Guest Editorial

Precision Machining of Optics

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An economical method of fabricating aspherics and optical design flexibility for an even broader family of optical shapes is now possible through precision machining of optics. One of the most exciting developments over the past few years has been in the area of diamond turning of optics. Diamond turning is now a recognized and sought-after technology.

The on-going and planned manufacturing technology transfer programs are described in my review paper describing the past, the present, and the exciting future of diamond turning.

The very limited availability of diamond turning is being expanded through efforts by Bell & Howell and government-funded technology transfer programs. The work at Bell & Howell is described by Benjamin.

For applications requiring low optical absorption, dielectric coatings are very useful. Hoffman (Westinghouse R&D Center) and his co-workers describe their process of ion polishing an optimum amount of material from diamond-turned copper mirrors and then the *in situ* coating. The film thicknesses were not monitored during the coating so the optimum reflectivity was not obtained. However, the resistance to continuous wave 10.6 micrometer radiation was excellent.

A major near-term demand on the diamond-turning capability is in the Los Alamos Scientific Laboratory's laser program. Sollid and Sladky describe the evaluation of diamond-turned copper mirrors for the LASL eight-beam CO_2 laser. Their results are very promising and LASL plans considerable cost savings from employing diamond-turned instead of conventionally polished optics. Gerth and his co-workers at Oak Ridge Y-12 Plant describe the fabrication of off-axis parabolas using diamond turning. The details of the fixturing, mounting, and electroplating will prove valuable to those interested in similar fabrications projects.

Two papers discuss polishing. Baker and Brown of the Lawrence Livermore Laboratory and Parks of the University of Arizona have been three of the leaders in polishing diamond-turned optics. Many optics, especially those used in the x-ray region, require polishing after the turning. The reasons for polishing are to reduce the light scattering caused by the shallow but periodic surface irregularities left by the tool and to improve the figure. Brown's paper on axisymmetric aspheric figuring gives some good insight for the small optical shop to employ in making aspheric components. Although his hypotheses are not yet experimentally confirmed, their timely inclusion in this issue will help stimulate interest in his planned experiments.

The paper by Saito (WPAFB) and Taboada and Altschuler (Brooks AFB) describes the initial feasibility study of using diamond turning for aircraft (F-111) windscreens. This paper serves as an example of the expanding uses of diamond turning. I have been excited to see the broadening spectrum of applications of diamond turning to manufacturing areas lying outside the area of optics.

Some of these papers were presented at the SPIE seminar on Precision Machining of Optics, August 30-31, 1978, in San Diego. The Proceedings of this seminar (SPIE Volume 159) will be published shortly and should be referred to by those interested in developments even more recent than those described in this journal.

My thanks go to the authors of the papers in this special feature on Precision Machining of Optics.