing" up until December 2002

March - April 1997 Acted as an Expert Witness in a dispute between Applied Vision, Ltd, UK and Optical Coating Laboratories Inc. (OCLI), Santa Rosa, CA, in a matter related to magnetron sputter deposition of optical thin films

1988 - 1997 SOLA International Holdings R&D, Adelaide, South. Australia.

Research Manager/Chief Scientist

- Led the Physical Technology and Strategic Quality Group of about 30 scientists and engineers engaged in optical thin films, vacuum deposition technology, strategic quality, measurement science and ophthalmic lens design for a $500M multinational company
- The Physical Technology Group I led developed new, high-value-added products which contributed about $20M per year (over 40%) of the profit of SOLA worldwide
- Pivotally involved in achievement of six highly esteemed Optical Laboratory Association (USA) awards for lens design and new materials innovation
- Effective project manager for the innovation of SOLA's novel and challenging UV-cured Spectralite^{TM} stock lens production process
- Very significantly improved several of SOLA's traditional processes including lens design, cast lens production, glass mold production and associated measurement technologies.

1983 - 1987 Commonwealth Scientific Industrial Research Organization (CSIRO), Division of Applied Physics/National Standards Laboratory, Sydney, Australia

Research Manager, Principal Research Scientist

- Led and managed seven groups (about 77 people) of the largest and most prestigious physics, optics, standards and engineering research laboratory in the Australian equivalent of NIST with a more applied physics flavor.
- Groups included: Optics and Thin Films, Radiometry and Photometry, Optical Fabrication (super precise surfaces), Vibration, Length Standards (lasers and interferometry), and Engineering Metrology
- Principal Australian Scientist on a joint ESA/NASA space project which successfully developed a state-of-the-art lithium niobate, electro-optic, tunable, imaging helio-spectrometer suitable for space deployment
- Invented a far infrared and millimeter-wave, interferometric, polarizing spectro-radiometer which has become the instrument of choice for broad band spectroscopy in the relevant three decades of the electromagnetic spectrum (wavelengths 10 micron to 10 millimeter)
- Rationalized national standards calibration procedures and implemented cost reduction and recovery measures for those services
- Implemented cost reductions of approximately AUD1M per year in ongoing utility costs for the Division of Applied Physics principally by rationalizing electricity, gas and communication services

Education	Postdoctoral Research Fellow	- Queen Mary College, University of London
	Doctor of Philosophy (physics)	- University of Queensland, Australia
	B.Sc. honors physics - first class	- University of Queensland, Australia

Immigration Status

American citizen

INS approved for "green card" as "Outstanding Researcher" July 2001

Previous Professional Affiliations

Member, American Vacuum Society, Member, Society of Vacuum Coaters

Member, Optical Society of America,

Member, Society of Professional Institution of Engineers, Optics (SPIE USA)

Fellow, Australian Institute of Physics, Foundation Member, Australian Optical Society

Technical Capabilities

Vacuum technology, design and evaporative or magnetron sputter deposition of optical coatings

Tests and measurements of optical coatings including color, spectral and durability properties

Materials science - especially of optical/dielectric materials (visible, IR, Far IR, mm wave and microwave).

Fuzzy Logic and Neural Networks; linear and non-linear computer regressions/optimizations; process optimizations and statistical process control; precursors to and final design of experiments; cost reduction - all as applied to optical fabrication and vacuum deposition processes amongst others

Optical design of precise measurement systems (including use of lasers, ultra-precise mechanical motions, CCD's and image processing software); digital phase-shifting interferometry

Optical fabrication of difficult materials e.g. lithium niobate

Optical design of ophthalmic lenses including differential geometry of progressive power lenses

Production of ultra-precise optical flats and high-volume production of precise ophthalmic glass molds

Development of UV cured lens casting process and transfer to production

Computer software applications: Windows (98, XP, NT, Vista), Unix, MS Word, PowerPoint, MS Project, Access, Excel and Visual Basic for Applications (VBA), FORTRAN, "C", Wit and Sharp Board (image processing), management of LabView project (including Real Time and Fuzzy Logic add ins), (TF Calc, Essential Macleod and my self-developed thin film modeling software), NCSS Statistical Package, SketchUp and SolidWorks3D, FilmStar (VBA compatible thin film analysis application)

Statistics, pure and applied mathematics [especially solving linear and non-linear equations]

Organic and semiconductor crystal purification and single crystal growth/doping

Microwaves, guided waves, millimeter waves, free space optics, radiation transfer optics, Gaussian optics

Liquid nitrogen, liquid helium and super-cooled liquid helium cryogenics associated with ultra low noise bolometric detectors, hot electron detectors and super-cooled, photo-thermal-ionization solid-state photon detectors

Design and utilization of discrete digital electronics and ultra-low noise analogue front-end electronics suitable for high performance optical radiation detectors

Solid state devices: LED's, lasers, detectors, charge transfer, noise, optical interfacing etc.

Publications

See separate list of Publications, Patents and Presentations

Languages

Tourist level: French, German, Japanese

Interests

Art, boating, business, business models, computers, cycling, entrepreneurship, film, financial investment, fishing, invention, kayaking, management, music, photography, sailing, science, SCUBA (qualified), surfing, swimming, tennis, travel.

Clive H Burton (PhD) – Publication List – 31 March 2011

1. AFG/ Asahi Glass Company (AGC) Publications 2004 - 2008

Clive Burton authored over twenty in-house publications in this period. The main focus of these was on computer modeling of various physical systems including optical thin film stacks and control schemes for large area production magnetron sputter coaters. I was also involved in improvements and innovations in coating instrumentation, durability testing and quality standardization and methods.
Other publications covered patent surveys.
These publications are still company confidential.

2. SOLA International Holdings Publications

(oldest first) (Note: SOLA International (acquired by Zeiss in January 2005) was, at the relevant time, the largest manufacturer of eyeglass lenses worldwide).

2.1 IRIS (Stage 4) **~20pp**

Author: Clive Burton (Sola International Holdings Research Center (SIHRC), Adelaide, Australia
Report No. MS 00/88-07
Abstract: IRIS is the code name for SOLA's primary progressive lens design software package built by an external software developer to SOLA Lens Design Group's specifications and using SOLA algorithms. This report details the six principal development areas of the proposed IRIS Stage 4 project :-
Abstract Wish Design, Quantitative Evaluation, Image Simulation, Presentation Graphics, Code Structure Enhancements and Consolidation.

2.2 Lens Power Modeling **~25pp**

Author: A.G. Constantine, R.B. Miller (CSIRO) -- prepared for and edited by Clive Burton
Report No C88/18
Abstract: Following a preliminary examination of data supplied by SOLA Optical to determine the feasibility of modeling lens power in terms of the geometrical parameters involved in the molds, it was decided that a more comprehensive investigation be undertaken, using the same data.

2.3 Trip Report: POSA, SADC, PVC-Europe, Lathom Research Labs. **29pp**

Author: C H Burton, Corporate Author: SOLA International Holdings Limited
April 1989, Pagination 29pp, Series C89/12
Abstract: Report details the outcomes of technical visits to POSA (SOLA glass lens manufacturing plant, Goetzenbruck, France), SADC (SOLA plastic lens manufacturing plant, Ireland), PVC-Europe (head office European Region), Lathom Research Labs (Pilkington's Research Labs), April 1989.
Topics: Glass progressives (POSA), ovens for glass progressive slumping, glass XL, stock lens power, and powermeters.

2.4 Notes on Diamond Film Deposition at DSTO (Defence Sciences and Technology Organization - Australia)

Author: C H Burton, Corporate Author: SOLA International Holdings Limited, 18 August 1989,
Report NoC89/02 **4pp**

2.5 Coatings by action protector lens lab dip coating system from USA (PE819) **~10pp**

Author: Raelene Kuijpers, Clive Burton
Report No. C89/40
Abstract: "Lenshield" hard coating and UV400 diamond dye are both substantially less abrasion resistant than SOLA Perma-Gard (tintable). Results of sample tested show they have similar abrasion resistance to SOLA CR39 uncoated lenses.

2.6 Glass Progressive Slumping Process Development
5pp

Report No. RD R00/25
Author: A G Guy, Adams, BD and Burton, CH, Corporate Author: SOLA International Holdings Limited, 27 October 1989, Pagination 5pp, Series C89/35
Abstract: Though short in page count this paper covers crucial improvements to the process of slumping glass progressive lenses in SOLA's production facility (POSA - Pilkington Optical S.A.) in Goetzenbruck, France.
Due to a lack of understanding of the need for exceedingly good temperature uniformity in slumping ovens the French production facility had been experiencing very poor yields on most of their progressive lens production. Statistical analysis of the progressive lens parameters versus oven position together with measurements of oven temperature uniformity and some glass flow modeling convinced POSA staff that better temperature uniformity was required and innovative modifications were made to their oven design to bring the ovens up to the same performance standard as ovens designed in SOLA International Research Centre, Adelaide. Average yield improved from about 68 % to over 95% with very significant economic benefit especially for photochromic glass progressives for which the glass blank cost of the order USD 15 per lens. See also related paper entitled "**Glass XL Slumping Yields in POSA".**

2.7 Progressive Lens Concepts **13pp**
Author: M J Kris and Burton, CH, Corporate Author: SOLA International Holdings Limited
27 February 1990, Pagination Includes 3 colored plates with plots of astigmatism of lenses for 36 different progressive lenses, Series R90/03 C
Abstract: Concepts for improvements to existing types of progressive lens design and for new type of progressive lenses are presented in this paper. A number of these concepts were utilized in subsequent product successfully commercialized by SOLA.

2.8 Overseas Trip Report: 2-28 June 1990 **24pp**
Author: C H Burton, Corporate Author: SOLA International Holdings Limited
19 July 1990, Pagination 24pp + 4 appendices, Report No R90/17
Abstract: This is an update on issues relevant to the work of the Physical Technology and Quality Group of GTCL in Japan and European Region and to attend the European Regional Meeting to contribute to the review of new product opportunities.

2.9 Glass XL Slumping Yields in POSA **21pp**
Author: C H Burton, Corporate Author: SOLA International Holdings Limited
1990, Pagination 21pp' Series C90/04
See also related abstract under **"Glass Progressive Slumping Process Development"**
Abstract: XL 75mm glass product designed for 75mm formers in SIHL or equivalent ovens has been yielding in excess of 99% for product slumped in SIHL ovens. However, POSA have been experiencing some problems in achieving acceptable yields for their 70mm version of the glass XL product. The problem is evident even in the SIHL ovens and both it and the 75mm product suffer greater yield losses in POSA ovens. (Note POSA was the glass lens and mold fabrication plant in Alsace for SOLA Europe).

2.10 Power Variation with Centre Thickness for Minus Range Spectrum T & L Stock Lenses **2pp**
Author: Kuijpers, RM, ; Burton, CH and; Anderson, JSR
Publisher SIHL, July 26, 1990, Pagination 2pp, Series PTQ FN27/90

2.11 Stock Lens Power: Status Report I **84pp**
Author: C H Burton, Corporate Author: SOLA International Holdings Limited
September 1990, Pagination 84pp' Report NoR90/21
Abstract: Obtaining and maintaining the spherical and cylindrical optical power of ophthalmic stock lenses had presented SOLA Optical with a significant challenge from the inception of its casting techniques for CR39 in the early sixties. The challenge continued to grow as tighter demands were placed on tolerances by national standards and industry requirements especially in Europe where SOLA's large manufacturing plant in Ireland (SOLA ADC Lenses) was unable to produce acceptable yields of stock lenses within tolerance. This problem had been addressed a number of times over a period of a decade and had not been solved. The author undertook a rigorous survey of the factors affecting stock lens power and with significant improvements to instrumentation, data collection, manufacturing processes for moulds, proper

use of statistics and introduction of better casting process control was able to bring over 99% of lenses produced in SOLA ADC (Ireland) within tolerance for power.

2.12 Trip report - SOUSA 6-19 September 1990 **28pp**

Author: C H Burton, Corporate Author: SOLA International Holdings Research Centre
October 15, 1990 Pagination 28pp Report NoC90/32B
Abstract: Vision Expo 9/90, Two-day meeting with Lathom, SOUSA, and SIHRC R&D, visit to SOUSA, technical discussions with various SOUSA staff, visit to Menlo Park, CREOL (Center for Research in Electro-Optics and Lasers, Orlando, FL) review. (Note: Lathom = Pilkington Bros. Research Center, Lathom UK), SOUSA = SOLA USA, SIHRC = SOLA International Holdings Research Center, Adelaide).

2.13 CREOL Review - September 1990 (Re : Anti Reflection Coating Project) **18pp**

Author: C H Burton, Corporate Author: SOLA International Holdings Research Centre
January 16, 1991, Pagination 18pp, Series C91/03 C
Under the direction of Dr Colin Perrott of SOLA
Abstract: Review of research performed under the direction of Professor Karl Guenther at the Center for Research in Electro-Optics and Lasers (CREOL), University of Central Florida. The objective of the research (set by Dr Colin Perrott then V.P. Technical, SOLA International) was the development of a very small scale, purely thermal, (no e-beam) AR coating unit for plastic ophthalmic lenses.

2.14 Minutes from the "A" Team Meeting on New Multi-Layer Coating Technology, Bodega Bay, 27, 28 and 29 June 1993 **23pp**

Author: F A Samson and Burton, CH, Corporate Author: SOLA International Holdings Limited
August 4 1993, Pagination iii, 23pp, Report NoR93/14B
Abstract: Initial recommendations Tests/Measurements and Specifications for Product Performance Principal Recommendations Production Process and Equipment Photran and R&D Sputter Systems. Box coater technology is capable of producing a high-performance coating at relatively high cost. The technology has become very complex and complicated. Its success depends on a large number of poorly understood variables. The technology is inherently a labor intensive batch process. Controlling production consistency is a formidable task. Mass production will be prohibitively expensive using this technology without understanding the fundamental underlying processes. New ways need to be found for mass production of a consistent, high performance product at an economical cost.

2.15 Overseas Trip Report June/July 1993 **15pp**

Author: C H Burton, Corporate Author: SOLA International Holdings Research Centre
July 28 1993, Pagination 15pp, Report NoR93/15
Abstract: Strongly recommended that SOLA take up the unique opportunity with Balzers A.G. for a Collaborative Research Agreement to develop a small scale, flexible sputter coater as a matter of urgency.

2.16 Minutes of the "A" Team on New Multilayer Coating Technologies **55pp**

Author: C H Burton
Corporate Author: SOLA International Holdings Research Centre,
August 16 1994, Pagination 55pp, Report NoR94/21B
Abstract: A team of SOLA technical and management staff from SOLA augmented by representation of similar staff from Leybold A.G., Balzers A.G. and Denton Vacuum was brought together to map out a strategy for SOLA to obtain a greater market share in the Anti-Reflective coating of ophthalmic lenses. Following this meeting a business and technical arrangement was forged with Balzers A.G. which met its technical objectives within SOLA but unfortunately was unable to meet its business objectives due to the demise of Blazers. This followed as a consequence of antitrust requirements following the takeover of Leybold A.G. by Balzers parent company (Oerlikon Buhrle).

2.17 Multilayer Coating Technologies **107pp**

Author: C H Burton
Corporate Author: SOLA International Holdings Research Centre
August 25 1994, Pagination 107pp, Report NoR94/15B
Abstract: A world wide survey of thin film coating technologies of possible application to the production of Anti-Reflection (AR) Coatings on ophthalmic lenses was undertaken and reported. The chief recommendation of the report was that SOLA should undertake research and development of AR coating systems based on reactive sputter technology. This recommendation was followed and has placed SOLA in the forefront of high volume, high quality AR coating technology for the ophthalmic industry.

2.18 Minutes: Inaugural Meeting of Production and Rx AR Coating Task Force Adelaide 29/30 November 1994 ~100pp

Author: C H Burton, Corporate Author: SOLA International Holdings Research Centre, December 1994, Pagination : about 100 pages including presentations of attendees.

2.19 New Multilayer Coating "A" Team Meeting : Minutes and Presentations 16pp

Bodega Bay, November 1995,
Author: C H Burton, 16 pp plus 16 presentations, Series C95/67 B
Corporate Author: SOLA International Holdings Research
Abstract: Minutes of one of a number of "A" Team Meetings, chaired by the author, which gave strategic direction to SOLA's fledgling efforts in vacuum deposition coatings. Participants included the CEO and several of his direct technical and managerial reports. Due in no small measure to the direction set by these meetings, SOLA is now world leader in the use and development of sputter technology for ophthalmic lenses.

2.20 Investigation of Taber Stylus Traces on Hard and AR Coatings 28pp
Author: Clive Burton

SOLA Optical USA, August 1996
Abstract: In pursuit of improvements in quality of product being AR sputter coated in DSI (Deposition Sciences Inc) machines in SOLA USA the author developed a stylus trace methodology which proved very valuable in understanding the reasons for product failure in abrasion resistance and adhesion tests.

2.21 Progress Towards XIN AR Sputter Coating Production - visit to SOUSA, June 1996 86pp

Author: C H Burton, Corporate Author: SOLA International Holdings Limited
September 17 1996, Pagination 86pp, Report NoR96/25B
Abstract: The Deposition Sciences Inc. (DSI) sputter coater (the "XIN" machine) was installed in SOUSA in October 1995 with the objective of providing alternative means of AR coating Matrix parts at high volume and reduced cost.
This paper records the new technology breakthrough in which, for the first time worldwide, high quality antireflection coatings were applied by sputter deposition methods to plastic ophthalmic lenses in a large scale production mode (400 lenses per batch). In a month of concentrated effort the author was able to improve product quality from unacceptable levels by a factor of better than 250% to very acceptable levels in a demanding industry and application.

2.22 Provisional Application for Patent Shield Devices for Magnetron Sputtering. 29pp

Author: C H Burton, Corporate Author: SOLA International Holdings Limited
October 18 1996, Pagination 29pp, Report NoC96/57C
Abstract: Provisional application for patent shield devices for magnetron sputtering. Describes, amongst other shielding schemes, the protective shield which, when placed between the DSI microwave plasma and lens substrates, made it possible for the first time to AR sputter coat ophthalmic plastic lenses in such a manner that they were able to withstand salt water boil tests.

2.23 Experimental Notebook Notes Re Provisional Application for Patent PN8712 - and Polarizing Film Lamination - Clive Burton - 4/10/96 10pp

Author: C H Burton, Corporate Author: SOLA International Holdings Limited, Report NoN96/82
Pagination 10pp
Abstract: Describes the design of a test apparatus for trying out the idea further of laminating AR coated thin polymeric films to lenses.

2.24 Series C96/63 C Provisional application for patent.
Method and apparatus for optical coating (Seamless or Graduated Transition Coatings) 21pp

Author: Clive Burton
Report No. C96/58C
Abstract: This application reveals a method of coating spectacle lenses and other optics with very durable Optically Effective Coatings (e.g. Antireflection Coatings). The advantage of this method is the improved durability of the coatings so applied compared to those having sharp transitions within the optical thin film stack or between the stack and the underlying hard coating. The method relies on graduated rather than sharp transitions between the materials comprising the films and coatings. As a non-limiting example these graduated transitions maybe achieved in conveyor belt type vacuum coating systems with high productivity.

2.25 Provisional Application for Patent Method and Apparatus for Optical Coating. 20pp

Author: C H Burton, Corporate Author: SOLA International Holdings Limited, November 8 1996, Report No. C96/63C
Abstract: Describes a continuous conveyor belt coater for ophthalmic lenses with vacuum hardcoat followed by vacuum AR coatings. A novel feature of the equipment is the ability to deposit coatings with graduated (seamless) transitions between the layers.

2.26 Provisional application for patent. Process and apparatus for coating spectacle and sun lenses (cyclic sputter coater) 22 pp

Author: Clive Burton
Report No. C96/67C
Abstract: This application describes a cyclic vacuum reactive sputter coater with load lock for optical coating of ophthalmic lenses. The coater has several novel features which allow rapid throughput of lenses of variable types as to curvature and substrate. The prototype is designed for throughput of about one lens surface per minute on a continuous JIT basis.

2.27 Safire Coating - Surface Analysis and Characterization 15pp

Author: Clive Burton
Date January 1, 1997
Report NoMS 00/97-19
Abstract: The SAFIRE coating from Leybold A.G. was characterized in terms of both chemical composition and physical surface morphology. A Number of characterization techniques were utilized, and a brief summary of the results of each is outlined.

2.28 Sources of Variation in Magnetron Sputter Coating, 4pp

Author: Clive Burton,
SOLA Optical USA, 22 August 1997 - similar to SOLA#31

2.29 Report on Visit to US Coatings Inc, Portland, Oregon, 13pp

Author: Clive Burton & Steve Machol, 18 September 1997

2.30 Report on Visit to Professor Robert Parsons, Physics Dept, University of British Columbia, Vancouver, Canada, 10pp

Author: Clive Burton : 22 Sept 1997, With Dr Norm Boling (Deposition Sciences Inc. Santa Rosa, CA)
Report No. RD R98/19, Pagination 10 pp
Abstract: Technical discussions regarding stress problems in AR coating, sputter process control, AR coated thin polymeric films (TPF), Loadlock project, Rotating magnet magnetrons.

2.31 Important Insights Developed regarding Sputter Technology, 5pp

Author: Clive Burton, 7 April 1998
Abstract: This report considers a number of insights gleaned from observation over a period of time of a large sputter coating system for deposition of AR coatings on ophthalmic lenses. These have been quite important in guiding development of a more robust production system. Amongst other considerations they encompass a “Wandering Anode” theory in a system wherein such phenomena were supposed not to occur. Also developed was an “Event Theory” connected with the sputtering of thick single layers and the like as opposed to standard AR stacks.

2.32 US Coatings Technical Due Diligence Assessment, 91pp

Author: Clive Burton,
SOLA Optical USA, 30 April 1998 Report No. RD R98/07
Abstract: This favorable technical “due diligence” assessment of US Coatings Inc (Oregon) cleared the way for purchase of the company by SOLA and has proven to be one of the few wise acquisitions made by SOLA.
Assessment Brief: Review US Coatings ability to take Shincron CD Aluminizers and efficiently convert them to operational, ion assisted coaters; Review UV and thermally cured back surface hard coating technology; Review machine control programs; Review and evaluate operating procedures; Review maintenance and downtime records of cryopumps; Review and identify list of equipment being purchased; Review inventory valuation list for reasonableness; Review list of leasehold improvements.

2.33 Diamonex Opportunities, 40pp

Author: Clive Burton, David Bohling, Matt Coda
SOLA Optical USA, 30 April 1998

Abstract: This report in PowerPoint form detailed the situation as Diamonex Inc. was dismantled by its owners (Monsanto Corp) after expenditure of about USD 100M setting up a 20 station vacuum deposition coating plant. A number of options were considered but none was regarded as extremely compelling. The business model developed by Diamonex does however bear further consideration.
Salient Points: Early 1998 Orcolite sold. Marketing Model built for Value Migration. Sell Diamonex Coated Product at $90 per pair extra (i.e. $150 retail). Extra $60 per pair Profit to be split between Diamonex and Retailer. Trial market in Minneapolis ($40M pa advert.*) and Columbus ($23M pa advert.*) [* Costs of total nationalized campaign]. Minneapolis Advertising Spend Rate equivalent to $6.66 per pair for 12 M. Achieved 5% Market Share in Minneapolis in ~ 7 months.

2.34 Catscratch Update Part I, 53pp

Author: Clive Burton
SOLA Optical USA, 9 December 1998
Abstract: Reports an investigation of "Catscratch" defects on hard and AR coatings. The shadowscope and environmental treatment methodology developed for this investigation has been much used since and continues to assist the development of more robust coatings.

2.35 Catscratch Update Part II 44pp

Author: Clive Burton
SOLA Optical USA, 9 December 1998
See SOLA#34

2.36 Visit to Applied Vision Ltd and Negotiations Pertaining Thereto

Author: Clive Burton,
SOLA Optical USA, 17 December 1998 Report No. RD R99/61
Abstract: This report details the technical aspects of the small scale sputter coating and liquid applied hard coating system which Applied Vision Ltd (AVL) of Leicestershire, UK, have developed over a period of about six years. It also records the results of negotiations with AVL which have resulted in a joint agreement between SOLA and AVL to develop a technology package which will allow AVL's PlasmaCoat sputter coating machines to deliver product to SOLA's premium "UTMC" level and be branded and warranted as such. (UTMC = Ultra Tough Multi Coat). AVL now have about 48 machines operating world wide and their conversion to UTMC would be a very important step for SOLA towards further vertical integration which has served its major competitors well in recent times.

2.37 Report on Load Lock System for DSI AR Coaters 48pp

Author: Clive Burton
SOLA Optical USA, 17 December 1998 Report No. RD R98/33
Abstract : This report describes an innovative load lock system for a large rotating drum lens coater was devised. It made use of a spare sputter cathode port and a commercially available vacuum robot. The load lock was designed to increase through put by a factor of about 2.5 and improve process stability substantially. The author's innovation of a substantially improved water vapor pumping arrangement (see Meissner patent Ref ??) has delayed the need for the implementation of the load lock system.

2.38 Leybold Mass AR Coater Assessment Part I 20pp

Author: Clive Burton,
SOLA Optical USA, 17 December 1998, Report No. RD R98/31
Abstract: This report is a result of a visit (on 20 July 1998) by David Bohling and the author to Leybold AG in Hanau and Balzers AG in Alzenau (Germany) in the company of Tony Doneghan (SADC)and Frank Samson (SIHRC). It was issued informally to Tony Doneghan (General Manager of SOLA ADC), Frank Samson and Alan Vaughan (V.P. Prescription Labs worldwide) on 6 August 1998.
The report examines an initial proposal by Leybold A.G. for a mass PECVD hardcoat and sputter AR coater for ophthalmic lenses. A number of serious issues were raised in the report. Partly in response to this Leybold re-assessed the initial design and likewise concluded it had a number of serious deficiencies. A second design has been proposed and is now being implemented. This design is considerably improved over the first.

2.39 Leybold Mass AR Coater Assessment Part II, Appendices 13pp

Author: Clive Burton,
SOLA Optical USA, 17 December 1998 Report No. RD R98/32
See SOLA#31above
Abstract : Frank Samson's comments on the original draft (SOLA#31) and miscellaneous information concerning Balzers Process Systems and Oerlikon Buhrle.

2.40 Fuzzy Logic Control System for DSI Sputter Coating Tool: Project Planning Stage 23pp

Author: Clive Burton, Randy Gove
SOLA Optical USA, 21 March 2000, 26 pages

Abstract: Describes a novel proposed system for controlling batch to batch stability in DSI MicroDyn™ or similar rotating drum reactive sputter coaters by using a Fuzzy Logic control based upon only two input and two output parameters. The system is applicable to most reactive sputter coaters using single magnetrons per coating stage.

2.41 Literature survey on ultraviolet emission from plasmas and possible effects on plastic lenses 18pp

Author: Clive Burton, William Mayer Date 3/29/99
Report No. RD R99/44, 18 pages
Abstract: There has for some considerable time been a question as to the effect that Ultraviolet and Vacuum ultraviolet Radiation may have on plastic lenses and hard coating during the DSI AR coating process. These questions relate both to the amount of influence such radiation may have the amount of degradation and yellowing which they may cause.

2.42 Title Photoemission Monitors/Optical Gas Controllers 23pp

Author: Clive Burton, William Mayer
Report No. RD R99/45, 23 pages
Abstract: A literature survey was conducted on the following key words: Optical Gas Controllers) or OGC; and Sputter; Photoemission Monitor(s) or Photo Emission Monitors(s) or PEM and Sputter.

2.43 Report on FIST Project and Technology Issues (large magnetron sputter cyclic coater) ~30pp

Details may still be confidential
Author: Clive Burton Date 6/2/99
Report No. RD R99/59

2.44 Applied Vision UTMC Process ~40pp

Author: Clive Burton, Randy Gove, Patti Vinson
Report No. RD R00/18
Abstract: Reports plans to develop a technology package for Applied Vision (AVL) PlasmaCoat AR sputter coaters for both internal use and for UTMC custom laboratories that enable coating of product to SOLA UTMC standards and which can be guaranteed for performance by SOLA. There is also a goal to develop a business relationship with AVL and their customers which encourages the latter to become UTMC partner laboratories. The ultimate deliverable is a generic user-friendly technology package of equipment, resins, process, procedures and testing that ensures the timely and reliable delivery of product to UTMC specifications.

2.45 Multi Anode Control System for DSI Sputter Coaters 24pp

Author: Clive Burton
Report No. RD R00/29
SOLA Optical USA, 14 March 2000, 24 pages

Abstract: Describes a novel proposed system for controlling row to row uniformity in DSI MicroDyn™ or similar rotating drum reactive sputter coaters using actively controlled multiple anodes along the length of the linear target. The system is applicable also to web coaters utilizing long linear magnetrons. This report details the choice of system integrators and the general proposed control scheme utilizing LabView software control, Kepco multiple power supplies and Cytec relay switches. Multi Anode Control System for DSI Sputter Coaters.

2.46 Status Report : Multi Anode Fuzzy : Logic Control of DSI MicroDyn™ Reactive Sputter Process 25pp

Auhor: Clive Burton and Randy Gove
SOLA Optical USA, 22 August 2000

Abstract: Describes the successful implementation of the two novel control systems proposed in reports SOLA#41 and SOLA#43 namely a Fuzzy Logic reactive sputter system for controlling batch to batch stability in DSI MicroDyn™ or similar rotating drum reactive sputter coaters and Multi-anode control system designed to improve row to row uniformity in such coaters. Both control systems are applicable to most reactive sputter coaters using single magnetrons per coating stage. The improvement in reflect color stability and uniformity of AR coatings in the DSI MicroDyn™ Coaters is worth about USD3M per annum in improved yield for the two DSI machines in full production on Polycarbonate Matrix parts.

2.47 Various Reports on Relocation of Denton Coaters to SOLA Guang Zhou and Associated Staff Training and Production Startup October 2001 – June 2002 (hundreds of pages and many hours of video training)
Author: Clive Burton
Note: SOLA Guang Zhou staff were completely new to vacuum deposition coating but were able to operate effectively within a few weeks of installation and on-site training.

2.48 Draft Report : Reflectance Color Tuning of Complex AR Designs Including "Teflon" 27pp
Author: Clive Burton
SOLA Optical USA, 11 November 2002
Abstract: Describes initial modeling of the Australian and Italian versions of the "Teflon" AR stack showing that the Italian version had greater reflectance color stability yet was still far from optimized against manufacturing variation. Also showed, using a randomized version of Solver, to address the problem of reverse engineering production coatings that it is not possible to do this accurately on the full nine-layer stack and that partial stacks need to be deposited to aid in color tuning. Recommended that the stack be redesigned to (i) improve manufacturability (ii) reduce the number of layers by removing alumina layers so as to improve craze resistance and compatibility with hard coatings on Transitions™ photochromic lenses. Removing the two alumina layers should also improve the ability to reverse engineer the stack.

3. Inventions and Patents

(titles converted for readability - newest first))

3.1Apparatus and Method for Angular Colorimetry, US Patent 7,548,317, June 16, 2009

3.2 Multi-anode Device and Methods for Sputter Deposition, US Patent 6,440,280, August 27, 2002

3.3 Method and Apparatus for Vacuum Coating Plastic Parts, US Patent 6,258,218, July 10, 2001

3.4 Self-Powered Electrochromic Ophthalmic Lenses (SOLA Patent proforma) November 1999

3.5 Multi-Anode Device for Control of Deposition Uniformity in DC Reactive Sputter using Linear Magnetron Cathodes (SOLA Patent proforma - patent application in preparation November 1999 by Burnes, Doane and Swecker)

3.6 Meissner Cold Trap for DC Reactive Sputter Drum Coating of Plastics (SOLA Patent proforma - patent applied for October 1999 by Burnes, Doane and Swecker)

3.7 Contrast Enhancing Lenses for Computer Users (SOLA Patent proforma) September 1999

3.8 Clear Polarizing Lenses for Indoor Use (SOLA Patent proforma) September 1999

3.9 Cyclic Magnetron Sputter Coater (Australian Provisional filed 21 Jan 1997 IRN 477410)

3.10 Graduated Transition Hard and Anti-Reflection Coating (Australian Provisional filed 21 Jan 1997 IRN473630)

3.11 Continuous Plasma Coater (Australian Provisional filed 21 Jan 1997 IRN 474133)

3.12 Laminate Optical Lenses (Polarizing Film Lamination) (Australian Provisional filed 14 November 1996 PO3618)

3.13 Sputter Coating Apparatus (Patent Shield Devices for Magnetron Sputtering) (Australian Provisional filed 4 November 1996 PO3383) with F A Samson

3.14 Multicoat for Light Transmitting Articles (AR and Hardcoated Thin Polymeric Film for Lamination to Lenses) Australian Provisional filed 15 March 1996 PN8712)

3.15 with K G Weir. See paper "Linear and Nonlinear A/D, D/A, A/A Conversions Using the Dual Slope Principle" Optimization Of Electrooptically Tunable Imaging Filters" (Australian Provisional Prepared 1988)

3.16 "Conversion of Signals" Australian Patent Application PB7484 filed

3.17 "Signal Conversion Arrangement" Australian Patent Application, PB4998 with K G Weir

4. Refereed Publications in International Journals

(latest first)

4.1 Electrooptic Fabry-Perot Filter: Development for the Study of Solar Oscillations,

C.H.Burton, A.J.Leistner and D.M.Rust, Applied Optics, 26, 2637-2642 (1987)
Observations of nonradial solar oscillations require Doppler velocity measurement at many points over the photosphere with a velocity resolution better than 1 m/s. An attractive form of imaging spectrophotometer for such a task utilizes a thin, solid, electrically tunable Fabry-Perot interference filter or etalon made of an electrooptic material such as lithium niobate (LiNbO/sub 3/). The problems to be overcome in producing such an etalon for an imaging spectrophotometer are discussed and practical solutions demonstrated on the basis of measurements made on prototype devices.
(Author's note : the fabrication and thin film coating of this freestanding single crystal lithium niobate etalon (less than 250 microns thick, 50 mm in diameter and uniformly thick to better than lambda/100) represents a *tour de force* of optical fabrication measurement science and art).

4.2 A Tunable, Solid, Fabry-Perot Etalon for Solar Seismology,

D.M.Rust, C.H.Burton and A.J.Leistner, Soc. Photo-Opt. Inst. Eng. Conf Proc. 627 (1986)
A solid etalon has designed and fabricated from a 50-mm diameter wafer of optical-quality lithium niobate. The finished etalon has a free spectral range of 0. 325 nm at 588 nm. The parallel faces are coated with silver, and the central 15-mm aperture of the etalon has a finesse of 18.6.
The reflective faces double as electrodes, and application of voltage will shift the passband. This feature was used in a servo circuit to stabilize the passband against temperature and tilt-induced drifts to better than three parts in 10SUP9.
The etalon will be incorporated into a servo-controlled, tunable filter at the APL Solar Observatory. Because of its large aperture and high acceptance angle, it does not require that the host telescope or the filter be scanned mechanically in the course of normal solar measurements. (Edited author abstract) 11 refs.

4.3 Fast Ion Conduction in the Presence of a Lattice Phase Transition,

D.Bingham and C.H.Burton, Phys. Stat. Sol.(b), 130, 483-487 (1985)
A mixed pseudo-spin /sup 1///sub 2/ model of ionic conduction in the presence of a displacive phase transition of the lattice is derived from a consideration of the microscopic forces acting on the migrating ions. A phonon-mediated interaction between the ions entering into the lattice transition and the mobile ions results in a number of phase transitions in the mobile ion order parameter (S/sup z/). These are correlated with the ionic conductivity. A search is suggested for a material displaying the required properties and some possible advantages of such a material are discussed.

4.4 An Improved Polarizing Michelson Interferometer for the Far Infrared

C.H.Burton, D.Bingham, L.B.Whitbourn and J.A.How, Infrared Physics, 25, 575-577 (1985)
An improved design for a simple polarizing Michelson interferometer which can result in a doubling in the detected signal, is presented. The improved design has been used to measure the transmittance of fused quartz over the frequency range 300-1000 GHz

4.5 Analysis of Multi-Component Gas Mixtures by Correlation of Infrared Spectra

D.Bingham and C.H.Burton, Applied Spectroscopy, 38, 705-709 (1984)

A simulation study and an experimental investigation of the effect of noise and resolution in the determination of polar gas pressures in gas mixtures has been performed. The pressures were obtained by a procedure which correlates the polar gas infrared spectra and describes band absorptance phenomenologically. For single-polar-component binary mixtures, the partial pressure may be found accurately over a wide range of resolution. Low resolving powers are favored with noisy spectra. Polar gas partial pressures were also extracted from quaternary mixtures, with an uncertainty of less than 5% over a wide range of resolving power. Improvements to and limitations of the technique are discussed. 8 refs.

4.6 **Spin Orientation and Exchange Interactions in (Fe,Co)C12**

M.C.K.Wiltshire, B.D. Howes and C.H.Burton, J. Mag. and Mag. Matls., 34 PtIII, 1465- (1983)
The far infrared spectrum of FeCl/sub 2/:Co shows a localized mode from whose position a set of Fe-Co exchange parameters has been determined Mossbauer spectra of the mixtures Fe/sub 1-x/Co/sub x/Cl/sub 2/ have been measured and their analysis yields a variation of iron-spin orientation consistent with calculations using these parameters

4.7 **The Effective Size of Mercury Lamps in the Far Infrared**

D.Bingham and C.H.Burton, Infrared Physics, 23, 293-294 (1983)
The authors have measured the relative distributions of radiance of two mercury discharge lamps across their length and width as a function of the maximum frequency detected. In the far-infrared region there are contributions to the radiant flux from the lamp envelope and the discharge. The full width at half-maximum (FWHM) of the discharge contribution is 4.0 mm, whilst the envelope contribution FWHM is 10.5 mm.

4.8 **Far Infrared Absorption and Localized Magnetic Modes In Fec12:Co And Coc12:Fe**

M.C.K.Wiltshire and C.H.Burton, J. Phys. C.: Solid St. Phys, 15, 5649-5655 (1982)
The far-infrared absorption spectra of FeCl/sub 2/:Co and of CoCl/sub 2/:Fe have been measured. The FeCl/sub 2/:Co spectra show a localized magnetic impurity mode below the host antiferromagnetic resonance (AFMR), whilst CoCl/sub 2/:Fe has just a broadened AFMR. Using the equation-of-motion simulation technique with a single set of Fe-Co exchange parameters derived previously, the qualitative features of the spectra are reproduced. By adjusting the next-nearest-neighbor anisotropic exchange, which is otherwise undetermined, good agreement has been obtained between the calculated and measured spectra.

4.9 **Far Infrared Photothermal Ionization Spectroscopy of Impurities in Germanium**

C.H.Burton, Jnl. Electrical and Electronics Engineering Aust. 1,14-16 (1981)
Far infrared (FIR) photothermal ionization spectroscopy (PTIS) is a powerful technique for detecting and identifying electronic impurities in semiconductors at concentration levels orders of magnitude smaller than those obtained (approximately=10/sup 10/ cm/sup -3/) by state-of-the-art methods of semiconductor purification and crystal growth.
The basis of the PTIS technique is explained and some results for impurities in germanium are presented

4.10 **Search for Intervalence Tunnelling in Mixed-Valence Compound U-(Pyrazine)-Bis(Pentaaminеruthenium) Pentabromide**

Elmars Krausz, Clive Burton and John Broomhead, Inorg. Chem. 20, 434-435 (1981)

4.11 **A Polarising Michelson Interferometer for the Far Infrared And Millimetre Regions**

C.H.Burton and Y.Akimoto, Infrared Physics 20,115-120 (1980)
A polarizing Michelson interferometer for the far-infrared and millimeter regions is described. It uses a simple mechanical drive to attain high-resolution spectra with excellent frequency accuracy, as evidenced by measurements of the rotational parameters for N2O, for which the D parameter is measured with an uncertainty of plus or minus 190 Hz, comparable with the accuracy of microwave techniques. (Author's note : This instrument has become the commercially produced instrument of choice for broad band spectroscopy in the far- infrared and instruments of this type have been used a number of times in space especially in important studies of the anisotropy of cosmic background radiation).

4.12 **Multiple-Sample Wheel for Far Infrared Dichroism Measurements**

C.H.Burton, Infrared Physics 20,115 (1980)
It is common practice in the far-infrared (FIR) transmission spectroscopy of solids to place several samples in a rotating sample 'wheel' which is immersed in the same liquid helium pool as the FIR detector. The author describes a multiple sample wheel which also allows dichroism studies to be performed in a simple and precise manner.

4.13 Variable Temperature FIR-Optical Cryostat with Unique Features C.H.Burton, Cryogenics 641-643 (1980)

Describes a convenient cryostat for optical and far infrared transmission and photoconductivity studies at temperatures in the range 5 to 300K.
Up to four samples can be loaded in a cell and inserted into the cryostat from above without disturbing large metal seals or optical tails. Thermal contact between the heat sink and the cell is made automatically during the cooling process. The thermal link between the heat sink and liquid cryogen reservoir is varied by means of a modified thermosyphon. Even samples which are poor thermal conductors can be controlled in temperature within +or-10 mK by an exchange gas in the sample cell.

Note: References to earlier publications etc. i.e.:-

- **13 Refereed papers,**
- **11 Conference Presentations**
- **10 CSIRO Divisional Reports**

have been omitted due to lack of relevance for this Resume.