LLE Review Quarterly Report

Contents

| In Brief ii | ii |
|---|----|
| Initial Performance Results of the OMEGA Laser System | 9 |
| A Novel Energy Measurement System for the OMEGA Laser | 0 |
| Self-Consistent Cutoff Wave Number of the Ablative Rayleigh-Taylor Instability | 7 |
| Distributed Phase Plates for Super-Gaussian Focal-Plane Irradiance Profiles | 6 |
| Electro-Optic Sampling of 1.5-ps Photoresponse Signals from $YBa_2Cu_3O_{7-\delta}$ Thin Films | 1 |
| Magnetorheological Finishing—A Deterministic Process for Optics Manufacturing | 5 |
| Publications and Conference Presentations | |

In Brief

This volume of the LLE Review, covering the period of April–June 1995, includes a description of the initial performance results of the upgraded OMEGA laser system. A series of acceptance tests were completed, demonstrating that all 60 beams can irradiate targets with more energy and better beam balance than was required by the Department of Energy's acceptance criteria. Other articles in this volume include a description of a novel energy measurement system used to diagnose all 60 OMEGA beams; a theoretical calculation of the cutoff wave number of the ablative Rayleigh-Taylor instability, applicable to both direct and indirect drive; a description of a new algorithm used for designing distributed phase plates that will produce super-Gaussian focal-plane irradiance profiles; a study of the photoresponse of high- T_c YBCO thin films; and a description of magnetorheological finishing, a new process for optics polishing.

Highlights of the research presented in this issue are

- The upgraded OMEGA laser system has irradiated targets with UV energies up to 37 kJ, a beam-tobeam energy balance better than 8%, and overall frequency-conversion efficiencies of 75%. The system performs as designed and in accordance with modeling.
- A novel beam-energy diagnostic system, based on optical fibers, has been implemented on OMEGA. It can measure the UV energy and the residual green and IR energies of all 60 beams with a relative, beam-to-beam accuracy of a fraction of a percent.
- A new analytic model is presented for calculating the cutoff wave number of the ablative Rayleigh-Taylor instability. This is valid for an arbitrary power-law dependence of the electron thermal conductivity and is applicable to both direct and indirect drive.
- A new algorithm is presented for designing phase plates that will produce nearly flat super-Gaussian irradiation distributions on target. These phase plates have continuous surfaces and thus minimize scattering losses.
- Electro-optic sampling has been used for the first time to study the photoresponse of YBCO thin films. Electrical transients as short as 1.5 ps have been observed and are the fastest photoresponse signals reported to date from YBCO thin films.
- A description is given of magnetorheological finishing, a new method for the finish polishing of optics in which the polishing is performed using a fluid suspension stiffened by a magnetic field. This method is being studied using a pre-prototype machine located at the Center for Optics Manufacturing.

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