OPTICAL FABRICATION
& TESTING WORKSHOP

A digest of technical papers presented at the
Optical Fabrication & Testing Workshop, June 12–13, 1985, Cherry Hill, New Jersey.

Sponsored by:
Optical Society of America
FOREWORD

The Optical Fabrication and Testing Workshops are a series of meetings that over the years have become increasingly important and well attended as a format for discussing and communicating information concerning the more practical aspects of the optical industry, those of fabrication and testing.

TECHNICAL PROGRAM

A total of 37 papers, 16 invited, 13 oral contributed, and 8 poster papers are scheduled during the two day meeting. All oral sessions will be held in the Hunterdon Room and the poster session will be held in the Cumberland Room of the Hyatt Cherry Hill Hotel.

Invited papers are 25 minutes in length followed by five minutes for discussion. Contributed papers are 12 minutes in length followed by three minutes for discussion. The poster session will be held on Thursday, June 13 from 11:00 AM-2:00 PM.

Sessions are scheduled for the following times:

Wednesday, June 12, 1985

8:30 AM  INTRODUCTORY REMARKS
Stephen D. Fantone, Optikos Corporation, Conference Chair

8:45 AM  INVITED PAPER
WAA1  Fabrication of Microoptics, Klaus Schubert, American ACMI. Microoptics has existed for some time but is not manufactured on a production basis. This presentation shows some methods for making small lenses and prisms on a production basis from the raw glass to the finished product.

9:15 AM  INVITED PAPER
WAA2  Microoptic Components for Fiber-Optic Connectors, Terry Bowen, Mike Garner, AMP, Inc. Microoptic components play an important role in many fiber-optic systems. Design considerations, design options, and applications to a variety of specialized system components are reviewed.


10:00 AM-10:15 AM  COFFEE BREAK
Refreshments will be served in the Exhibit Hall—Marlton Room

HUNTERDON ROOM

8:30 AM  INTRODUCTORY REMARKS
Stephen D. Fantone, Optikos Corporation, Conference Chair

8:45 AM  INVITED PAPER
MICROOPTICS
Dennis Leiner, Leiner Associates, Presider

9:15 AM  INVITED PAPER
MICROOPTICS
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10:00 AM-10:15 AM  COFFEE BREAK
Refreshments will be served in the Exhibit Hall—Marlton Room
HUNTERDON ROOM

OPTICAL FABRICATION
Lance Lund, Tinsley Laboratories, Presider

10:15 AM INVITED PAPER
WBB1 Specifying Fused Silica for Large Optics, John B. Helm, Herbert A. Miska, Corning Glass Works. Fused silica, because it is manufactured by nonconventional glass-making techniques, has characteristics and applications that require specifications which differ from more conventional optical glasses.

10:45 AM INVITED PAPER
WBB2 Fabrication and Testing of the Nova 77-cm f/4 Focus Lenses, Julius Meckel, Tinsley Laboratories, Inc. The challenge of present day manufacturing and test problems of large single-element aspheric lenses are discussed in the context of a large diameter f/4 lens for the laser fusion program.

11:15 AM WBB3 Manufacture of 27-cm-square KDP Crystals for the Nova Laser, F. Thomas Marchi, Richard T. Maney, Kenneth R. Bradley, Samuel L. Thompson, Lawrence Livermore National Laboratory. The manufacturing processes to diamond machine, phase match, and test KDP crystals for frequency conversion of the Nova laser are described.

11:30 AM WBB4 Unitized Mosaic Mirror Fabrication, Stephen D. Fantone, Optikos Corporation. Unitized mosaic mirror technology (UMMT) is a method of fabricating a large generalized aspheric mirror from smaller more readily manufactured mirror segments. This paper presents a design for a specific mirror and experimental results from scaled mirror designs including cryogenic cycling.

11:45 AM WBB5 Ultra-Precise Flat Polishing, A. J. Leistner, CSIRO Division of Applied Physics, Australia. The technique of Teflon polishing developed at this laboratory for producing ultra-flat surfaces and some of the results achieved with it are described.

12:00 M-1:30 PM LUNCH

GLOUCESTER ROOM

1:30 PM-2:00 PM AWARDS CEREMONY
R. R. Shannon, University of Arizona, Presider
The 1985 David Richardson Medal will be presented to Norman J. Brown. The 1985 Joseph Fraunhofer Award will be presented to Peter K. Runge.

2:00 PM-3:30 PM LENS DESIGN AND OF&T JOINT SESSION
R. E. Fischer, Hughes Aircraft Company and Stephen D. Fantone, Optikos Corporation, Co-Presiders

2:00 PM INVITED PAPER
WC1 Beyond Optical Design: Interaction Between the Lens Designer and the Real World, Kevin P. Thompson, Perkin-Elmer Corporation. Techniques are explored for enhancing the communication link between the optical designer and the engineering groups involved in the design and implementation of high performance optical hardware.

2:30 PM INVITED PAPER
WC2 Testing Methods for Modern Refractive Lenses, Robert E. Hopkins, Optizon. Monochromatic laser sources eliminate the need for chromatic correction. Lenses with remarkable performance can now be built but new approaches to fabrication and testing are required. Some of these methods are described.

3:00 PM INVITED PAPER
WC3 Bridging the Designer-Fabricator Gap, Verne Muffoletto, Muffoletto Optical Company; John B. Goodell, Westinghouse Electric Company. The lens manufacturer's and lens designer's activities should be closely coupled throughout the entire design, fabrication, and testing cycle. The designer must choose materials on the basis of favorable optical, physical, and chemical characteristics for ease of manufacture. Cost and availability are important factors. The manufacturer should "hold the designer's hand" to help avoid critical shape factors and difficult configurations. Finally, lens performance requirements should be stated in terms of the manufacturer's test methods, and when called upon the designer must be prepared to answer special questions.

3:30 PM-4:00 PM COFFEE BREAK
Refreshments will be served in the Exhibit Hall—Marlton Room
SURFACE CHARACTERIZATION
James Zavislan, University of Rochester, Presider

8:00 AM  INVITED PAPER
ThAA1  Surface Evaluation Techniques for the Optics of the Future, Jean M. Bennett, U.S. Naval Weapons Center. Roughness, scattering, absorption, and other quantities useful for surface characterization can be accurately measured, making possible higher performance optics.

8:30 AM  INVITED PAPER
ThAA2  TIS Microroughness Measurement in the Optical Shop, John M. Guerra, Polaroid Optical Engineering. Surface microroughness measurement employing total integrated scatter is noncontact, fast, economical, and precise. Design, implementation, and use of a versatile TIS device for the optical shop are discussed.

8:45 AM  INVITED PAPER
ThAA3  Interferometric Surface Metrology of Magnetic Recording Materials, David M. Perry, 3M Company.

9:15 AM
ThAA4  Scratch Standard is not a Performance Standard, Matt Young, U.S. National Bureau of Standards. History and description of the scratch standard is presented, showing that the scratch number should never be related to width and that the standard is cosmetic only.

9:30 AM  INVITED PAPER
ThAA5  Specification of Optical Surface Quality Using the Finish-Function Relationship, E. L. Church, USA ARDC. The conditions under which conventional TIS and linear stylus measurements may be used to specify the finish of mirror surfaces are investigated.

10:00 AM
ThAA6  Rapid Assessment of Midspatial Frequency Figure Errors, N. C. Wong, Robert E. Parks, U. Arizona. A geometrical optics theory has been developed that permits the rapid measurement and evaluation of midspatial frequency figure errors. Theory and examples are given.

10:15 AM
ThAA7  Optical Craftsmanship, D. Janeczko, Martin Marietta Orlando Aerospace. A forgotten series of 16 films, slides, and manuals of fabrication of lenses and prisms has been discovered. Excerpts will be shown during the poster session.

10:30 AM—11:00 AM
Presentation on the Department of Defense Federal Acquisition Supplement entitled “Retention of Domestic Precision Optics Items—Production Capability” Regulation.

WEDNESDAY, JUNE 12, 1985—Continued

DIAMOND GRINDING AND POLISHING PROCESSES
Wiktor Rupp, Itek Optical Systems, Presider

4:00 PM  INVITED PAPER
WDD1  Design Parameters for Diamond Tools, Dominic T. Taurone, Norton Company. This paper reviews the variables in a diamond-wheel specification and the operating conditions and how they affect the grinding of optical lenses.

4:30 PM  INVITED PAPER
WDD2  Mechanism of Diamond Grinding of Glass, Wiktor Rupp, Itek Optical Systems. An attempt to explain the mechanism of diamond grinding of glass is presented, and a method of evaluating tool performance characteristics by means of microscopic examination is proposed.

5:00 PM  INVITED PAPER
WDD3  Machining Parameters for Diamond Grinding, Larry Dillon, CDP Diamond Products.

5:30 PM
WDD4  Polishing Optical Parts with a Diamond Pad, Qiming Xin, Beijing Institute of Technology, China; Robert E. Parks, U. Arizona. Using different speeds, pressures, and different kinds of glass and coolant, a range of experiments show that a diamond pad is a promising polishing method.

6:00 PM  BBQ DINNER
Dinner will be served outside on the Hyatt premises—weather permitting.
CUMBERLAND ROOM

11:00 AM–2:00 PM  POSTER SESSION


ThBB2 Optical Figuring a Damaged Clark Objective, Arthur S. De Vany, San Clemente, CA. A damaged 20.3-cm objective has been optically refigured by a novel technique. Repolishing of thin optical components causes the Tywman effect to twist the opposite surface during repolishing. To prevent flexure during repolishing, the elements are held in a nonwrap hold.

ThBB3 Design of an 8-m Polishing Machine, Robert E. Parks, U. Arizona; H. Campbell, Campbell Grinder Company. Proposed telescopes with fast 4–8-m mirrors call for a new type of polisher. We describe a unique computer-controlled polisher that uses floor space efficiently.

ThBB4 Optical Craftsmanship, D. Janeczko, Martin Marietta Orlando Aerospace. A forgotten series of 16 films, slides and manuals of fabrication of lenses and prisms has been discovered. Excerpts are shown during poster session.

ThBB5 Conic Constant and Paraxial Radius of Curvature Measurements for Conic Surfaces, R. Diaz-Uribe, ECFM-UAP, Mexico; A. Cornejo-Rodriguez, J. Pedraza-Contreras, O. Cardona-Nunez, INAOE, Mexico. A method of measuring $k$ and $r$ for a concave or convex conic surface of revolution, using a He-Ne laser and nodal bench, is presented.

ThBB6 Materials Properties Influence on Smoothness of Diamond-Turned Electroless Nickel, C. K. Syn, T. T. Saito, J. S. Taylor, R. R. Donaldson, Lawrence Livermore National Laboratory. Surface roughness of diamond-turned electroless nickel has been studied and found to correlate well with phosphorus content and heat treatment temperature.

ThBB7 Method for the Evaluation of Subsurface Damage, David S. Anderson, Michael E. Frogner, Spectra-Physics, Inc. An easy method has been developed for revealing the structure and depth of subsurface damage due to milling and grinding operations.

HUNTERDON ROOM

OPTICAL TESTING

Philip Armitage, Zygo Corporation, Presider

2:00 PM  ThCC1 Performance of an Infrared Phase-Shifting Interferometric System, H. Phil Stahl, Breault Research Organization. Measured performance parameters of an IR phase-shifting interferometric system developed at the University of Arizona Optical Sciences Center are presented.

2:15 PM  ThCC2 Monitoring Aspherization with a Spherometer, R. E. Parks, S. Lam, R. C. Crawford, U. Arizona. A 2-ball spherometer was used during the aspherizing of a 1.871 m f/2.7 parabola. Ease of use, method of data reduction, and accuracy are described.

2:30 PM  ThCC3 Interferometric Lens Testing to $\lambda/40$ at $\lambda = 0.442$ $\mu$m, Joann Berman, George C. Hunter, Bruce E. Truax, Zygo Corporation. The considerations and implementation of an interferometric system to test precision microlithographic lens setups are discussed. Performance results of the final system are presented.

2:45 PM  ThCC4 Method of Interferogram Interpretation, Giuliano Pinto, Gabriella Vietri, Selenia S.p.A., Italy. Fabrication-related defects of an optical system are evaluated by subtracting the nominal system wave-front errors from the wave front obtained by processing the experimental interferogram.

3:00 PM–3:15 PM  COFFEE BREAK

Refreshments will be served in the Exhibit Hall—Mariton Room
THURSDAY, JUNE 13, 1985—Continued

HUNTERDON ROOM

OPTICAL FABRICATION EQUIPMENT DESIGN
Stephen D. Fantone, Optikos Corporation, Presider

3:15 PM INVITED PAPER
ThDD1 Practical Design Consideration of Optical Machining and Tooling, Donald Nord, Nord Engineering. This paper presents approaches to optical machinery design including design concept, application, and material choice for conventional and planetary machines. Optical tooling design and materials will also be discussed.

3:45 PM INVITED PAPER
ThDD2 Design and Construction of High Speed Optical Generators, John Plummer, Plummer Precision Optics. This paper will discuss design parameters and construction of computer controlled diamond generating machines which have the capability of producing close tolerances of center thickness sphericity and sub-surface fractures. Slides of some recently developed machines will be shown.

4:15 PM
ThDD3 Contouring with the Large Optical Generator, R. E. Parks, P. Lam, W. Kuhn, D. Ketelson, W. C. Kittrell, U. Arizona. An off-axis segment of an f/0.35 10-m diam dish has been generated. A figure of 4-μm rms and a finish of 2-μm rms were achieved.

4:30 PM MEETING ADJOURNED