SINGLE POINT DIAMOND TURNING OF AN ORGANIC NONLINEAR CRYSTAL, L-ARGININE PHOSPHATE

STEPHAN P. VELSKO, CHOL SYN, AND BARUCH A. FUCHS

Lawrence Livermore National Laboratory, P.O. Box 5508, L-490, Livermore, CA 94550

We have demonstrated that single point diamond turning can be used to generate high optical quality finished surfaces on a new organic nonlinear crystal, L-arginine phosphate (LAP). The proper choice of cutting conditions can produce surfaces with less than 5 angstroms rms surface roughness. Local softening or melting near the cutting tool tip may play a key role in the machining process by ensuring that material is removed by ductile cutting rather than brittle fracture. At the same time, the low melting temperature of LAP makes lubrication and cooling especially important to prevent extensive melting and tool fouling. In spite of the presence of a weak cleavage plane in LAP, the surface quality is relatively insensitive to crystallographic orientation. Tool wear is apparently negligible, so that surface flatness is governed by the stability of the diamond turning machine. Data on residual subsurface strain and preliminary measurements of the optical damage thresholds of diamond turned LAP surfaces will be presented.

We compare machining phenomena we have observed in LAP with those observed in other nonlinear crystals which have been diamond turned, such as KDP and Lithium Niobate. A criterion based on thermomechanical properties is used to assess the machinability of various classes of nonlinear crystals.

These results have important implications for the fabrication of large aperture harmonic converters such as those used in lasers for inertial confinement fusion.

*Work performed under the auspices of the U. S. Department of Energy by the Lawrence Livermore National Laboratory under contract number W-7405-ENG-48.